Technical Summary Report

(by the Joint Agency Review Team)

Proposed Expansion to the Burlington Quarry

June 2023

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1. TECHNICAL REVIEW BY THE JOINT AGENCY REVIEW TEAM

The review of proposals for new or expanded mineral aggregate operations within Halton Region occurs through a joint agency work program detailed in the Halton Consolidated – Streamlined Mineral Aggregate Review Protocol. The Protocol, often referred to as the JART Protocol, was originally developed through an extensive, consultative process between Halton Region, Niagara Escarpment Commission (NEC), local municipalities, Conservation Authorities, the Ministry of Natural Resources and Forestry (MNRF) and Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA). The Protocol was first approved by Halton Regional Council on January 31, 2001. It was most recently updated in February 2020.

In Halton Region, a Joint Agency Review Team ("JART") is formed to complete technical review of proposals for new or expanded mineral aggregate extraction. Per step 6 of the Halton Consolidated – Streamlined Mineral Aggregate Review Protocol, the Chair of a JART will co-ordinate agency comments where possible and, with JART members' assistance, produce a JART Report or Reports consolidating and summarizing this work. As Chair of JART for the proposed expansion to the Burlington Quarry, Halton Region has prepared this Technical Review Summary Report ("JART Report" or "this Report") with input from the other public agencies.

1.1 PURPOSE OF REPORT

This technical report details the structure of JART, and the work undertaken by the team on the review of the quarry expansion proposed by Nelson Aggregate Co. ("Nelson") to the west and south of its existing operation on Mount Nemo. It includes a consolidated description of the proposal shared by the agencies. The summary of the technical work undertaken includes initial responses of the various agencies and an overview of technical findings arriving from the work of the technical reviewers. This technical work is to be used by the various participating agencies to inform the production of planning opinions and recommendation reports to the Councils, Boards, and Commission, as applicable.

The applicant and Ministry of Natural Resources and Forestry will be provided a copy of this Report.

The Report will also be provided to the Niagara Escarpment Commission, Halton Region Council, and City of Burlington Council, and the Board of Conservation Halton for information.

1.2 LIMITATIONS OF THE REPORT

This Report does not make a recommendation on the proposal itself. It is a distillation of technical review completed since the relevant applications were filed in May 2020.

The contents of this report are based upon technical review of information submitted up to August 4, 2022—the date of Nelson's filing of appeals for non-decision on the Regional and Local Official Plan Amendment application—plus information received after that date to complete the third technical submission started by Nelson. Technical review is generally based upon the documents listed in section 2.5 of this report, public input, and working meetings with the applicant.

Any revisions to the Nelson proposal to address remaining issues in this report or any other objector concerns will require review—and may necessitate updated analysis to be completed through JART or by the individual agencies.

1.3 JOINT AGENCY REVIEW TEAM (JART) MEMBERSHIP

The Niagara Escarpment Commission, Halton Region, the City of Burlington, and Conservation Halton first became aware of a potential proposal for quarry expansion on these lands in spring 2019. Nelson Aggregate Co. ("Nelson", or "the proponent") requested presentation meetings of planning staff at the various agencies to discuss the proposed expansion and conversation of the proposed after-use of the operation to an active park from its current approval for lake filling.

Throughout the review of the proposal, agency leads for the JART were:

- Halton Region, as lead agency: Gena Ali, Joe Nethery (Chair), Brian Hudson, Janice Hogg
- Niagara Escarpment Commission: John Stuart (prior to his move to the City of Burlington), Joe Muller
- City of Burlington: Brynn Nheiley, Kyle Plas, Gordon Dickson, John Stuart
- Conservation Halton: Kellie McCormack, Leah Smith, Jessica Bester

JART was supported by a number of agency staff, including Betty Pakulski, Umar Malik, Alina Korniluk, Jacek Strakowski, Lisa Jennings, Lesley Matich, Janette Brenner, and Jennifer Young.

Halton Region retained peer review support in the following areas of focus. Note that peer reviewers did review in multiple issue areas to ensure integration of reports—in particular, with respect to hydrogeology and the natural environment:

Table 1: Technical Peer Reviewers Retained by Halton Region for JART Support

Agricultural Impact Assessment	AgPlan Limited Michael K. Hoffman
Air Quality	Gray Sky Solutions Dr. Andrew Gray
Blasting	Englobe Ray Jambakhsh
Financial Impact	Watson & Associates Gary Scandlan and Daryl Abbs
Hydrogeology	S.S. Papadopulos & Associates, Inc. Chris Neville Norbert Woerns
Karst Topography	Daryl Cowell
Natural Heritage	North South Environmental Sarah Mainguy Matrix Solutions Inc. Arnie Fausto

Noise	J.E. Coulter Associates Ltd. John Coulter Brendon Colaco
Surface Water Assessment	Scheckenberger & Associates Ltd. Ron Scheckenberger
Traffic	CIMA+ Jaime Garcia

The City of Burlington retained Christienne Uchiyama (Letourneau Heritage Consulting Inc.) for support on archaeology and cultural heritage.

Halton Region additionally retained Nick McDonald (Meridian Planning Consultants Inc.) to provide support to the land use planners on the relevant policies and structure to consider in undertaking a land use planning analysis. Planning analysis was to be undertaken by agency planning staff based upon the technical review undertaken and summarized in this report.

1.4 Timeline of Applications

On November 6, 2019, a pre-consultation meeting was held with representatives of Nelson and staff from the Region, the City of Burlington, Conservation Halton, and the Niagara Escarpment Commission. A pre-consultation meeting is required in advance of the filing of Regional and City of Burlington Official Plan Amendment applications by Section 187(3) of the Region's Official Plan and City of Burlington Pre-consultation By-law 40-2007 and Official Plan Policy Part VI, Section 1.3(e). Meeting participants discussed application requirements, including required technical studies and associated terms of reference, and the main parameters for a Joint Agency Review Team approach and work plan for reviewing the proposal.

Terms of Reference for the technical studies needed were required by the agencies at the pre-consultation meeting. Those arrived in early 2020.

Nelson submitted the following applications for the proposed quarry expansion (noting the applications were submitted while draft terms of reference were still under review through JART):

- On May 14, 2020, an *Aggregate Resources Act* licence application for the proposed west and south extensions issued by the Ministry of Natural Resources and Forestry, with future potential to amend the licence for the current operation (associated with the rehabilitation plan).
- On May 15, 2020, a Niagara Escarpment Plan Amendment to re-designate the proposed expansion land to permit mineral aggregate extraction, and a Development Permit to ultimately permit the development.
- On May 14, 2020, an amendment to the Halton Region Official Plan to re-designate the proposed expansion land to permit mineral aggregate extraction.
- On May 14, 2020, an amendment to the City of Burlington Official Plan to re-designate the proposed expansion land to permit mineral aggregate extraction.

On July 20, 2020, the Region's Chief Planning Official and City of Burlington staff deemed the *Planning Act* applications complete. The Niagara Escarpment Plan Amendment process was initiated through a staff report received by the Niagara Escarpment Commission on August 20, 2020. The Ministry of Natural Resources and Forestry deemed the *Aggregate Resources Act* applications complete on October 5, 2020.

On November 4, 2021, Halton Region, the City of Burlington, Conservation Halton, and the Niagara Escarpment Commission received a circulation from Nelson Aggregate Co. regarding a proposed Site Plan Amendment to the licence for the current operation. The general intent of the amendment was to allow for the integration of the entire site as a single operation, which sought to permit aggregate material extracted within the proposed extension lands to be transported to the existing quarry for processing and shipping. This would be achieved by constructing a new entrance/exit access ramp adjacent to No. 2 Side Road to transport material from the proposed south extension into the existing quarry. The revision also included added noise attenuation recommendations that relate to the existing quarry and were identified through the ongoing technical review associated with the quarry extension applications.

1.5 JART Work Program

Initial conversations around forming a JART for review began following spring 2019 meetings requested by Nelson Aggregates Co. (note that the City of Burlington did not participate in the summer 2019 meetings). JART conversations continued through to the November 2019 preconsultation meeting conducted by the applicant through City of Burlington pre-consultation requirements and became a regular occurrence in spring 2020 to prepare for the arrival of the respective applications.

The application went through two complete technical circulations with JART agencies: a first circulation from May 2020 that completed in January 2021, and then a second circulation arriving in stages from September 2021 through to May 2022. A third circulation of the application began with updated information submitted by Nelson on June 27, 2022. On August 3, 2022, while technical review was being completed on some parts of the third circulation, Nelson filed appeals with Halton Region for non-decision on the application for a Regional Official Plan Amendment, and the City of Burlington for non-decision on the application for a Local Official Plan Amendment. The third technical circulation has been completed by staff and peer reviewers. Review involved detailed assessment of the submitted reports, internal discussion meetings to review findings, and discussion meetings with the proponent to work through issues. The consolidated comment tables are attached as a series of appendices to this report.

Throughout the Nelson expansion's application review process with JART, multiple site visits occurred to better understand the area's context. The site visits enabled JART to assess the application in more detail through closer investigation. The following focused site visits and field work occurred:

- **November 20, 2019**
    - Intent: Preparation for the preconsultation meeting.
    - Attendees: Select Nelson team and JART staff.
- **November 9 and 24, 2021**
    - Intent: General site orientation, visiting and observing the features of the proposed expansion lands, and receiving a tour of the current site and operation.
    - Attendees: Nelson, JART staff and peer reviewers.
- **December 3 and 9, 2021**
    - Intent: Detailed staking of woodlands features.
    - Attendees: Nelson, JART staff and peer reviewers (ecologists).
- **October 25 and November 3, 2022**
    - Intent: JART reviewers looking at select features on Conservation Halton lands within the Medad Valley, including piezometers and test wells drilled by Nelson with the authority's permission.
    - Attendees: JART staff and peer reviewers (hydrogeologists, surface water engineers, ecologists, and planners).

In addition to the above focused visits, each agency and a number of peer reviewers completed their own independent site visits and area scans.

The Halton Consolidated – Streamlined Mineral Aggregate Review Protocol and associated work program is adaptable and meant to be flexible rather than prescriptive. It is based upon agreement by agency staff to work together as much as possible. The processing of each application will vary depending on the type and scale of the application under consideration as well as its location and predicted impact. The work program also is flexible to respond to shifting needs or requirements during technical review.

1.6 Letters of Objection to the *Aggregate Resources Act* Licence Application from the Agencies

Letters of Objection were provided by the JART agencies in December 2020, within the initial 45-day review window. Concerns identified in these letters were informed by the preliminary review of technical reports and studies submitted in support of the application by staff and retained consultants.

The Niagara Escarpment Commission's Letter of Objection focused on a lack of sufficient detail to demonstrate conformity with the 2017 Niagara Escarpment Plan.

Key issues raised were:

- Cumulative impacts of the existing extraction operation and proposed future recreation use in the context of a continued and expanded extraction operation were not comprehensively analyzed with respect to:
    - The proposed rehabilitation plan for the extensions and amendment of the rehabilitation plan for the existing quarry.

    - Insufficient hydrogeology and surface water baseline data to permit a comprehensive analysis of impacts of the existing quarry, and proposed expansions.
- The scope of the assessment of key natural heritage features and key hydrologic features, including their connectivity, being limited to 120 metres of the lands, rather than the 240 metres of connectivity between key natural heritage features and key hydrologic features stipulated in Niagara Escarpment Plan, resulting in proposed removal of some connecting features and subsequent isolation of some key natural heritage features and key hydrologic features.
- Incomplete analysis of Impacts to critical fish habitat resulting from proposed changes to hydrogeology, surface water, and blasting, in addition to a lack of confirmation by the Department of Fisheries and Oceans (DFO) of the proximity of critical fish habitat on or near the site.
- Incomplete Cultural Heritage Assessment (archaeology, built heritage, cultural heritage landscapes and visual impact assessment), and no documented Indigenous consultation.
- An incomplete evaluation of the proposed Progressive and Final Rehabilitation Plan, focused on justifying a specific after-use, where a comprehensive inventory and analysis of prior and present environmental conditions of the subject lands from a natural heritage, hydrologic feature, prime agricultural, or open landscape character perspective is warranted.
- Incomplete evaluation for potential rehabilitation of lands to resume agricultural use of the site, given the identification of extension lands as prime agricultural.
- A Visual Impact Assessment lacking a comprehensive assessment of the open landscape character requiring more viewpoints and potential project impacts from Mount Nemo and surrounding areas, to provide a complete mapping of cultural heritage landscape(s).
- Incomplete integration of the findings from the various technical studies, particularly from lens of natural heritage and ecology.

The Niagara Escarpment Commission also noted the *Aggregate Resources Act* application was premature because, under Section 24 (3) of the *Niagara Escarpment Planning and Development Act* (NEPDA), no permits may be issued nor approval, permission or decision authorized under any *Act* prior to a Development Permit being issued under the *Niagara Escarpment Planning and Development Act*. Further, those permits and approvals must be consistent with the issued Development Permit.

Halton Region's Letter of Objection raised 29 distinct issues, categorized under the following nine thematic groupings:

- The potential effects of the operation of the proposed pit and quarry on the natural environment have not been adequately addressed, including effects upon key natural features, cumulative impacts, and the potential impacts are not addressed by the proposed Adaptive Management Plan.
- The baseline used for the assessment of impacts was inadequate with respect to natural heritage as it omitted important information gained from surveys conducted recently (in the mid-2000s) in the course of past investigations.

- The potential effects of the operation of the proposed pit and quarry on nearby communities have not been adequately addressed, including transportation, air quality, and noise and vibration effects.
- The suitability of the progressive rehabilitation and final rehabilitation plans for the Site have not been adequately addressed.
- The potential effects on ground and surface water resources including on drinking water sources and private wells have not been adequately addressed.
- The potential effects on agricultural lands have not been adequately addressed, including the Burlington Springs Golf Course's location on Prime Agricultural Lands as identified in the Regional Official Plan.
- Detailed consideration should be given to planning and land use matters, including conformity with Provincial and Regional plans and policies.
- Haulage routes and effects related to truck traffic have not been adequately addressed.
- Considerations remain with respect to the applicant's existing licence and how expansion plans are considered and accommodated by those licences.
- Other, miscellaneous concerns related to fees and the *Aggregate Resources Act* review process, the plan drawings and notations, and public engagement.

The City of Burlington's Letter of Objection, dated December 3, 2020, indicated several concerns with the proposed ARA licence application broadly summarized as follows:

- Improved coordination and cross-referencing between the applicant's various disciplines is needed to perform a holistic review and analysis of issues related to groundwater, hydrology (quality and quantity) and impacts on surface water.
- Suitability of the analytical tools selected by the applicant to simulate the existing and proposed drainage conditions and the accuracy of modeling techniques, assumptions and interpretation of results.
- Additional assessment is required by the applicant to demonstrate that the lost hydrologic functions are appropriately replicated in the post-development conditions
- Further review is needed by the applicant of the potential impacts to surrounding key hydrologic features
- The further consideration and analyses of these matters may involve the coordination and review of other technical studies and reports in the context of natural heritage, including potential and/or indirect impacts that may result from the proposed development
- Additional information is required to ensure the protection and reduced impacts of the proposed development on significant natural heritage resource areas, features and functions; particularly as it relates to mitigation and monitoring.
- The assessment of long-term, cumulative impacts of future uses and long-term rehabilitation (after-use) plans may require additional clarification and data support.
- The provided Agricultural Impact Assessment (AIA) makes several assumptions and conclusions regarding impact to prime agricultural lands that require further justification.

- A peer review related to the applicant's Air Quality Assessment has yet to be concluded.
- There has not been consistent or adequate detail pertaining to the use of the existing quarry lands for an industrial use in the event that aggregate resource extraction ceases (or is substantially reduced) on that portion of the quarry operation and its resultant conformity with applicable legislation and policy related to the Niagara Escarpment Area.

Conservation Halton issued a Letter of Objection dated December 9, 2020, indicating several concerns with the proposed ARA licence application as summarized below:

- The 45-day notification and consultation period does not allow adequate review, given the scale, scope and potential implications of the application. The studies submitted require detailed technical review and the review is still ongoing in coordination with JART.
- Based on a preliminary review of the information submitted, the following key issues and/or deficiencies have been identified, including but not limited to:
    - Insufficient detail has been provided to determine what impacts the proposed quarry may have on surrounding surface water and groundwater resources, as well as natural heritage features, functions, and areas. Further, it is not clear whether the proposed mitigation measures will adequately ensure that features and their functions will not be impacted over the long term.
    - The study area(s) identified in the reports may not be sufficient to fully assess potential impacts of the proposed quarry on surrounding features.
    - Insufficient detail has been provided to assess cumulative impacts to surface water, groundwater, and the natural environment. Further, the 10-year period of baseline data for groundwater and surface water is insufficient to evaluate impacts.
    - The various studies submitted have not been adequately coordinated and integrated to provide a comprehensive evaluation of impacts and the identification of appropriate mitigation measures.

These initial responses were supplemented with a full set of technical comments from JART provided in installments from December 2020 to February 2021.

The agencies also explained that a Joint Agency Review Team (JART) was formed to coordinate the assessment of the application by Halton Region, the City of Burlington, the Niagara Escarpment Commission and Conservation Halton, and to contribute effectively to MNRF's decision.

Copies of the original Letters of Objection are provided as Appendix A to this report.

1.7 Reply Letters of Objection and Confirmation of Objections from Agencies

Nelson Aggregate Co. provided reply letters of objection to the agencies (and other public objectors) on June 29, 2022, or July 4, 2022, in the case of Conservation Halton. This initiated the formal reply period under the *Aggregate Resources Act* where objectors would need to indicate if the resolution was satisfactory or if the objection remained (and what might be required to resolve the recommendation). Nelson provided approximately 40 days to the agencies to respond (August 15, 2022).

- The Niagara Escarpment Commission's reply of August 12, 2022, confirmed the objection remained. The response stated the *Aggregate Resources Act* application should not be approved until further public consultation and technical review had occurred, as well as the Niagara Escarpment Plan Amendment being approved, and the Development Permit being issued.
- Halton Region's reply of August 12, 2022, confirmed the objection remained. The letter acknowledged progress made by Nelson in resolving some of the initial concerns raised. The most significant outstanding concerns relate to the protection of water resources and natural heritage features and functions that depend on them. Recommendations to resolve included addressing the technical comments raised in JART review, including completing a requested revision of Nelson's predictive groundwater model, additional field work, inclusion of past recent survey findings, and revisions to the proposed Adaptive Management Plan.
- The City of Burlington's reply of August 15, 2022, confirmed the objection remained. The letter noted many issues remaining in the original five thematic areas (operational/coordination, effects on water quantity and quality, natural heritage, agricultural effects, and human health/air quality), and that the JART process should continue through to its conclusion of review.
- Conservation Halton's reply of August 10, 2022, confirmed the objection remained. The letter noted insufficient detail or further work being required to provide a comprehensive evaluation of the impacts and identification of appropriate mitigation measures.

Copies of Nelson's reply letter and agency confirmation Letters of Objection are provided as Appendix B to this report.

1.8 Public Meetings and Sessions

The City of Burlington development application review process includes a developer / proponent-led pre-application community meeting, in which proponents are required to take notes of any comments received. Comments and the proponents' response are required to be included in the application submission. Nelson hosted this pre-application community meeting on February 18, 2020, at the Burlington Springs Golf Course. It was an open house and town hall format, with display boards covering various topics. The proponents were there with several of their technical consultants to address questions. City Staff attended to explain the planning review process. The meeting was also attended by the Mayor of Burlington, Ward Councilor, and approx. 150 residents. Questions and comments during the town hall session generally pertained to water quality and quantity impacts, traffic, and dust pollution.

In August 2020, the Ministry of Natural Resources and Forestry released a bulletin titled, "Resuming aggregate application timelines and public consultation under the Aggregate Resources Act (Post COVID-

19)." Prior to that, the Ministry of Natural Resources and Forestry had suspended all application review timeframes in alignment with Provincially-issued emergency orders related to COVID-19. As part of responding to the end of the Province's emergency order O.Reg. 73/20 on September 11, 2020, the Ministry made a modification to its consultation requirements. Nelson elected to proceed with individual conversations with residents and did not schedule a public information session as a result of the August 2020 bulletin. Nelson will be required to provide summaries of conversations held in pursuit of resolving objections in their final submissions to the Ministry of Natural Resources and Forestry.

Halton Region facilitated a virtual public meeting on Thursday, December 10, 2020, between 6:00 pm and 8:00 pm. The event was held in response to a resolution unanimously adopted by Halton Regional Council on November 25, 2020, to hold a public consultation event enabling residents to ask questions about the project and voice concerns to Nelson. Nelson's team provided a presentation and answered attendee questions live, with unanswered questions responded to in writing following the event. The content was distilled in an event summary report. This was not a statutory public meeting under any legislation or Act. Members of the public were invited to join the session online through Zoom as advertised. A call-in option was also provided. Participants were able to submit questions during the live event or via email in advance of the session. Overall, 158 members of the public attended the session. No identified members of the media were in attendance.

Halton Region hosted its statutory public meeting under the *Planning Act* on September 15, 2021. A statutory public meeting is required by legislation to be held with respect to applications for amendment to an official plan to give the public an opportunity to make representations in respect of the proposal. There were 182 total attendees on Zoom and 140 livestream viewers for a total of 322 viewers across both platforms with 31 delegates. Issues raised include protection of the natural environment, well-water concerns, concerns about traffic and heavy trucks, flyrock concerns, noise and vibration concerns, air quality and dust concerns, and the financial implications on taxpayers for the proposed after-use as a park.

The City of Burlington is planning to schedule a public meeting regarding the Local Official Plan Amendment upon release of the JART report.

With public meetings held by Halton Region and the City of Burlington with the proponent and Niagara Escarpment Commission staff in attendance, the Commission did not intend to host a separate public meeting under the *Niagara Escarpment Planning and Development Act* within the commending period. If any future public meetings are scheduled by other public agencies, the Niagara Escarpment Commission will coordinate with organizers to make staff available.

1.9 PUBLIC INPUT RECEIVED

Public input related to the proposal was welcomed and encouraged at any time during the application review process. JART staff was monitoring and facilitating four active application streams with consultation expectations, in addition to Provincial consultation requirements through the Environmental Registry of Ontario. As part of its mandate, the JART received and considered public input to explore the range of technical issues and impacts related to the proposal.

Technical information provided by the public was shared with technical reviewers and the applicant for consideration in their respective reviews. Content received by the various commenters was provided as part of staff reports (Region and City) and consultation reporting requirements (NEC). Public input was catalogued, summarized, and consolidated with materials received through statutory public consultation into a complete record of public comments received by each agency and placed before the respective Councils, Boards, and the Niagara Escarpment Commission.

JART technical reviewers considered submissions as part of their review of the application. The consolidated comment summary tables are attached as various appendices to this report.

Comments started arriving soon upon receipt of the application in May 2020. The majority of comments were received in advance of consultation milestones: April and May 2020 with the Niagara Escarpment Commission, and prior to Halton Region's Statutory Public Meeting in September 2021.

The Region received 455 emails indicating support for the proposed rehabilitation plan that includes using a portion of the expanded quarry as a park following the completion of extraction. The evaluation of the technical merits of the application to permit extractive uses looks at the proposed use itself. While the rehabilitation plan is a part of the overall proposal, the proposed after-use of the quarry site as parkland is not part of the technical consideration for the Regional Official Plan Amendment application. Regional staff note that some of these submissions were recalled or clarified by submitters after being introduced to the quarry proposal.

The Niagara Escarpment Commission received 298 responses through the Environmental Registry of Ontario posting of the NEP Amendment application: 295 objecting and three supporting. The three JART partner agencies (Halton Region, City of Burlington, and Conservation Halton) also submitted their letters of objection through the ERO, as did two community and environmental groups: Conserving Our Rural Ecosystem of Burlington Inc. (CORE) and Protecting the Escarpment and Rural Land (PERL).

Over 2,000 emails were received by the JART staff from residents and concerned citizens about the negative impacts of continued quarrying on the natural environment (wildlife, streams, and woodlands), quantity and quality of water (wells, streams, and wetlands) served by the headwaters of Mount Nemo, increased traffic, dust, vibration, flyrock, potential import of contaminated fill back onto the site, and removal of farmland and greenspace. Acknowledging some duplication of submissions as the majority shared the same template, the following emails went to individual agencies:

- 1942 comments by the Niagara Escarpment Commission for the NEPA application.
- 2343 comments received by the City of Burlington in response to public circulation of the Local Official Plan Amendment application. Some of these were copies of letters sent to other agencies.
- Halton Region was copied on many of these same emails.

Concerns raised in public submissions included:

- The importance of protecting the Niagara Escarpment as a designated United Nations Educational, Scientific, and Cultural Organization (UNESCO) Biosphere Reserve.

- The loss of key natural heritage features and functions including wetlands, woodlands, and protected species habitat.
- The loss of overall green space for the area, and potential loss of the golf course.
- The loss of prime agricultural lands.
- The expanded quarry operations contribution to climate change.
- The impact of the quarry operation on water quality and quantity for both drinking water (well supply) and the natural environment (groundwater and surface water).
- Increased quarry-related traffic, including truck traffic on Cedar Springs Road despite it not being a designated truck route by the City of Burlington, and safety concerns over the joint use of the haul route for recreation and active transportation.
- Concerns over the quality of fill proposed to be brought to the site.
- Increased industrial activity moving closer to existing residential communities.
- Operating hours of the quarry, including potential for all-day truck movement.
- Loss of property value, including a request to consider lowering property taxes if property values were shown to be reduced.
- The impact of blasting on homes with a history of blast damage from this operation, including those that would become closer to the quarry if approved, as well as concerns over the model methodology used by the proponent and inputs used in the model.
- The impact of dust from quarry operations on air quality and overall amenity, including settling on outdoor spaces on neighbouring properties.
- The lack of actual emissions data from the current quarry to inform the proponent's model.
- The impact of noise from quarry operations on quality of life, including concerns over the model methodology used by the proponent and inputs used in the model.
- The perception that the proponent proposed solutions that only meet minimum standards, contrasted with other operations where monitoring and adaptive management could be continuous.
- Questions as to how alternatives to the proposal have been considered, including aggregate recycling.
- Local understanding that the current quarry is approaching its end of operations, with the proposal effectively extending the operating life of the quarry.
- Requests for more analysis and further studies to assess the potential effects of the quarry.

In addition to comments received from the general public, JART has received comments from community groups Conserving Our Rural Ecosystem of Burlington Inc. (CORE) and Protecting the Escarpment and Rural Land (PERL). JART facilitated technical review meetings with both groups and select JART peer and technical reviewers, as well as a number of technical working sessions with Nelson and its consultant team.

Individual agencies will be providing public comment records to their respective Councils, Board, and Commission in accordance with typical reporting procedures.

2. DESCRIPTION OF THE PROPOSAL AND APPROVALS REQUIRED

Nelson is applying for a Class A (Quarry Below Water) licence under the *Aggregate Resources Act*, which is known as the Burlington Quarry extension application. If approved, the proposed new quarry would permit the expansion of the existing quarry onto new lands south (across the No. 2 Side Road) and west (on the current Burlington Springs Golf Course) of the existing quarry. Since the launch of the review process, Nelson has also filed site plan amendments to their current *Aggregate Resources Act* licences to enable the integration of operations across all licence boundaries—treating all of Nelson's licences at this location as a single, integrated quarry operation. The maximum annual tonnage proposed is 2,000,000 tonnes.

2.1 LOCATION

The Burlington Quarry has been in operation since 1953. The current quarry is generally located in the eastern half of the original survey block bounded by Colling Road to the north, Cedar Springs Road to the west, No. 2 Side Road to the south, and Guelph Line to the east. Nelson Aggregate Co. operates this site under the authority of licence No. 5499 and No. 5657 pursuant to the Aggregate Resources Act (ARA). In total, approximately 218.3 hectares are currently licenced as a quarry.

The proposed west extension licenced area is proposed to be approximately 58.8 hectares, (September 2022 site plan), of which approximately 33.1 hectares would be under active extraction. The lands under application are currently occupied by the Burlington Springs Golf and Country Club. Within the proposed west extension licenced area there is an area designated as part of the Region of Halton's Natural Heritage System. This area includes three small woodlands located adjacent to active golf holes. The proposed west extension includes one Butternut tree (Endangered), three golf course maintenance buildings containing barn swallow nests (Special Concern), 0.48 ha woodland that contains significant wildlife habitat (Eastern Wood-Pewee), which continues to be proposed for extraction, and another 0.48 woodland that contains significant wildlife habitat (Bats and Eastern Wood-Pewee) and habitat for an endangered species (Bats), that has been reassessed as contiguous with Woodland D and is now proposed for retention (not originally proposed for retention). The proposed west extension licenced area also contains and/or is adjacent to features regulated by Conservation Halton. This includes tributaries of Willoughby Creek, and the flooding and erosion hazards associated with these watercourses in addition to wetlands.

The proposed south extension licenced area was originally proposed to be approximately 18.1 hectares, of which approximately 14.3 hectares would be under active extraction. The area proposed for extraction is predominantly in agricultural production. The remaining lands not under application for the south extension are generally occupied by natural heritage features and functions, including significant wetlands, wetlands, woodlands (both plantation and natural), and habitats of wildlife including but not limited to fish, reptiles, amphibians, bats, and snakes. Significant wildlife habitat is found in a pond along a channel proposed as a discharge point for water from the quarry. Habitat restoration is also proposed along the southern property line. The proposed south extension licenced area also contains and/or is adjacent to Conservation Halton regulated features. This includes tributaries of Grindstone Creek, and the flooding and erosion hazards associated with these watercourses, in addition to wetlands.

In total, approximately 76.9 hectares of land are proposed to be redesignated in the Niagara Escarpment Plan, Halton Region Official Plan, and the City of Burlington Official Plans to permit the extraction of mineral aggregates on these lands. Of the approximately 76.9 hectares of land, approximately 47.4 hectares would be the site of active extraction. Remaining lands would include all lands that are a component of an aggregate operation required as conditions of the licence, such as berms or ponds.

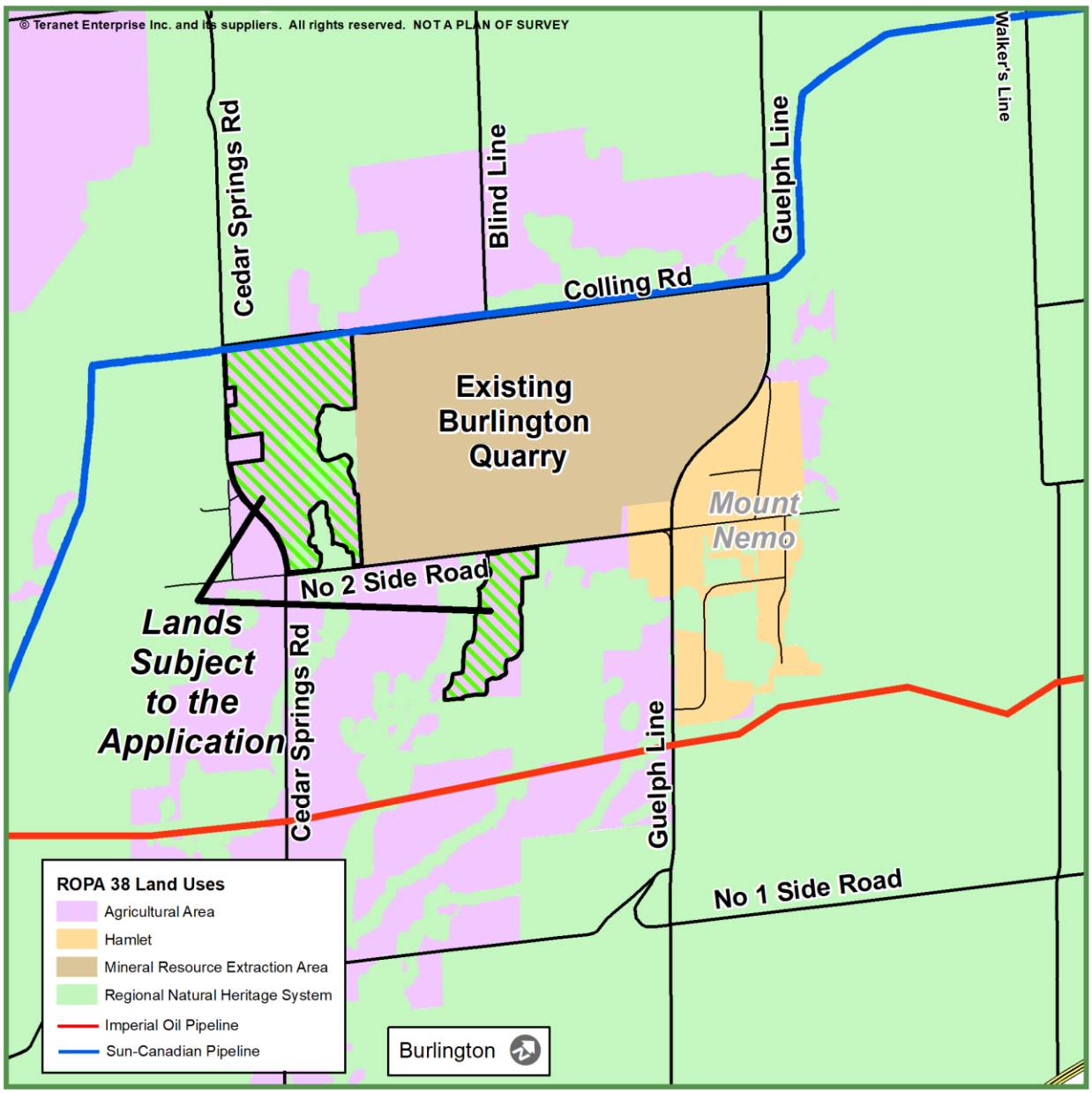

Figure: *Existing Burlington Quarry and surrounding areas with Regional Official Plan designations.*

2.2 Surrounding Land Uses

The Burlington Quarry abuts the hamlet/rural settlement area of Mount Nemo and extends approximately 1.5 kilometres west to border the Burlington Springs Golf Club. Rural and estate residential development exist to the south and west of the golf course, while agricultural lands and lands within the Region's identified Natural Heritage System generally surround the entire quarry lands.

Imperial Oil operates the Sarnia Products Pipeline running from Sarnia to Toronto, via Waterdown and Burlington. It is important infrastructure that provides products used by households and businesses across the Greater Toronto and Hamilton Area. This includes a significant portion of jet fuel for Toronto Pearson International Airport, as well as gasoline and diesel fuel. It runs south of the existing and proposed quarries, between the No. 1 Site Road and No. 2 Side Road. Imperial Oil replaced a 63-kilometre portion of the pipeline from the Waterdown Pump Station in rural Hamilton, through Burlington, Oakville, Milton and Mississauga, to a storage facility located in Toronto's North York area. Construction activities were completed in early 2023.

The Sun-Canadian Pipe Line Company Ltd. transports refined petroleum products, namely gasoline, diesel, jet fuel and fuel oil from the Suncor and Shell refineries in Sarnia to London, Hamilton, and the Greater Toronto Area. The system is composed of two transmission pipeline systems: one supply line to the Hamilton terminal and a second supply line to the Toronto terminal that crosses through Halton Region—generally along Colling Road to the immediate north of the existing quarry. The supply line runs through Halton Region. Its total length is approximately 644 kilometres.

2.3 Approvals Required and Current Applications

As detailed in section 1.2, of this report, the following approvals are required to facilitate the proposed quarry expansion:

- A Niagara Escarpment Plan Amendment to re-designate the proposed expansion lands to permit mineral aggregate extraction, and a Development Permit to ultimately permit the development.
- An amendment to the Halton Region Official Plan to re-designate the proposed expansion lands to permit mineral aggregate extraction.
- An amendment to the City of Burlington Official Plan to redesignate the proposed expansion lands to permit mineral aggregate extraction.
- A licence for the new site issued by the Ministry of Natural Resources and Forestry (Aggregate Resources Act Licence).
- A corresponding amendment to the site plan for the current operation was also required by the Ministry of Natural Resources and Forestry, to allow for the integration of the entire site as a single operation.
- Niagara Escarpment Commission Development Permit recommended conditions are part of the application of the expansion of the lands.

2.4 CONSERVATION HALTON'S REVIEW ROLE

Conservation Halton is a member of JART but is not a decision-making body with respect to the applications. Conservation Halton reviewed the applications based on its responsibility to comment on risks related to natural hazards, including the prevention or mitigation of those risks, and based on its delegated responsibility to represent the Province on the natural hazard policies of the Provincial Policy Statement (PPS Sections 3.1.1 through 3.1.7) per O.Reg. 686/21. Conservation Halton also reviewed the applications to ensure that they aligned with Conservation Halton's regulatory requirements under O.Reg. 162/06 (e.g., natural hazard or wetland related policies and requirements).

The proposed extension lands contain and/or are adjacent to features regulated by Conservation Halton under O.Reg. 162/06. Conservation Halton regulates all watercourses, valleylands, wetlands, Lake Ontario and Hamilton Harbour shoreline, hazardous lands, as well as lands adjacent to these features. Conservation Halton regulates a distance of 15.0 metres from the greater of the flooding and erosion hazards associated with watercourses part of major valley systems, which includes Bronte and Grindstone Creeks, 120.0 metres from Provincially Significant Wetlands and wetlands greater than 2 hectares in size and 30.0 metres from wetlands, less than 2.0 hectares in size. Conservation Halton has Board approved regulatory policies that guide the administration of CH's regulation entitled, "*Policies, Procedures and Guidelines for the Administration of Ontario Regulation 162/06 and Land Use Planning Policy Document*". Conservation Halton's regulation applies prior to an ARA licence being granted and once it is surrendered or revoked, or for lands outside of a licenced area.

Prior to the introduction of Bill 23 by the Province in fall 2022, Conservation Halton also provided technical advisory advice through the JART on natural heritage and water resources matters through the technical review process. However, on January 1, 2023, *Ontario Regulation 596/22: Prescribed Acts – Subsections 21.1.1 (1.1)* and *21.1.2 (1.1)* of the *Conservation Authorities Act (O. Reg. 596/22)* came into effect. As a result, Conservation Authorities are no longer able to provide technical review services for planning and development applications that were previously provided under Memorandums of Understanding with municipalities (e.g., technical reviews related to natural heritage and select aspects of stormwater management). Consequently, all outstanding natural heritage related reviews and comments are deferred to the Region, City and Niagara Escarpment Commission.

O.Reg. 596/22 does <u>not</u> affect Conservation Halton's mandatory programs or services. As part of Conservation Halton's review of the most recent submission to JART (i.e., Nelson's third submission), Conservation Halton has limited its responses to comments related to natural hazards, and wetland matters, per *Ontario Regulation 686/21* and *Ontario Regulation 162/06*.

2.5 REPORTS SUBMITTED IN SUPPORT OF THE APPLICATION

Nelson Aggregate Co. submitted the following reports in support of the proposal and during the technical review:

- Agricultural Impact Assessment, MHBC Planning, April 2020
- Soil Survey and Canada Land Inventory (CLI) Assessment, DBH Soil Services Inc., November 2020

- Archaeological Assessments: Stages 1 and 2, Golder Associated Ltd., March 2020 (revised September 2020); Stages 1, 2 and 3, Archaeologix Inc., July and August 2003; and Stage 4, Archaeologix Inc., August 2004
- Cultural Heritage Impact Assessment, MHBC Planning, April 2020 (revised June 2021)
- Environment Technical Report (Level 1 and 2), Savanta Inc., and Stantec Consulting Ltd., September 2010 (revised by Savanta Inc., April 2020)
- Watercourse Characterization Summaries, Earthfx Incorporated, Savanta Inc. and Tatham Engineering, April 2021
- Wetland Characterization Summaries, Earthfx Incorporated, Savanta Inc. and Tatham Engineering, March 2021
- Financial Impact Study, Nelson Aggregates, April 2020; Altus Group, September 2021
- Air Quality Study, BCX Environmental Consulting, March 2020
- Planning Justification Report and Aggregate Resources Act Summary Statement, MHBC Planning, April 2020 (revised September 2020)
- Progressive and Final Rehabilitation Monitoring Study, MHBC Planning, April 2020
- Traffic Report, Paradigm Transportation Solutions Limited, February 2020
- (Traffic) Safety Review, True North Safety Group, June 2021
- Level 1 and 2 Hydrogeological Assessment (including a Karst Assessment as an appendix), Earthfx Incorporated, April 2020
- Surface Water Assessment, Tatham Engineering, April 2020
- Adaptive Management Plan, Earthfx Incorporated, Savanta Inc. and Tatham Engineering, April 2020
- Noise Impact Assessment, HGC Engineering, April 2020 (revised November 2021)
- Blast Impact Analysis, Explotech Engineering Ltd., March 2020 (revised June 2021)
- Visual Impact Assessment, MHBC Planning, April 2020 (revised June 2021)
- Site Plan and associated notes, MHBC Planning, April 2020

Many of the reports were prepared as comprehensive studies covering both the existing site and the proposed site plan amendment, not solely the expansion areas. The reports were reviewed comprehensively to produce comments for all applications.

Additional information was received from Nelson throughout the technical review process, in the form of replies to JART comments, addendum reports, memos, and email correspondence. This information was used as the basis for technical discussions between JART staff and peer reviewers and Nelson. References to this updated information are found throughout the technical review summaries in Section 3 and the detailed appendices to this report. These items are listed below (noting that all individual correspondences may not be reflected in this list):

- **Fall 2020**

    - Updated the date of the Archaeological Assessment Report in Section H, September 2020
    - Agricultural Impact Assessment Comments Response, September 2020
    - Site Plan Signed, September 2020
    - Bronte Creek Watershed Study, September 2020
    - Level 1 and 2 Natural Environment Technical Report, September 2020
    - Grindstone Creek and Annual Monitoring – Long Term Environmental Monitoring Program – October 2009, September 2020
    - Sixteen Mile Creek, Grindstone Creek and Supplemental Monitoring – Long Term Environmental Monitoring Program – 2012, September 2020
    - Grindstone Creek, Sixteen Mile Creek and Supplemental Monitoring – Long Term Environmental Monitoring Program – 2011, September 2020
    - Bronte Creek, Urban Creeks and Supplemental Monitoring – Long Term Environmental Monitoring Program – 2012, September 2020
    - Acoustic Assessment Report – Halton Asphalt Supply, September 2020
    - A summary of stationary source noise levels for each receptor, all calculations, and updated noise limits, September 2020
    - Whitewater Well Monitoring Letters and Water Quality Results, September 2020
    - Surface Water Balance – Proposed Conditions, September 2020
    - Natural Hazard Study, September 2020
    - Hydrologic Model, September 2020
    - Grindstone Creek Wetland Evaluation Report, September 2020
    - Mount Nemo Wetland Evaluation Report, September 2020
    - Pre-Application Public Consultation Report, September 2020
    - Soil Survey and Canada Land Inventory (CLI) Assessment, November 2020
    - Revisions to the site plan legend were made to address a Ministry of Natural Resources and Forestry's letter, December 9, 2020

- **Summer 2021**
    - MNRF wetlands for South Extension, April 2021
    - Significant Wildlife Habitat, Species of Conservation Concern and Species at Risk, April 2021
    - Nelson Response to JART Archeology Comments – LHC Heritage Planning & Archaeology Inc., June 2021
    - Nelson Response to JART Blasting Comments – Explotech, June 2021
    - Nelson Response to JART Agriculture Comments – DBH Soil Services, June 2021
    - Nelson Response to JART AMP comments – Earthfx, June 2021
    - Nelson Response to JART Cultural Heritage Comments – MHBC, June 2021
    - Nelson Response to JART Visual Impact Comments – June 2021

- Nelson Response to JART Traffic Comments - Paradigm Transportation Solutions Limited – June 2021
- DFO – Letter of Advice, June 2021
- Nelson Response to JART Air Quality Comments – BCX Environmental Consulting, July 2021
- Nelson Response to JART Financial Impact Comments – Altus Group, June 2021
- Nelson Response to JART Surface Water Comments – Tatham Engineering, July 2021
- Nelson Response to JART Natural Environment Comments – Savanta, July 2021
- Nelson Response to JART Hydrogeology Comments – Earthfx, July 2021
- The site plan revisions consisted of areas to be removed from the limit of extraction and adjusted the proposed berm locations. Revisions 1 and 2 for the west extension, revision 3 for the south extension.
- Revision 1
    - Berm repositioned to remain 30m from Wetland
- Revision 2
    - Area to be removed from limit of extraction to remain 30m from FOD7-2
    - Area to be removed from limit of extraction to remain 30m from FOD7-4
    - Berm repositioned to remain 30m from FOD7-4
- Revision 3
    - Berm repositioned to remain 30m from FOD7-4

- **November 2021**
    - Nelson Response to JART Noise Comments – HGC Engineering, November 2021

- **Winter 2022**
    - Surface Water Clarifications; Schedule A: MECP Response Matrix, Schedule B: Wetland Characterization, Schedule C: Watercourse Characterization
    - Updated site plans to address agency comments and to incorporate requested changes by agencies from the ongoing technical review
    - Adjusted licence boundary and limits of extraction in the proposed west and south extensions based on dripline and wetland surveys completed in the field
    - Nelson Response to JART Air Quality Comments – BCX Environmental Consulting, January 2022
    - Modifications in the west extension:
        - Added Earth and Life Science Area of Natural and Scientific Interest (ANSI) Lake Medad Meltwater Channel and Medad Valley to plan view
        - Added MNRF Unevaluated Wetland, MNRF - Unevaluated (Assumed Significant for Planning Purposes)
        - Labeled Wetland 13202, Surveyed by Savanta/MNRF in Accordance with OWES (Assumed Significant for Planning Purposes)
        - Added two Bat Maternity Colonies
        - Added MNRF Unevaluated Wetland

- Modifications in the south extension:
    - Added additional Significant Wildlife Habitat - Amphibian Breeding (woodland) area and Turtle Wintering Area
- Updated site plan to address agency comments
- Added additional wetland surveyed by Savanta and MNRF to the west extension
- Air Quality Modeling Reports

- **Spring 2022 (including items up to the August 2022 filing of *Planning Act* appeals)**

    - Modifications to the proposed west extension including:
        - Updated limit of extraction in the west extension
        - Added dripline and setbacks dimensions from the driplines to the plan view
        - Adjusted driplines to correspond with the surveyed driplines
        - Updated hatching to be solid green which represents significant woodlands
    - Modifications to the proposed south extension included:
        - Added dripline and setbacks dimensions from the driplines to the plan view
    - Revised note H.1 on the Site Plan
    - Earthfx Memo, dated April 19, 2022, regarding Response to JART comments and follow up to February 16, 2022, JART working meeting
    - Earthfx Presentation dated May 20, 2022 regarding Medad Valley. The presentation was prepared for the May 20th meeting with NDMNRF
    - Earthfx Memo dated May 29, 2022 regarding Documentation of Deep Pond Simulation Results presented at May 20, 2022 NDMNRF Meeting
    - GEI Memo dated May 31, 2022 regarding Nelson Burlington Extension and the Medad Valley Life Science ANSI and PSW
    - Earthfx, GEI and Tatham Adaptive Management Plan, dated June 2022
    - An additional updated site plan, June 2022
    - Nelson Response to JART Agricultural, AMP, Archaeology, Blasting, Cultural Heritage, Financial, Groundwater, Hydrogeology, Natural Environment, Noise, Surface Water, Traffic, and Visual Comments, June 2022

- **September 2022**
    - Updated site plan for the proposed extensions and existing quarry

- **Spring 2023**
    - Memorandum Re: Nelson Quarry, Burlington, Response to Comments, prepared by Tatham Engineering, April 13, 2023

2.6 *Aggregate Resources Act* Site Plan Amendment for the Existing Operation

On November 4, 2021, Halton Region, the City of Burlington, Conservation Halton, and the Niagara Escarpment Commission received a circulation from Nelson Aggregate Co. regarding a proposed Site Plan Amendment to the existing Licence Nos. 5499 & 5657 which apply to the existing quarry lands along No. 2 Side Road. The general intent of the amendment was to allow for the integration of the entire site as a single operation, which would allow for material extracted within the proposed extension to be transported to the existing quarry for processing and shipping. The amendment proposed several changes to the existing licences, including:

- A revised extraction limit in the existing quarry adjacent to the proposed west extension to allow for an integrated operation.
- Harmonization across all licences of the proposed after-use of the operation from a deep lake system to a shallow lake system supporting a park and agricultural use.
- Additional permissions for material extracted from the expansion lands to be processed on the existing quarry site.
- A new entrance/exit ramp adjacent to No. 2 Side Road.
- Requests for Provincial overrides to facilitate integrated operation of the existing and proposed extension operations and rehabilitation.
- A revised rehabilitation plan.
- Revised noise attenuation mitigation measures.
- Updated site plan notes characterizing proposed variations to the Control and Operation of the Pit or Quarry.
- Other minor housekeeping items.

On December 6, 2021, Niagara Escarpment Commission staff provided comments back to the Ministry of Natural Resources and Forestry in response to the Site Plan Amendment Application noting that until such time that an NEC Development Permit was issued, any approval of an amendment to a Site Plan under the Aggregate Resources Act being contemplated would be premature as the lands are subject to NEC Development Control established by O.Reg. 826/90, as amended.

On December 8, 2021, Halton Region staff provided comments back to the Ministry of Natural Resources and Forestry in response to the Site Plan Amendment Application. The comments outlined a series of concerns related to the proposed Site Plan Amendment for the existing quarry. These concerns were informed by the review of technical reports and studies submitted in support of the application by staff and retained consultants. Halton Region posted the same information to Environmental Registry of Ontario posting 019-4921 on February 8, 2022.

In its review of the proposed site plan amendment to the existing licences, the City of Burlington issued a number of concerns in a December 2021 letter addressed to the MNRF and the applicant's representative. These concerns included:

- Prematurity of the application in relation to the legislative requirement for an NEC Development Permit to be issued prior to any other approvals being issued.
- Changes to the proposed rehabilitation plan may not be permitted unless the after use meets the policies of the NEP (2017) and a Development Permit under the NEPDA is issued.
- The application is premature as it fails to consider additional rehabilitation obligations.
- The application incorporates the proposed expansion lands into the newly designed overall rehabilitation plan. The expansion lands are still subject to a number of applications reviews including under the Aggregate Resource Act (ARA).

On December 8, 2021, Conservation Halton staff also provided comments back to the Ministry of Natural Resources and Forestry in response to the Site Plan Amendment Application. Similar to the other agencies, the comments outlined concerns and identified that a decision should be made on the expansion applications before the Site Plan Amendment Application is approved. Conservation Halton posted the same information to the Environmental Registry of Ontario posting 019-4921 on February 15, 2022.

Given that the proposed site plan amendments were driven by Nelson's expansion plans, many of the issues identified apply equally to the existing quarry licence and, in particular, to the amended site plan for which the applicant is seeking approval. Many comments raised during the technical review considered the proposal as a single, integrated operation with integrated effects.

2.7 Niagara Escarpment Plan Amendment and Development Permit

The Niagara Escarpment Plan Amendment application seeks to both redesignate lands from Escarpment Rural Area to Mineral Resource Extraction Area and apply a special policy for continued use of existing infrastructure used in the current Nelson Aggregate operation. At its meeting on August 20, 2020, the Niagara Escarpment Commission circulated the proposed amendment for comments from the public, non-governmental organizations (NGOs), and partner agencies including municipal, provincial, and federal organizations.

The proposed amendment was posted on the Environmental Registry of Ontario on February 24, 2021, with a request for comments by April 26, 2021 (a 61-day commenting period). As noted above in section 1.9, a total of 298 comments were received through the Registry posting, in addition to 1942 direct emails.

On March 15, 2021, the Niagara Escarpment Commission circulated the Proposed Amendment and requested comments from relevant Indigenous communities, Ministries, affected municipalities, interested parties, neighboring property owners and the public. The proponent also posted a notice at the site with specifications provided by the Niagara Escarpment Commission, for comments to be filed by April 16, 2021. Notices were also placed in the Burlington Post and Milton Champion newspapers on February 25, 2021, requesting comments by April 26, 2021. The Niagara Escarpment Commission Public Interest Advisory Committee (PIAC) convened on March 29, 2022, and July 26, 2022, and provided advice on the Proposed Amendment recommending against the proposed Niagara Escarpment Plan Amendment.

Objection letters were received from the Region of Halton, City of Burlington, and Conservation Halton. Halton Regional staff identified a number of concerns with the application, concluding that the application as submitted does not have appropriate regard for the development criteria listed in Part 2 of the Niagara Escarpment Plan, or support objectives listed in Policy 1.9.1 of the Niagara Escarpment Plan.

City of Burlington staff identified several areas where information or data provided were not sufficient, analyses were not adequately coordinated between studies and/or where the methodology behind information presented in the plans and studies or reports was unknown or inconsistent.

Conservation Halton staff identified concerns with the data collection, evaluation, analysis, and conclusions in the proposal where information or data provided were not sufficient, analyses were not adequately coordinated between studies and/or where the methodology behind information presented in the plans and studies or reports was unknown or inconsistent.

On May 10, 2022, the Niagara Escarpment Commission circulated the Development Permit Application and requested comments from relevant Indigenous communities, Ministries, affected municipalities and non-governmental organization. Objection letters were received from the Region of Halton, City of Burlington, and Conservation Halton, reiterating prior comments made on the proposed Niagara Escarpment Plan Amendment.

At the request of the proponent, on April 27, 2023, the proposed Niagara Escarpment Plan Amendment was referred by the Niagara Escarpment Commission to the Ontario Land Tribunal, and the Development Permit Application was refused. The proponent made this request in order to facilitate a consolidated hearing at the Ontario Land Tribunal.

2.8 Previous Application (2004-2012)

Nelson previously made applications in October 2004 to permit extraction of approximately 82.3 hectares of land south of No. 2 Side Road, in the general area of the south extension currently proposed. At its meeting on October 28, 2009, Regional Council refused the Regional Official Plan Amendment application. At its meeting on November 9, 2009, City of Burlington Council refused the Local Official Plan Amendment application. The proposal was ultimately brought to a Joint Board hearing convened under the former *Consolidated Hearings Act*.

JART completed its technical review of the applications and made every attempt to ensure a thorough and comprehensive analysis. A number of issues were identified which JART concluded were left largely unaddressed or lacking in sufficient justification:

- The application did not demonstrate conformity with portions of the Niagara Escarpment Plan, Region of Halton, and City of Burlington Official Plans.
- The proposed footprint as identified in the 2008 revised application would have included extraction within a significant woodland and a Provincially Significant Wetland not supported by policy.

- The assessment of the applications needed to consider the broader Mount Nemo Plateau in a landscape ecology context.
- With respect to wells and hydrogeology, questions around lake filling, wetland protection, and the impacts on private wells (water quality and quantity) remained unaddressed.
- The applications suggested an extended timeline for rehabilitation of the existing quarry, in light of the fact that processing of materials from the new quarry would be carried out in the existing quarry. Questions regarding integration between the existing quarry and proposed quarry operations remained outstanding.
- Detailed mitigation measures remained outstanding for species at risk.
- Commitment to the preparation of an Adaptive Management Plan and related legal agreements and associated securities, needed to be addressed.

On October 11, 2012, the application was denied by the Joint Board on the basis that Nelson had not made sufficient provision for the protection of the unique ecological and environmentally sensitive areas and that, if approved, the expansion of the extraction operation, as proposed, had the potential to impact habitat for the Jefferson salamander, an endangered species found in the area.

While the proposed southern extension occupies part of the footprint of the refused 2012 application, and technical studies submitted in support of the current applications do reuse some material and data from the previous applications, all current applications are being treated by the agencies as new applications.

2.9 THE PLANNING POLICY FRAMEWORK

The following provincial and regional policies must be considered when reviewing the proposal:

- The Provincial Policy Statement (PPS, 2020) contains policies for managing and protecting natural resources including the following relevant areas to the proposal: Natural Heritage, Water, Agriculture, Mineral Aggregate Resources, and Cultural Heritage and Archaeology. It also requires that development be directed away from areas of natural hazards where there is an unacceptable risk to public health or safety or of property damage, and to not create new or aggravate existing hazards. Further, the PPS requires rehabilitation of man-made hazards such as mineral aggregate operations prior to permitting future development on these sites in order to protect public health and safety. (At the time this report is being published, a draft new Provincial Policy Statement is being consulted on by the Province of Ontario. It remains in consultation status.)
- The subject lands are within the Niagara Escarpment Plan Area under the Greenbelt Plan (2017) to which the policies of the Niagara Escarpment Plan apply as well as the Parkland, Open Space and Trails policies of the Greenbelt Plan.
- The subject lands are located within the Escarpment Rural Area land use designation in the Niagara Escarpment Plan (2017). As a Provincial land use plan, the Niagara Escarpment Plan guides land use planning decisions within the Plan area and takes precedence over the Provincial Policy Statement and the Greenbelt Plan to the extent of any conflict. Municipal Official Plan policy must not conflict with the Niagara Escarpment Plan and no development approvals can be

given, including an *Aggregate Resources Act* licence until the Niagara Escarpment Commission has issued a Development Permit.

- A Place to Grow: The Growth Plan for the Greater Golden Horseshoe, as amended by Amendment 1 (2020) provides policies for growth management and environmental protection. This Plan defers to either the Greenbelt Plan or the Niagara Escarpment Plan where similar or overlapping matters are addressed. (At the time this report is being published, the Province of Ontario is consulting on combining the Growth Plan and the Provincial Policy Statement into one standalone document. This proposal remains in consultation status only.)
- The Halton Region Official Plan (2022, as amended up to and including ROPA 49) includes requirements for amending the Official Plan as well as policies for the protection of the Agricultural System and Agricultural Area, Mineral Resource Extraction Areas, and the Natural Heritage System.
- There are two official plans applicable in the City of Burlington. The 1997 Burlington Official Plan (as amended) outlines a long-term vision of the community and quality of life for Burlington residents and provides policy direction to the public and private sectors on land use, development, and resource management matters to guide the future planning and development of the City towards the desired community vision. The Official Plan implements policies recognizing and guiding the protection of the City's agricultural system, water resources, cultural heritage, natural heritage, and mineral resources.
- Burlington's New Official Plan was adopted by City Council on April 26, 2018, and approved with modifications by the Region of Halton on November 30, 2020. The 2020 Official Plan includes policy to manage physical change in relation to land use and development, transportation, infrastructure, the natural environment, heritage, parks, and social, economic, and environmental sustainability. The New Official Plan builds on the principles and direction of the previous Official Plan, including the recognition of a City Natural Heritage System, as well as recognizing and achieving consistency and conformity with policy advancements being implemented at other levels of government. The Ontario Land Tribunal has confirmed that sections of the new Official Plan are in force and not subject to appeal.

3. Overview of Technical Findings by the Joint Agency Review Team

JART planners worked with the applicant and their consultants through three circulations of updated plans and responses to technical review comments (through the consolidated comment tables and memoranda or letters as required). A third circulation was initiated in the summer of 2022, during which appeals for non-decision on the Local and Regional Official Plan Amendment applications were received from Nelson. These technical comments expanded upon the initial Letters of Objection provided by the agencies in December 2020. The work was supported by subject matter experts retained by Halton Region and the City of Burlington (see section 1.1 of this report) and technical staff from the public agencies.

The full record of consolidated technical comments is attached as individual appendices to this report. Below is a summary of the retained consultant's findings and opinions.

3.1 Agricultural Impact Assessment (AIA)

Michael Hoffman was retained by Halton Region to provide a review of the Agricultural Impact Assessment (AIA) prepared by MHBC Planning.

Detailed technical comments and proponent replies are provided in Appendix C to this report.

3.1.1 Review Methodology

The soils and agricultural review of the information provided by consultants on behalf of Nelson was prepared with the expectation that opinions provided by Nelson's consultants would be based on evidence. In the absence of information collected using randomized controlled trials, the following criteria were used to evaluate the Agricultural Impact Assessment, proposed rehabilitation plan, and other information presented in a technical review meeting listed above:

i. Concordance between the supplied terms of reference and the submitted AIA
ii. Conclusions and opinions based on quantitative evidence
iii. Context, both geographic and temporal, to provide for comparison (a relative importance ranking) as required by policy
iv. A description of methods as supported by published literature and practice in agrology
v. Searches to ensure that the latest information available is being used to assess agriculture (for example, currently OMAFRA, is correlating soils and soil capability values in Ontario which will potentially change soil names and soil capability classes)
vi. A study area, larger than the site subject to the proposed designation change, where the minimum study area size would be set by the zone of impact measured over time in former, as well as existing, quarry operations
vii. Discussion of the limitations of the methods and information presented
viii. The language in policy used as a rationale for the agricultural characteristics or factors documented and compared

ix. Discussion on the relative importance of agricultural characteristics documented and compared (for example, if agricultural characteristics are weighted or are not weighted, why was that decision made, and if agricultural characteristics are combined into a single rank or score, how that was completed?)
x. The scale at which the information is presented and the limitations of combining information (multi-attribute analysis) which may only be available at different scales
xi. An analysis of the size, location, and boundary conditions of the lands to be temporarily or permanently removed from agricultural use and/or the agricultural designation (prime agricultural area)
xii. Proof demonstrating that, for lands already used for aggregate extraction in Ontario, substantially the same areas and same average soil capability for agriculture have been restored; and, that the proposed Nelson rehabilitation to an agricultural after use will use the same or similar soil materials, within the same or similar environment, following the same or similar methods of rehabilitation as used to reach the goal of the same areas and same average soil capability for agriculture have been restored

3.1.2 Original Findings

AgPlan's peer review summarized findings related to MHBC's submitted AIA, the "AIA Reply", and the DBH Soil Services Addendum for the proposed west extension as incomplete because of:

i. Missing or incomplete information (Agricultural Table: Row 15)
ii. Inadequate reference to, and application of, existing policy, and guidelines including the analysis of alternative locations (Agricultural Table: Row 13)
iii. Lack of reference to quantitative, preferably replicated, studies concerning impacts to agriculture resulting specifically from the existing quarry, and/or generally to other aggregate operations (Agricultural Table: Row 17)
iv. An evidence-based rationale for the size of the secondary study area (Agricultural Table: Row 10)
v. No discussion on cumulative impacts (Agricultural Table: Rows 10 and 51)
vi. Insufficient integration of information from different disciplines (Agricultural Table: Row 14)

The review of the MHBC Site Plan Amendment (report number 4 on page 1 of this summary) listed several requests for additional information. The primary conclusion of the AgPlan review was that agricultural and soils information may be available, if and when, an updated Agricultural Impact Assessment is prepared by MHBC/DBH Soil Services.

3.1.3 Professional Opinion

Key conclusions out of the agricultural impact review include the following:

1. The proposed aggregate expansion application will remove prime agricultural lands from production in a Prime Agricultural Area (Agricultural Table: Row 18)
2. There is nothing in the information provided that the same or a similar range, diversity, and yield of crops, input requirements (e.g., water, fertilizer, farm management), and ecological effects will result on lands proposed to be rehabilitated to an agricultural after use relative to the agricultural

lands proposed to be removed from agricultural production as a result of aggregate mining. Therefore, an assessment of the rehabilitation plan cannot be based on the probability of the same or a similar crop diversity and yields, inputs, and ecological effects (Agricultural Table: Row 26)

3. In the peer reviewer's opinion, the approach taken by Nelson with respect to alternative locations does not consider a broader range of alternative locations, from a soil capability perspective, or a cost-benefit analysis, for example, at various scale from the Province through to the sub-tier municipal level, and subsequently to the lands in proximity to the proposed expansion area. Therefore, the analysis of alternative locations, required by agricultural planning policy, is flawed (Agricultural Table: Row 34)
4. The matter of cumulative impact has not been appropriately discussed. Such review and impacts need to be defined with respect to characteristics, time, distance, and scale relative to different kinds of impacts on agriculture (Agricultural Table: Rows 10 and 51)

The Proponent's Adaptive Management Plan shows additional use of soils to create an island in a ground water lake where that island will be rehabilitated for an agricultural after use. Unfortunately, the proponent has not cited literature indicating the probability that the agricultural island can be rehabilitated to a condition in which substantially the same areas and same average soil capability for agriculture are restored. Therefore, agricultural rehabilitation may require using new and/or untested methods to reach an end goal of same or similar soil capability relative to the agricultural land area used for aggregate extraction. Current information provided by the proponent means that it is unknown if adaptive management may reproduce similar soil capability, poorer soil capability or better soil capability for agriculture.

3.2 Air Quality Assessment

Dr. H. Andrew Gray (Gray Sky Solutions) was retained by Halton Region to conduct a review of the Air Quality Study prepared by BCX.

Detailed technical comments and proponent replies are provided in Appendix D to this report.

3.2.1 Review Methodology

Dr. Gray reviewed the Air Quality Study, which consisted of the main report and a number of appendices documenting the modeling and analysis, including emission calculations, mobile source emissions factors, AERMOD supporting files (emission scenario summaries), and model results. In addition, Dr. Gray reviewed a set of AERMOD modeling files for several emission scenarios.

3.2.2 Original Findings

Comments on the air quality study included:

- A recommendation to estimate air quality impacts in a larger geographic area, not just in the immediate vicinity of the facility (Air Quality Table: Row 2)
- A recommendation to evaluate the significant uncertainties in the modeled air quality impacts due to the use of marginal quality emission factors (mostly taken from US EPA AP-42), many of

which are outdated and/or are not applicable to the sources at this facility. Source testing of existing operations could also be conducted to determine more appropriate emission factors (Air Quality Table: Row 3)

- A recommendation to include a health impact analysis to evaluate the potential increased mortality and morbidity in the surrounding community associated with emitted particulate matter at the facility (Air Quality Table: Row 4)
- A recommendation to include additional information in the report concerning the preparation of the meteorological data files (specifically, where the meteorological data was obtained, and whether the AERMINUTE preprocessor was used to reduce the number of calm hourly winds. This item is expanded upon in Section 3.2.4 below (Air Quality Table: Row 6)
- A recommendation to include a non-uniform diurnal distribution of traffic emissions and/or account for peak hourly truck traffic in the modeling analysis. (Air Quality Table: Row 7)

3.2.3 Summary of Changes through JART Review

The Applicant did undertake additional research in response to Dr. Gray's review:

- BCX analyzed the contribution of various data quality rated emission groups to the receptor with the maximum PM2.5 (24-hour average) concentration. The contribution of the marginal data quality group is approximately 38%. If the contribution of the marginal data quality group is conservatively doubled, the PM2.5 (24-hour average) modelling result is still predicted to be below the PM2.5 (24-hour average) criterion (Air Quality Table: Row 3)
- Maximum hourly trucking of 112 truck trips per hour were updated in the calculation sheets. Two scenarios were prepared: Peak hourly traffic was very conservatively concentrated into morning hours as requested, and actual expected truck distribution per hour as provided in Appendix B of the Traffic Study. Modelling results PM2.5 (24hr) shows that there would be negligible change and that the AQS conclusions remain unchanged (Air Quality Table: Row 7)

3.2.4 Professional Opinion

The Nelson air quality assessment has not complied with the request to provide sufficient additional information regarding the data sources for the preparation of the meteorological data. Per the fourth bullet in Section 3.2.2 above, it is apparent that one-minute ASOS wind data were not included in the meteorological data preparation. This represents a significant shortcoming in the meteorological data used for the dispersion modeling analysis.

Despite this and the few minor errors that remain in the dispersion modeling analysis, the total particulate matter will likely not exceed Provincial air quality criteria. However, this needs to be confirmed through updated analysis.

3.3 Archaeology and Cultural Heritage

LHC Heritage Planning & Archaeology Inc. was retained by the City of Burlington to conduct a review of the Cultural Heritage Impact Assessment and Archaeological Assessments.

Detailed technical comments and proponent replies are provided in Appendix E to this report.

3.3.1 Review Methodology

LHC completed a review of the Cultural Heritage Impact Assessment and Archaeological Assessments submitted as part of the above noted application. The review of these reports was informed by previous iterations of the Cultural Heritage Impact Assessment Report and the Golder Stage 1-2 Archaeological Assessment, and proponent responses to the comment on those earlier versions.

3.3.2 Original Findings

LHC reviewed the comment responses and revised Cultural Heritage Impact Assessment and is of the opinion that the revised report dated June 2021 generally satisfies the submitted Terms of Reference, with the exception of outstanding concerns related to the evaluation of the property 5235 Cedar Springs Road - specifically the stone Ontario Gothic Revival Cottage. LHC maintains that, given the potential for a direct adverse impact related to removal, a screening-level evaluation is insufficient, and the property warrants further research and evaluation to determine if O.Reg. 9/06 criteria are satisfied. Further to the site visit on November 24, 2021, additional concerns have been identified related to the smaller outbuilding at 2280 No. 2 Side Road and a large barn immediately northwest of the proposed south extension lands (Cultural Heritage Table: Row 1).

The Stage 1-2 Archaeological Assessment dated September 15, 2020, has been entered into the Ontario Public Register of Archaeological Reports. A letter from the Ministry of Heritage, Sport, Tourism and Culture Industries, dated May 14, 2021, was included in the comment response package. The review letter from the Archaeological Review Officer was not included in the comment response package and should be provided to the agencies for review. LHC is of the opinion that the Study Area's location on the Mount Nemo Plateau, has not been considered in the understanding of the property's physiography and that consideration of other sites on the plateau (such as those identified within the proposed south extension) is warranted in this case. Notwithstanding this, the identification of areas of archaeological potential appears to have captured all undisturbed lands within the study area and the extent of Stage 2 activities appears to be in conformance with the Ministry of Heritage, Sport, Tourism and Culture Industries Standards and Guidelines for Consultant Archaeologists. A more robust understanding of the context of the Study Area or AiGx-462 would be very unlikely to affect the results and recommendations (Cultural Heritage Table: Rows 1, 2, and 15).

3.3.3 Professional Opinion

Two specific areas of concern remain related to LHC's peer review. Specifically, these relate to potential direct impacts (related to removal) of the smaller outbuilding at 2280 Side Road No. 2 and the stone Ontario Gothic Revival Cottage (golf club house) at 5235 Cedar Springs Road. In both cases, insufficient evidence has been provided to clearly demonstrate a lack of cultural heritage value or interest. Based on the available information, both of these structures appear to have likely cultural heritage value or interest. Avoidance would mitigate this concern (Cultural Heritage Table: Row 1).

No substantive outstanding issues remain with respect to the archaeological assessments. LHC concurs with the proponent responses that the standards outlined in the Ministry of Heritage, Sport, Tourism and Culture Industries Standards and Guidelines for Consultant Archaeologists have been met.

3.4 BLAST IMPACT ASSESSMENT (BIA)

Englobe (previously DST Consulting Engineers Inc.) was to carry out a peer review of the blast impact analysis prepared by Explotech Engineering Limited (Explotech). The peer reviewer conducted and submitted a preliminary (draft) review of Explotech's March 24, 2020, blast impact assessment report on October 19, 2020.

Detailed technical comments and proponent replies are provided in Appendix F to this report.

3.4.1 REVIEW METHODOLOGY

This review was limited to the scope of Explotech's blast induced vibrations and overpressure assessment based on the Ministry of Environment, Conservations and Parks (MECP) Model Municipal Noise Control By-law NPC 119 governing blasting in mines and quarries in the province of Ontario. The review highlighted areas of concerns not addressed, and critical factors that should have been considered by Explotech in their BIA report.

Following an area visit on September 25, 2020, to observe the site, surrounding receptors, and verifying potential for blasting impacts on third-party properties, Englobe conducted and submitted a more comprehensive review of Explotech's report on November 2, 2020.

3.4.2 ORIGINAL FINDINGS

The following highlights the identified deficiencies in the original BIA, and recommendations made by Englobe:

1. Critical conditions recommended by the BIA be included in the site plan notes (Blasting Table: Row 12)
2. The Golder Associates vibration attenuation study report referred to in the BIA report be provided for ease of technical review and cross reference (Blasting Table: Row 13)
3. The source of the Nelson Quarry vibration and Air Attenuation Curves included in Appendix C (Figures 5 and 6) of the BIA report be identified (Blasting Table: Row 14)
4. Vibration and overpressure data collected in the first 12 months of the proposed quarry extensions be incorporated in the data attenuation database to develop a more reliable and new site-specific attenuation formula (Blasting Table: Row 15)
5. Provide the rational why the attenuation formula established by Golder in 2004 was used, but the historical vibration and overpressure data from the same site was not incorporated in formula (Blasting Table: Row 16)
6. According to the "Level 1 and Level 2 Natural Environment Technical Report, April 2020, page 60, Fish Habitat Summary" conducted by SAVANTA, there are potential direct fish habitat within 120.0 metres of the adjacent lands, and no fish habitat within the extraction areas. Potential impact of blasting may be insignificant on the potential fish habitat within 120 m of the adjacent lands considering the proposed blasting parameters, however, the potential impact should have been addressed by the BIA. Location of these water bodies are also shown in the site plan drawings and described as "Water Features" (Blasting Table: Row 17)

7. Considering that the proposed blasting operations at one point will approach a standoff distance of 12.8 m from Sun Canadian Pipeline corridor, all requirements of their blasting specifications outlined in Appendix 2, section 8.3 to 8.5 under the heading "Vibration and Blasting Control" be implemented (Blasting Table: Row 18)

3.4.3 Summary of Changes through JART Review

The proponents responded to JART feedback by making the following changes to the application:

1. The critical conditions have since been revised to include conditions of approval (with the exception of reference to latest Explotech's BIA report, please refer to Explotech's BIA report of June 16, 2021, Nelson_-_Blasting_Response_to_JART_June_2021_Package). (Blasting Table: Rows 12 and 21)
2. Explotech has included the complete Golder's report in Appendix C of their updated blast impact assessment (Blasting Table: Rows 5 and 13)
3. The source of the Nelson Quarry vibration and air attenuation curves has since been identified by Explotech in their updated blast impact assessment.
4. Explotech has provided explanation regarding the exclusion of the historical vibration and overpressure data obtained during the 2014-2019 blasting campaigns. The exclusion is due to lack of details of blasting parameters required to establish site-specific attenuation equation. Recording of details are generally not required when vibration and overpressure monitoring are conducted for compliance purposes. The peer reviewer is satisfied with this explanation (Blasting Table: Row 16)
5. In their updated BIA report of June 16, 2021, Explotech has included a section under the heading "Blast Impact on Adjacent Fish Habitats." This section provides mitigation procedures and set back distances required by DFO to allow blasting operations in the vicinity of fish habitats. The peer reviewer is satisfied with this explanation (Blasting Table: Row 17)
6. Explotech has incorporated the requirements of the third-party pipeline company, namely Sun Canadian Pipelines guidelines for vibration and blasting control in their updated BIA report of June 16, 2021, which satisfies the pipeline companies' concerns (Blasting Table: Rows 18 and 21)

3.4.4 Professional Opinion

The context of blasting impact assessment the proponent has satisfied the requirements of the *Aggregate Resources Act* as it applies to the effects and impact of blast induced vibration and overpressure (noise) levels on sensitive receptors, provided the proponent implements the recommendations outlined in the Explotech updated BIA report of June 16, 2021.

3.5 Financial Impact Assessment

Watson & Associates Economists Ltd. (Watson) undertook an initial peer review analysis of the file and provided comments (report dated February 2021). Subsequently, Nelson retained Altus Group Economic Consulting (Altus) to update the financial impact study that was prepared in 2008. This report was also reviewed by Watson to determine the accuracy of the information presented and to confirm the report

met the requirements of the JART. The applicant and Altus provided comments in June 2022 along with an update memo. This memo along with the comments were also reviewed by Watson.

Detailed technical comments and proponent replies are provided in Appendix G to this report.

3.5.1 Review Methodology

The peer review assignment was undertaken by reviewing the Altus Report and identifying areas that were either not addressed or addressed incorrectly. Watson prepared an initial letter report for review with JART members and City of Burlington finance staff for discussion and input. This analysis included testing of assumptions (e.g., property assessments, tax classes) to determine the validity of the information utilized in the Altus Report.

When conducting a financial impact analysis, the methodology Watson uses involves an operating and capital cost/revenue analysis. The operating portion of the analysis involves calculating the City's and Region's tax and non-tax expenditures and revenues with the addition of the proposed quarry expansion. Note that for the purposes of the analysis, utilizing Financial Information Return (F.I.R.) data is reasonable as it provides the most up to date data on actual spending and revenues received for the municipalities. The data for population and employment is based on the applicants' assumptions (identified through the economic impact analysis discussed subsequently). The evaluation, revenues, and expenditures attributable to the development are estimated on an incremental basis. That is, revenue and expenditure dollars are assigned to the project, only in accordance with anticipated variations it would create from the base year, if it had been built out, as of that time. Sunk costs are ignored, and service levels are planned as remaining generally constant.

The impacts on services may be identified through other submitted studies (e.g., roads and water changes or issues which may have a financial impact) or through an analysis of the operating budget.

In undertaking the economic impact analysis, Watson utilized the input-output multiplier information provided by Statistics Canada. For temporary benefits arising from initial construction, these multipliers provide an estimate of the number of direct and indirect jobs per million dollars of construction value. This can also be utilized to estimate anticipated income tax revenue for the Provincial government (based on average salaries for the construction industry). For permanent impacts, the multipliers provide for an estimate of the number of direct and indirect jobs per million dollars of Gross Domestic Product (GDP) from the sale of aggregates. This information can also be used to estimate the income tax revenue for the Provincial government.

In general, Altus utilized a similar methodology, with some variations on the operating budget analysis.

The methodology Watson utilizes in conducting financial and economic impact analyses was used to peer review the Altus Report. This methodology has been utilized by the firm in conducting similar analyses, is considered best practice in municipal finance, and has been tested as the Ontario Land Tribunal (formerly, Local Planning Appeal Tribunal and Ontario Municipal Board). Since 1989, Gary Scandlan has undertaken over 175 municipal financial and economic impact assessments.

3.5.2 FINDINGS

As the quarry expansion will not increase employment, but rather continue the existing level of employment, there are no direct incremental economic benefits to identify. However, Altus has noted that the analysis reflects the continuation of operations relative to ceasing operations (Financial Table: Row 14).

In general, the fiscal impact study prepared by Altus initially focused on revenues the municipality will receive (e.g., property taxes, TOARC fees). With respect to operating expenditures, the approach taken was based on incremental assessment rather than incremental employment. Further, where a decrease in net operating costs was identified, no corresponding rationale for the decrease in services is provided. In Altus' latest update, the decreases in operating costs have been removed from the analysis (Financial Table: Rows 2, 6, 8, 10, 12, 13, 23, and 33).

With respect to the anticipated tonnage of aggregate to be extracted, it appears the amount utilized in the analysis is not in addition to the current extraction amount. This implies the revenues identified are not incremental to existing revenues. If the argument of the applicant is that without the quarry extensions, the revenue would no longer be provided to the City and Region, the fiscal impact study should also include a scenario which identifies the fiscal impact of this option. In Altus' June 2022 update memo, this was confirmed (Financial Table: Row 27).

ASSESSMENT ASSUMPTIONS

Watson would suggest an alternative approach to the estimating assessment. As part of the *Assessment Act*, the land valuation for assessment purposes shall have reference to equity with similar lands in the vicinity. As a result, Altus' survey of quarries in Brant, Puslinch, Melancthon, and Wellesley would not be appropriate. The survey should be focused on properties in the more immediate area (e.g., Burlington, Milton, and Halton Hills).

The assessment assumptions were overstated and therefore the tax revenues were overstated (Financial Table: Rows 7, 15, 28 and 29).

TAX CLASS ASSUMPTIONS

The assumption for the quarry expansion was that the entire licenced area would be taxed at the industrial rate and the remaining lands would be taxed 50% at the farmland rate and 50% at the managed forest rate.

The MPAC valuation guide for quarries and the Assessment Act note the following:

- The lands in the licenced area that are used for extraction are to be classed as industrial;
- The lands that are licenced but are not industrial or farmland are classed as residential; and
- The non-licenced lands in the total site area would be classed based on the use.

As a result, it is Watson's suggestion that the anticipated tax revenue was overstated as more of the property was identified as industrial which has a higher tax rate than residential (Financial Table: Row 22).

MPAC Proximity Adjustments

Watson identified adjustments that MPAC makes for residential properties adjacent and within one kilometre of a quarry site. No analysis was initially provided by Altus to quantify the impact on existing assessment values. The June 2022 update memo provided a high-level rationale for not undertaking the analysis. Given the property tax revenue was overestimated and not adjusted, the analysis should be undertaken to confirm the potential impact on assessment and tax revenue for the City of Burlington and Region of Halton (Financial Table: Row 29).

Calculation of the annual aggregate levy amounts was appropriately completed; however, the analysis appears to note that the tonnage amounts identified are a continuation and not incremental to existing tonnages. As a result, the annual aggregate levy calculated is not in addition to current revenues. This was confirmed in the 2022 update memo, which states that the analysis is undertaken in comparison to the scenario whereby the quarry ceases operations (i.e., does not expand) (Financial Table: Row 8).

The net operating expenditures analysis is undertaken in a similar manner to Watson's methodology, with the exception that assessment data is used rather than population and employment data to identify incremental costs. Some costs are identified to decrease based on a loss in assessed value, however, no rationale is provided. Watson would suggest a smaller (if any) reduction in the cost of services arising from this expansion. As a result, Altus updated their analysis to remove the reduction in operating costs (Financial Table: Row 33).

Based on the items noted above, the net fiscal impact (i.e., surplus) on the Region and City budgets was overstated (Financial Table: Rows 7, 15, 28 and 29).

Through comments on the initial financial impact submission by the applicant, it was noted that any long-term monitoring of the water supply, along with any related costs such as pumping, would be the financial responsibility of the applicant. Although this is a cost to be funded by the applicant, should the applicant no longer own/maintain the property in the future (e.g., through bankruptcy or other means), the City and Region should assume the potential annual costs to continue with long-term monitoring, pumping, etc. It was recommended that the financial impact analysis include an estimate of these costs, however, in the 2022 update memo, it was noted that this would be the responsibility of the Province. It appears that TOARC fees fund a program for rehabilitation of quarry sites called the Management of Abandoned Aggregate Properties (MAAP). The rehabilitation of any site can only be undertaken with the consent of the property owner and is paid from the 3% portion of the tonnage fee paid by aggregate producers (Financial Table: Rows 10 and 12).

The Altus Report estimates the economic impacts of the quarry expansion using the standard Input-Output model. This approach estimates the impacts using multiplier data from Statistics Canada. The anticipated employment, wages, and taxes are estimated based on the assumed Gross Domestic Product from sales of 1,000,000 tonnes of aggregate per year. In general, the approach to the calculations appears valid and consistent with the approach Watson would undertake. However, the economic impact of the ongoing operations (section 4.2.4 of the Altus report) should clarify that this would be a continuation of the existing levels of economic activity and not incremental to the existing operations. Note that the 2022

Altus update memo confirms this employment is a continuation of existing quarry employment (Financial Table: Rows 14, 16, 32).

3.5.3 Results of Analysis

Although the net financial impact has been overstated, in Watson's opinion, this alone would not be a basis to deny the application of Nelson to expand the Burlington Quarry. The net financial impact, however, provides the JART with a full picture of the information in order to properly assess the financial implications of the proposal. Once the items noted are addressed, staff will be able to incorporate these results into their overall recommendations.

3.6 Hydrogeology

Norbert Woerns was commissioned to review technical reports related to hydrogeology. Additional support comes from S.S. Papadopulos & Associates, Inc. (modelling focus) and Daryl Cowell (karst focus). Technical review by Conservation Halton staff was also provided. Hydrogeology emerged as the issue area associated with the greatest need for further integration into other studies prepared by Nelson and their consultants to support the proposal.

Detailed technical comments and proponent replies are provided in Appendix H to this report.

3.6.1 Review Methodology

Hydrogeological documentation was reviewed for appropriateness of methodologies used in the investigations, completeness of the investigation and analysis, and consistency between the report conclusions and recommendations and the field data. The documentation was also reviewed to ensure it aligned with the terms of reference prepared by Nelson in support of their studies, with comments incorporated into the first round of technical review.

The following major components are included in the hydrogeological review:

1. Review of the Terms of Reference for the 'Level 1 and Level 2 Hydrogeologic and Hydrologic Impact Assessment of the proposed Burlington Quarry Extension, Nelson Aggregates Co.' February 2020.
2. Review of the 'Level 1 and Level 2 Hydrogeological and Hydrological Impact Assessment Report of the Proposed Burlington Quarry Extension, Nelson Aggregates Co., April 2020' by Earthfx Incorporated (Earthfx) for completeness.
3. Assess whether the Earthfx report adequately characterized the hydrogeology of the subject lands and adequately defined the potential for impact of the proposed quarry operations on the local groundwater system.
4. Review of the conclusions and recommendations with respect to local impacts on the groundwater system from the proposed quarry operations as they relate to existing groundwater users and natural heritage features.
5. Assessment of the adequacy of the proposed groundwater and surface water monitoring and mitigation program.

6. Examination of the reports by Tatham Engineering (Tatham), Savanta Inc. (Savanta), MHBC Planning, Urban Design and Landscape Architecture, (MHBC), and Explotech Engineering Limited (Explotech) as well as plans of the proposed quarry operations by MHBC. These related reports and plans were examined to ensure consistency with respect to the assessment of potential impacts on the groundwater and surface water systems, natural heritage features, and groundwater users.

3.6.2 Original Findings

The review resulted in the identification of some deficiencies and inconsistencies in the hydrogeological investigations completed by Earthfx. The detailed comment table is long, with numerous issues identified by JART reviewers which remain unresolved by Nelson. The following issues are particularly critical to supporting the principle of the application:

1. The integrated groundwater and surface water model is complex, consisting of a number of subcomponents which have been combined to provide an integrated groundwater/surface water model. The hydrogeological analysis relies upon the integrated model for predictions of potential impact of the quarry expansion. The conclusions of the analysis do not fully account for some field evidence at odds with the report conclusions and mitigation recommendations. The assumption that existing conditions represent 'baseline' conditions for purposes of computer modelling, does not identify or acknowledge the impacts of the existing quarry and therefore cannot be considered an analysis of cumulative impacts as defined through applicable policy documents (Hydrogeology Table: Rows 6, 61, 63 and 65)
2. Considerable on-site groundwater monitoring data exists, particularly for the proposed southern extension, from previous investigations that have not been incorporated into the studies for this application. There are gaps in groundwater monitoring data utilized in the model simulations that limit calibration of the model results for critical periods. The report does not identify the significance of these data gaps with respect to the reliability of the model analysis and conclusions. Further, the applicant and the JART and agency staff recognize data limitations for the proposed west extension lands and have proposed establishing threshold groundwater levels for those lands once sufficient data have been collected—as a condition of approval. The applicant has proposed that the collection of monitoring data, from which threshold levels are to be established for the proposed west extension, will be obtained during the period of operation of the proposed south extension. It is questionable whether these data will provide appropriate baseline conditions from which to establish threshold levels as they will be established while potentially under the influence of the ongoing operations of the proposed south extension (Hydrogeology Table: Rows 10, 20, 156, 191, 262, 263, and 276)
3. The model predicts there will be minor impacts to private wells located downgradient of the western extension. It is proposed to construct an infiltration pond to maintain groundwater levels and thereby maintain downgradient water supplies to private wells. There are no data or field testing to confirm that the proposed infiltration ponds will function as assumed and be sufficient to maintain down gradient private wells (Hydrogeology Table: Rows: 229, 264, 269 and 311)

4. Flow profiling data obtained as part of the previous Nelson Aggregate Co. expansion application in 2004 demonstrated that water availability diminishes with depth through the Amabel Formation with no flow of water near the bottom of the Amabel Formation. These data cast doubt on the proposed mitigation measure of deepening existing wells into the Amabel Formation in maintaining private wells that are subject to well interference from the proposed quarry expansion (Hydrogeology Table: Row 308)
5. Measures to protect groundwater quality within the quarry ponds and sumps from significant potential sources of contamination such as the adjacent pipeline have not been addressed. The spill response plan provides a description of the mechanics of spill reporting and cleanup, also outlining roles and responsibilities of individuals with respect to spill detection, reporting and cleanup. Absent from this document are monitoring requirements to determine effectiveness of spill cleanup and measures to protect the quarry sumps from discharging contaminants in the sump discharge. Likewise, water quality limits were provided in the Environmental Certificate of Approval (ECA) for sump discharges for the existing quarry. It was proposed to maintain those limits with the proposed rehabilitation Scenario RHB1 where sump discharge would continue as part of the rehabilitation plan. No reference is made to drinking water quality limits as the discharge water is proposed to be infiltrated by proposed infiltration ponds to maintain groundwater levels in down-gradient private wells (Hydrogeology Table: Rows 7 and 208)
6. Earthfx contends that the Halton Till is a regionally extensive aquitard that limits groundwater flow and isolates the surface wetlands from the groundwater system. The modelling results indicate minor groundwater contribution to wetlands in the vicinity of the proposed quarry extensions. The report fails to provide a thorough analysis of on-site data including hydrographs of shallow groundwater monitors installed by Tatham and from hydrographs and previously completed pumping tests by Golder Associates (2004 and 2006) that suggest there is hydraulic connection between wetlands and the underlying groundwater system (Hydrogeology Table: Rows 9 and 99)
7. The revised site plan for the existing quarry (April 2021) shows a vertical quarry wall adjacent to a part of the proposed southern extension, along No. 2 Side Road. The potential for enhanced seepage through and long-term stability of the intervening rock mass should be evaluated as part of the site rehabilitation and closure of the aggregate operations (Hydrogeology Table: Row 19)
8. The proposed rehabilitation plan RHB1 requires ongoing pumping in perpetuity to maintain current water regimes." The analysis provided does not contain adequate evaluation of all possible alternatives to perpetual pumping (Hydrogeology Table: Row 252)

3.6.3 Summary of Changes through JART Review

Earthfx responded to the JART comments by providing clarifications of its analysis and also provided additional summary tables of their analysis and conclusions. Additional computer simulations were also provided of the proposed infiltration ponds between the proposed west extension and the private wells along Cedar Springs Road to the west. Additional water quality data was provided for groundwater monitors primarily in the west extension area as well as some private wells.

3.6.4 Professional Opinion

Nelson and Earthfx responded to a number of issues identified above and provided some clarification with additional information to the JART (Hydrogeology) Comment Summary Table. The major issues noted above require further resolution and additional information. Some additional information was provided during the site visit and has not yet been received in writing. For example, additional monitors have been installed and a commitment to an on-site climate station was provided.

Few details were originally provided on the nature and preliminary design of the proposed infiltration ponds. It was noted in subsequent information that the proposed infiltration ponds would be excavated to the bedrock surface with the removal of overburden deposits (Hydrogeology Table: Row 94).

It was observed during site visits on November 9, 2021, and October 25, 2022, that additional shallow overburden monitors were completed in the proposed west extension area primarily associated with the existing wetlands and in the Medad Valley respectively. Monitor details and monitoring data collected from these monitors was unavailable for the technical review. These monitors were completed after the pumping test of the bedrock in the proposed west extension and were not available for the pumping test to determine the hydraulic interconnection between the overburden and bedrock. Earthfx has not provided an explanation on the apparent contradiction in their conclusions regarding hydraulic connectivity between the overburden and bedrock in the west extension, where hydraulic connection is assumed through the overburden to the bedrock, and the south extension, where the Halton Till overburden is considered, a regional aquitard resulting in presumed hydraulic isolation of the wetlands from the underlying bedrock (Hydrogeology Table: Row 9).

The additional water quality data provided identified locally elevated sodium and chloride levels within groundwater monitors in the proposed western extension. This was attributed to localized road salt impacts. Higher sodium and chloride levels in deeper monitors with decreasing levels in shallower monitors suggests that the elevated sodium and chloride is from a deeper source and not road salt. This has implications for the proposed deepening of private wells impacted by quarry operations as a mitigation measure for private wells. A more complete investigation of downgradient private wells and the proposed mitigation measures is warranted given the uncertainties of the proposed mitigation measures (Hydrogeology Table: Rows 7 and 84).

3.7 Hydrologic/Hydrogeologic Modelling

S.S. Papadopulos & Associates, Inc., (SSP&A) was retained to provide an independent peer review of the hydrologic/hydrogeologic modelling prepared by Earthfx. Conservation Halton staff also reviewed the modelling.

Detailed technical comments and proponent replies are provided in Appendix I to this report.

3.7.1 Review Methodology

In addition to the Level 1 and Level 2 Hydrogeological and Hydrological Impact Assessment Report (Earthfx, April 2020), SSP&A reviewed a number of the various technical reports, the site plans as updated, and responses and clarifications provided by Nelson.

During the peer review, SSP&A has also consulted guidance documents on groundwater modelling and model reviews, including:

- Anderson *et al.* (2015). Applied Groundwater Modeling;
- American Society for Testing and Materials (ASTM) groundwater modelling guidance documents (2010, 2013, 2014, 2016);
- Spitz and Moreno (1996) textbook, A Practical Guide to Groundwater and Solute Transport Modeling;
- Wels *et al.* (2012) Guidelines for Groundwater Modelling to Assess Impacts of Proposed Natural Resource Development Activities, prepared for the British Columbia Ministry of the Environment; and
- Reilly and Harbaugh (2005) United States Geological Survey Guidelines for Evaluating Groundwater Flow Models.

SSP&A has also reviewed documents on the state of the practice of coupled and integrated groundwater/surface water modelling, including the following summaries of intercomparisons of integrated surface water/groundwater models published in the peer-reviewed literature:

- Delfs *et al*. (2021), "An inter-comparison of two coupled hydrogeological models."
- Haque *et al*. (2012), "Surface and groundwater interactions."
- Kollet *et al*. (2012), "The integrated hydrologic model intercomparison project."
- Maxwell *et al*. (2012), "Surface-subsurface model intercomparison."

3.7.2 Original Findings

The modelling reported in the Burlington Quarry Extension Level 1/2 Assessment Report (Earthfx, 2020) is an essential component of the proposed application and serves an important purpose. The modelling identifies the natural and manmade features that may be affected by the proposed extensions. These features include streams, wetlands, and private wells. The coupled analyses that have been developed and applied are comprehensive and have been conducted to a high technical standard.

The modelling is essential; however, it is important to note that it involves deliberate simplifications of a complex natural system. Viewed from this perspective, an impact assessment that is model-driven is problematic. Rather than replacing data collection and synthesis, the modelling should be complementary. Models provide insights into what is likely to happen when a proposed development proceeds and are important for the ongoing interpretation of changes. It must be stressed that models are not definitive. The emphasis of the assessment should be directed to the analysis of all site data, and to the development of a comprehensive and robust Adaptive Management Plan (Hydrogeology Table: Row 63).

Review of the Assessment of the Predicted Impacts for the South Extension

The presentation of the simulation results in the Earthfx (2020) report suggests that the impacts from construction of the proposed south extension are likely to be negligible. There are important uncertainties in the predictions of potential impacts. The uncertainties in the assessment highlight the importance of a comprehensive and robust Adaptive Management Plan.

1. There are no climate stations at the existing quarry or on Mount Nemo (Hydrogeology Table: Rows 104 and 113)
2. The simulations do not extend over a sufficiently long enough time period to adequately capture the likely range of climatic conditions (Hydrogeology Table: Rows 64 and 65)
3. The simulations are limited to a period during which the footprint of the quarry has not expanded (Hydrogeology Table: Row 61, 64 and 65)
4. Referring to Earthfx (2020) Figures 8.6 through 8.9, it is not possible to assess the reliability of the simulated streamflows through the wetlands (Hydrogeology Table: Row 236)
5. The conclusion that none of the wetlands in the immediate vicinity of the quarry receive significant groundwater inflows is contingent on the assumption that the wetlands are hydraulically isolated from the bedrock groundwater system (Hydrogeology Table: Row 340)
6. The simulated water levels at the wetland monitors near the proposed south extension are generally not consistent with field observations presented in the Earthfx wetland characterization summaries (Hydrogeology Table: Row 63)
7. The simulated wetland water budgets have fundamental limitations with respect to the assessment of potential impacts. First, the water budgets are presented for time-averaged conditions. The results are not useful for assessing the potential seasonal changes, and in particular the changes in the components of the water budget during the critical time of the wetland hydroperiods. Second, the plotted water budgets for the Phase 1 and 2 scenario cannot be compared directly with simulated water budgets for the baseline period. The water budgets for baseline conditions are averaged over water years 2010 and 2014 (see Earthfx, 2020; Figures 7.24 through 7.30). In contrast, the Phase 1 and 2 scenario water budgets are averaged over water years 2010 and 2011 (see Earthfx, 2020; Figures 8.31 through 8.37). The approach for presenting the results of the modelling in a manner that cannot support direct comparisons must be questioned (Hydrogeology Table: Rows 69 and 79)
8. The reporting of the potential lowering of groundwater levels resulting from the proposed south extension is presented only for Model Layer 6, the hypothesized Middle Amabel Fracture Zone (Figures 8.5 and Figures 8.12 through 8.19 in the Earthfx report). With respect to impacts to the wetland areas, the critical changes in groundwater levels are expected to occur at the contact between the glacial sediments and the bedrock, that is, Layer 4 of the GSFLOW model (Hydrogeology Table: Row 194)

Review of the Assessment of the Predicted Impacts for the West Extension

The wetlands of the Medad Valley are relatively close to the proposed west extension. Between the proposed extension and the Medad Valley there are numerous private wells along Cedar Springs Road.

1. As shown in Earthfx (2020) Figure 3.6, the wetlands of the Medad Valley are relatively close to the proposed west extension. The provided model predicts that the development of the proposed west extension (Phases 3, 4, 5 and 6 scenario) is predicted to cause reductions in surface water flows through the Medad Valley, and the model containing a high degree of uncertainty in prediction of changes to streamflow in the Medad Valley (Hydrogeology Table: Row 114 and 336)
2. There are also numerous private wells along Cedar Springs Road. The model predicts that development of the west extension may cause a lowering of groundwater levels (drawdown) in the Amabel aquifer surrounding the excavation. The model predictions suggest a complex pattern of drawdown. A small drawdown of 0.05 m or less is predicted in Model Layer 6 at a hypothetical monitoring location that is closest to the excavation, GW1 (Figure 8.12 of the Earthfx report). However, at the hypothetical monitoring location GW2, which is farther from the excavation, a maximum drawdown of about 0.65 metres is predicted in Model Layer 6 (Figure 8.13 of the Earthfx report). Referring to Figure 8.43 of the Earthfx report, the model predicts that time-averaged drawdowns may decrease sharply with distance; beyond 500 m from the active face will be less than 2.0 metres (Hydrogeology Table: Row 63)
3. Time-averaged water budgets for the Medad Valley wetlands (MNRF #13204) are not included in the *Level 1/2 Assessment Report*. However, it is indicated in the report that "The effects of P3456 on the wetlands in the vicinity of the excavation has been demonstrated by the water budget analysis". Simulated time-averaged water budgets are presented for the Medad Valley wetland in the *Wetland Characterization Summaries* (Earthfx, 2021; Wetland 13204 Figures 2A through 2E). Between the Baseline and P3456 simulations, the reported groundwater discharge to the stream running through the Medad Valley is predicted to decline from 187 m^3/day to 97 m^3/day, a 47% reduction. The reported leakage from the stream is predicted to decline from 99 m^3/day to 60 m^3/day, a 38% reduction. The predictions suggest that development of the west extension may cause substantial changes to the groundwater budget for the Medad Valley (Hydrogeology Table: Rows 69, 79)
4. The proposed infiltration pond at the west extension is conceived to help maintain groundwater levels and the flow divide between the quarry and Cedar Springs Road. The proposed infiltration pond at the west extension pond will have implications with respect to both the quantity of groundwater discharge to the Medad Valley and to the groundwater quality. The assessment of the potential effects of the proposed infiltration ponds presented in the Earthfx memorandum dated May 29, 2022, is model-driven, rather than data-driven. At the present time there are no data provided to confirm the reliability of the predictions. It is noted that the area between the proposed west extension and the Medad Valley has not been subject to extensive field investigations. As a result, the modeling predictions should be considered highly uncertain (Hydrogeology Table: Row 116)

5. The assessment of potential impacts on groundwater levels is limited to consideration of conditions in Model Layer 6, the Middle Amabel Fracture Zone. This approach introduces important uncertainties in the assessment (Hydrogeology Table: Row 63)
6. The requirement to retain a continuous model layer for the Middle Amabel Fracture Zone has been interpreted in a way considered to be nonphysical. The approach that has been adopted in the analyses likely leads to overprediction of the available drawdown in wells along Cedar Springs Road (Hydrogeology Table: Row 194)
7. In the assessment of private groundwater supplies, Earthfx has assumed that at any location in the vicinity of the quarry a private water well could be drilled to Model Layer 8, the Amabel Lower Fracture Zone. This is not supported by the available data. The depths of private wells within 500 metres of the extraction boundary are reported on Table 5.3 of the Earthfx report. It is likely that most of the private wells extend only into the weathered top of rock (Model Layer 4) or the Amabel Middle Fracture Zone (Model Layer 6) (Hydrogeology Table: Row 340)
8. It has been assumed in the modelling that the lower portion of the Amabel Formation is a productive aquifer. This assumption does not appear to be consistent with the results of packer testing (Figure 5.6), which do not show an interval of consistently higher productivity at the bottom of the Amabel (i.e., relatively higher hydraulic conductivity). It appears that the greatest weight has been placed on the results of the testing of BS-01 (Figure 3.25), a location that does not seem to be typical of the bottom of the Amabel Formation as shown on the profiles of packer testing (Figures 5.6, 5.7 and 5.8). (Hydrogeology Table: Row 194)

3.7.3 Summary of Changes through JART Review

A substantial record of comments and responses was developed during the JART review. The responses to comments have provided important clarifications of the analyses that have been conducted. However, the essential elements of the proposal have not changed through the review. During the review, additional analyses were conducted to assess the potential impacts of an infiltration pond included in the plans for the proposed west extension. This pond will have implications with respect to both the quantity of groundwater discharge to the Medad Valley and to the groundwater quality. However, it is indicated in the documentation of these analyses that the proposed infiltration pond is intended to maintain heads and the flow divide between the quarry and Cedar Springs Road. It is also indicated that the infiltration pond is not required. The additional analyses have not confirmed whether it would be advantageous to include the infiltration pond in the final proposed site plans.

3.7.4 Professional Opinion

There are important limitations and uncertainties in the analyses of the proposed south and west extensions. The uncertainties highlight the importance of including the conception and evaluation of mitigation measures and contingencies in the assessment. With respect to the proposed south extension, on the basis of the model results it is concluded that "the wetlands will leak a small amount more to the groundwater system when Phases 1 and 2 are complete, but the effect of this change will be so small that it cannot be measured in the field and will not change the overall water budget of each wetland". It is not clear how impacts to wetlands will be mitigated if there are areas where the vertical hydraulic conductivity of the Halton Till is higher than assumed in the analyses (Hydrogeology Table: Row 63).

With respect to the proposed west extension, it is not clear how impacts to private wells will be mitigated if declines in groundwater levels lead to reductions in well capacities. It is not clear that well capacities can be maintained by drilling the wells deeper; restoring well capacities by extending wells may not be feasible if the deeper rock is not sufficiently transmissive, or the ambient water quality deteriorates with depth (Hydrogeology Table: Row 63).

3.8 KARST HYDROGEOLOGY

Daryl Cowell was retained to contribute to a technical review of a component of the hydrogeology, specifically focussing on potential karst issues. Conservation Halton also reviewed the studies to ensure the regulatory requirements under O.Reg. 162/06 in terms of natural hazards: potentially hazardous karst (i.e., unstable bedrock) are met. Those findings are summarized in the Natural Hazards section.

Detailed technical comments and proponent replies are provided in Appendix J to this report.

3.8.1 REVIEW METHODOLOGY

Technical reviews are based on Mr. Cowell's professional training and work in the area of karst hydrogeology including undergraduate and a Master's studies and karst field and research work conducted over an approximately 50-year career. This work included previous involvement in Nelson's first expansion application in 2004. His opinion is informed by this knowledge and experience of potential karst features and processes on the site and immediate surroundings that could impact significant surface water features due to extended dewatering of the proposed two extensions.

A formal technical review with detailed comments on the submitted Hydrogeology report (including Dr. Worthington's Karst appendix) and the AMP report was submitted on December 21, 2020, with further review and responses to Nelson's reply submissions and comments in this issue area.

3.8.2 ORIGINAL FINDINGS

Significant surface water features include several Provincially Significant Wetlands and an Area of Natural and Scientific Interest – earth science and life science referred to as the Medad Valley. Potentially impacted wetlands include those on the surface of the till plain surrounding the proposed expansions, particularly to the south, and the Medad Valley to the west. Impacts to the till hosted wetlands could result from the interaction of karst and/or bedrock fracturing and enhanced permeability zones within the till hosting the wetlands. The water balance within the Medad Valley relies heavily on karst spring groundwater discharge from the escarpment located between the valley and the proposed western extension.

The two key findings related to a karst-oriented review of the proposal are:

1. The Halton Till does not have a uniform hydraulic conductivity (known as "K" in technical literature), is not an aquitard as stated, and has not been appropriately characterized regarding wetland hydrology and model layer input (Hydrogeology Table: Row 21)
2. Groundwater flows to the Medad Valley have not been adequately characterized. These flows involve flow through discrete karst conduits (not an equivalent porous medium, or EPM), which

could result in complete or partial abandonment due to extraction. Impacts to groundwater flow to the valley and its wetlands have not been adequately defined (Hydrogeology Table: Rows 34, 39 and 55)

There is also a lack of monitoring proposed in the adaptive management plan, particularly of spring flows, and no reference to how monitoring would be adjusted or revised based on the information generated. One particular fault is the absence of any contingency recommendations in the event of impacts such as shifting or halting quarry operations based upon the scale of issue generated (Hydrogeology Table: Rows 56 and 57).

3.8.3 Summary of Changes through JART Review

Four minipiezometers were placed within the Medad Valley in order to monitor potential changes in groundwater levels within the valley. Three of these, located on HRCA lands, were visited on November 3, 2022, with one located in a talus pile well above the groundwater table, a second near the upper limits of the groundwater table and the third within the groundwater table.

3.8.4 Professional Opinion

Issues arising from the proposed expansion application include:

- The role and functioning of a proposed infiltration pond located at the western boundary of the proposed western extension (Hydrogeology Table: Rows 44 and 52)
- The lack of monitoring (quantity and quality) of spring flows in springs known to be feeding the Medad Valley (Hydrogeology Table: Rows 56, 57 and 211)
- Use of 'simulation flows' to represent flows in Willoughby Creek at stations #7 and #14 (Hydrogeology Table: Rows 53, 54 and 55)
- Continued representation of hydraulic conductivity of the Halton Till (being 10^{-7} m/sec throughout the entire site/surface plain above the Medad Valley) (Hydrogeology Table: Row 21)
- The rehabilitation proposal to not fill the western extension excavation thereby permanently impacting groundwater flow to the Medad Valley (Hydrogeology Table: Row 76)

3.9 Natural Heritage – Terrestrial

North-South Environmental Inc. was commissioned to review technical reports, with a focus on terrestrial habitat and fisheries associated with the quarry expansion. Conservation Halton also reviewed technical reports with a focus on regulated wetlands. Review in this discipline was informed by collaboration and discussion with JART's groundwater and surface water experts.

Detailed technical comments and proponent replies are provided in Appendix K to this report.

3.9.1 Review Methodology

The natural environment, rehabilitation plans, and draft adaptive management plans were reviewed, along with the site plans at various stages of review.

Review compared the methods and protocols used by Nelson's consultants to protocols recommended by appropriate sources accepted as best practice within the Province of Ontario. North-South Environmental undertook this assessment of method and protocols utilizing experience obtained over 20 years of consulting practice in Ontario, with an understanding gained of standard practice during field surveys, analysis and reporting for private, municipal, provincial, and federal clients.

Survey methods utilized by the applicant's respective consultants were also reviewed, as these are critical factors in determining habitat function and detecting the presence of species at risk (SAR) and other indicator species of significant habitats. The analysis of significance was reviewed using an understanding of the protocols for interpreting the findings of field results according to the guidance from provincial and regional policies. Water balance analysis was reviewed using an understanding of the vernal pool hydroperiod requirements for breeding amphibians in general, and particularly Jefferson Salamanders which have documented habitat in proximity to the proposed extraction area. Review was undertaken to ensure a comprehensive understanding of the impacts of duration and depth of flooding on vegetation communities. Additional consultant expertise was gained in North-South's well-documented history in both drafting and applying Halton Region's Natural Heritage Reference Manual, which provides guidance on evaluation and delineation of natural heritage features.

Review in this discipline was informed by collaboration and discussion with JART's groundwater and surface water experts.

3.9.2 Original Findings

The initial wetland characterization summaries provided required additional information, including the addition of wetland 13015. Where available, reference should be made to functions determined from studies conducted during the previous investigations in the proposed south extension, as wetlands would likely continue to support these functions, and they are important to the understanding of wetland significance. More detail was requested on post-extraction water balances, particularly to describe what they imply for the hydroperiod of the wetland from an ecological perspective.

Eighteen additional issues remained based upon initial review:

1. Uncertainty regarding impacts of groundwater drawdown on off-site features has not been resolved, but that impacts of the drawdown could extend hundreds of metres off site. Concerns remain that there may be impacts on hydroperiods of wetlands and on habitat for wetland-dependent wildlife, including Jefferson Salamander, and of insufficiency of groundwater monitoring in breeding ponds (Natural Environment Table: Row 24; and Surface Water Table: Row 146).
2. Times, dates and weather conditions for amphibian, bird and reptile surveys should be summarized in a table for peer-review, as this is standard practice (Natural Environment Table: Row 27).
3. Concerns remain that salamander trapping was not conducted in the golf course ponds. The ponds should be trapped, as NSE's latest observations indicated that these ponds are similar to

other human-made ponds that have been observed by NSE staff to support Jefferson Salamander and/or other Ambystomatid salamanders (Natural Environment Table: Rows 25 and 51).

4. Surveys for Blanding's Turtle were apparently conducted in 2021. The results of these surveys should be provided to JART for review (Natural Environment Table: Row 26).
5. Snake surveys continue to be recommended, based on MNR Guelph District protocols for surveying Milksnake, which are recommended for snake species that are not at risk, and that information provided to JART (Natural Environment Table: Row 55).
6. A review of woodland significance is required, based on dripline surveying conducted during site visits in November and early December 2021, and based on concerns that the sampling protocols did not include large enough sampling plots to encompass the heterogeneity of the woodlands on the site (Natural Environment Table: Row 50).
7. The linkage function of the "non-significant" woodlands on the golf course, which are included within Halton's Natural Heritage System, has not been adequately analyzed, particularly the function of the woodlands to support connection between regionally significant features on and off-site (Natural Environment Table: Row 110).
8. Though the revised Rehabilitation Plan shows a connection between the retained Significant Woodlands and the landscape to the south, this connection will be removed during extraction south of the woodland, so the connectivity of the landscape potentially will be impaired for many years (the timing has not been provided). The proposed connection is narrow and mainly consists of steep slopes. The connection of the retained Significant Woodland to features within the natural heritage system on the north side of Colling Road is severed. The linkage is proposed to be "switched" during extraction from the south to the west and back to the south, which would likely be ineffective to provide connectivity between the retained woodlands and the surrounding natural heritage system (Natural Environment Table: Row 31).
9. Impacts of fragmentation within the retained significant woodland has been incompletely analyzed (Natural Environment Table: Row 30).
10. The Regional significance of wetland 13203 should be analyzed. As noted in item 1, the impacts of pumping water into this wetland during dewatering of the proposed south extension should be analyzed. The omission of some wildlife surveys from this wetland means that significant species may have been missed (Natural Environment Table: Row 33).
11. It should be clarified whether surveys of Wetland 13203 included surveys for Blanding's Turtle (Natural Environment Table: Rows 54 and 83).
12. Terrestrial cumulative impacts should be analyzed, as the current cumulative impact analysis only considers impacts from an aquatic ecology perspective (Natural Environment Table: Rows 30, 32, 34 and 97).
13. The impacts on significant wildlife habitat of pumping sump water into wetland 13203 should be discussed (Natural Environment Table: Row 33).
14. The proposed function of the infiltration pond should be clarified. There has been conflicting information regarding its function, with two explanations provided: 1) that it is needed to maintain seepage in the Medad Valley and to maintain hydroperiod in wetland 13201 north of No. 2 Side Road; or 2) it is proposed to replace the golf course ponds as an amenity (Natural Environment Table: Row 46). This clarification should be provided to JART.

15. Floristic Quality Analysis should be used to compare the quality of significant and non-significant woodlands on the golf course (Natural Environment Table: Row 49). This clarification should be provided to JART.
16. Searches should be conducted for turtle nesting habitat within the study area and the results shared with JART (Natural Environment Table: Row 54).
17. The location of Snapping Turtle, which is a Species at Risk with a status of Special Concern, should be shown on Figure 7a, as habitat for Special Concern species is considered a criterion for Significant Wildlife Habitat (Natural Environment Table: Row 54).
18. A restoration area for Jefferson Salamander has been proposed south of the proposed south extension. The restoration is proposed to respond to Regional policy. The Region should be circulated on details regarding this restoration area. There appears to be no technical support for the feasibility of restoring this area for Jefferson Salamander, since no background studies have been conducted to determine if salamanders move in this direction, or whether suitable habitat could be restored in this location. In addition, the restoration will be within the 120 metre zone of influence of the landfill, where impacts could be more significant, so we question whether this is an appropriate place for restoration of salamander habitat. Concerns remain that such a restoration area could become an ecological sink for Jefferson Salamander (Natural Environment Table: Row 113).

3.9.3 Summary of Changes through JART Review

The site plan has been revised to include Woodland E as part of the protected area. It was pointed out in previous comments that the dripline of Woodland E is less than 20.0 metres from the dripline of Woodland D, and that it should have been included in the complex of woodlands and wetlands that form Woodland D on the golf course when the initial assessments were completed. Its function as bat maternity roost habitat will contribute to the overall function of Woodland D as Significant Wildlife Habitat, and as habitat for Species at Risk.

Further details were included with respect to survey dates, times, and weather conditions, addressing an initial issue raised (Natural Environment Table: Rows 28 and 110). There was also additional staking undertaken on site to delineate feature boundaries on site, and additional features were proposed for protection.

Figure: *Woodlands Map*
This map has been prepared to help with geographic location identification for the reader.

Updated wetland characterizations were also provided by Nelson (Natural Environment Table: Row 24).

It was clarified that Blanding's Turtles were not found during additional investigations. Surveys for overwintering turtles were not conducted in the proposed south extension, where there is potential habitat for this species as well as other Species at Risk such as Snapping Turtle (Natural Environment Table: Rows 51 and 54).

Conservation Halton reviewed wetlands as per O.Reg 686/21 and O.Reg 162/06. As identified above, Conservation Halton regulates a distance of 120.0 metres from Provincially Significant Wetlands (PSW) and wetlands greater than 2 hectares in size and 30.0 metres from wetlands less than 2.0 hectares in size. The proposed extraction limits are outside of Conservation Halton's regulated areas for all wetlands except for wetland 13037 PSW complex. The proposed extraction limit is approximately 30.0 metres from the limit of this feature.

3.9.4 Professional Opinion

The inclusion of Woodland E in the Woodland D wetland/woodland complex improves the configuration of the retained woodland, will contribute to the woodland's function as extraction progresses, and will also contribute to its connection to the south following rehabilitation. However, while the inclusion of Woodland E contributes to the connectivity of woodlands along the east side, it does not complete the connection between Woodland M and the Woodland D/E complex, which will be severed during extraction. It is important that Woodland D/E remain connected both to the north and to the south, with linkages appropriate for the features on the site and the features to which they connect (Natural Environment Table: Row 28 and 29).

The lack of sufficient baseline data for some wetlands is concerning. The information concerning wetland fauna that was found in earlier studies (e.g., presence/absence of key amphibian species) should be included as part of this baseline. The fact that some wetlands adjacent to the quarry supported breeding habitat in past years should be acknowledged and used to inform monitoring thresholds and water level targets (Natural Environment Table: Rows 51, 52 and 120).

The golf course ponds should be sampled for Ambystomatid salamander breeding, particularly for Jefferson Salamander, as they resemble ponds where the peer reviewer has found breeding salamanders in the past (Natural Environment Table: Rows 51 and 52).

The current proposal to maintain linkage is first to maintain the linkage from Woodland D/E to the south, where it is currently connected through the golf course and the hedgerow, then switch the linkage to the west, through Phase 6, and then restore the southern linkage with a narrow, steep-sided ridge. There have been no animal movement studies to support the future effectiveness of these proposed routes. In NSE's professional opinion, this proposal is convoluted and potentially ineffective. In addition, the temporary linkage to the west will be impeded by the infiltration pond. The final linkage to the west (shown on the Site Plan) is still impeded by the infiltration pond as well as by a steep-sided valley. Studies on animal movement should be completed to establish the current direction of movement with more certainty. Animal movement is likely to occur to the south across the golf course, using the woodlands as stepping stones, but would likely not be restricted to the area of the woodlands. It also may occur to the

west through the golf course, but this corridor has not been planted or established (Natural Environment Table: Rows 28 and 97).

There is also concern with the width of the proposed final linkage to the south. To be effective, Regional corridors are recommended to be a minimum width of 60.0 to 100.0 metres. The proposed final linkage is less than the minimum width, with steep-sided slopes, and not likely to be effective in maintaining biodiversity of these woodlands in the long term (Natural Environment Table: Row 31).

3.10 Natural Heritage – Fish

Matrix Solutions was commissioned to review technical reports, with a focus on aquatic habitat and fisheries associated with the quarry expansion. As surface and groundwater disciplines are interrelated with fisheries and aquatic habitat, comments from surface water and the hydrogeology specialties were noted through discussions and provided as additional explanation (where warranted).

Detailed technical comments and proponent replies are provided in Appendix L to this report.

3.10.1 Review Methodology

In addition to review of submitted technical reports and the site plan, some documents related to the previous application were also reviewed:

- Biological Inventory of Nelson Quarry and Adjacent Property, City of Burlington, Nelson Aggregate Co., prepared by ESG International Inc. (October 2000)
- Summary of Natural Heritage Features, Nelson Quarry Company- Extension Lands, Burlington, prepared by Stantec Consulting Ltd. (August 2004)
- Level II Natural Environment Technical Report, Nelson Aggregate Quarry Expansion. Prepared by Stantec Consulting Ltd. (October 2004)
- Level II Natural Environment Technical Report, Nelson Aggregate Co. Burlington Proposed Extension Prepared by Stantec Consulting Ltd. (Revised May 2006)
- Summary of Terrestrial and Aquatic Field Investigations 2006: Addendum to "Level II Natural Environment Technical Report, Revised May 16, 2006", dated September 29, 2006

3.10.2 Original Findings

The Natural Environment Technical Report (Level 1 and 2) describes the current fisheries inventories conducted within the existing quarry (Burlington Quarry) and proposed expansion lands and provides an assessment based on the proposed changes associated with extraction and future operations on those lands. Discussion is limited to within 120 metres of the proposed quarry expansion lands. Supporting studies, such as the Surface Water Assessment, as well as hydrogeology reports submitted as part of the application discuss other impacts that may be associated with fisheries beyond 120 metres (Natural Environment Table: Row 12).

EXISTING FISH HABITAT BACKGROUND CONDITIONS

The two proposed quarry expansion areas are categorized as the west extension, which primarily affects the outflow to the Willoughby Tributary and unnamed tributary which comes from the Medad Valley; and the south extension, which primarily affects the outflow to the Mount Nemo Tributary. The headwaters of the East Branch of Willoughby Creek originate from the pump water of the existing quarry and from the golf course located on the west side of the quarry. A pump at the northwest sump of the existing quarry discharges to a ditch along the southeast side of Colling Road. Approximately 55% of the off-site discharge from the existing quarry is directed to this tributary. The West Branch of Willoughby Creek arises in the Provincially Significant Medad Valley wetland/ESA. The creek exhibits groundwater discharge and significant forest cover from this headwater area all the way downstream to Colling Road. A large dam structure is located on the creek approximately 100 meters upstream of Bronte Creek proper.

In the proposed south extension, a tributary to Grindstone Creek originates on the north of No. 2 Side Road on Nelson-owned lands. This tributary is labelled as the West Arm of the West Branch of the Mount Nemo tributary. Baseflow to this tributary is provided by groundwater that is pumped from a holding pond during dewatering activities. This holding pond (known as the South Pond) is centrally located in the quarry and water being removed from quarry sump 0200 is directed through an underground pipe and released into a cattail marsh on the north side of No. 2 Side Road. Additional groundwater seepage may occur within the cattail marsh and this wetland community effectively forms the headwaters of the tributary. The tributary of Grindstone Creek is characterized as an intermittent, warmwater system. Flows in the vicinity of Cedar Springs Road usually cease around mid-summer. The tributary is classified as an intermittent, warmwater system, although the segment on the south subject lands appears to be permanent due to a consistent input from quarry activities.

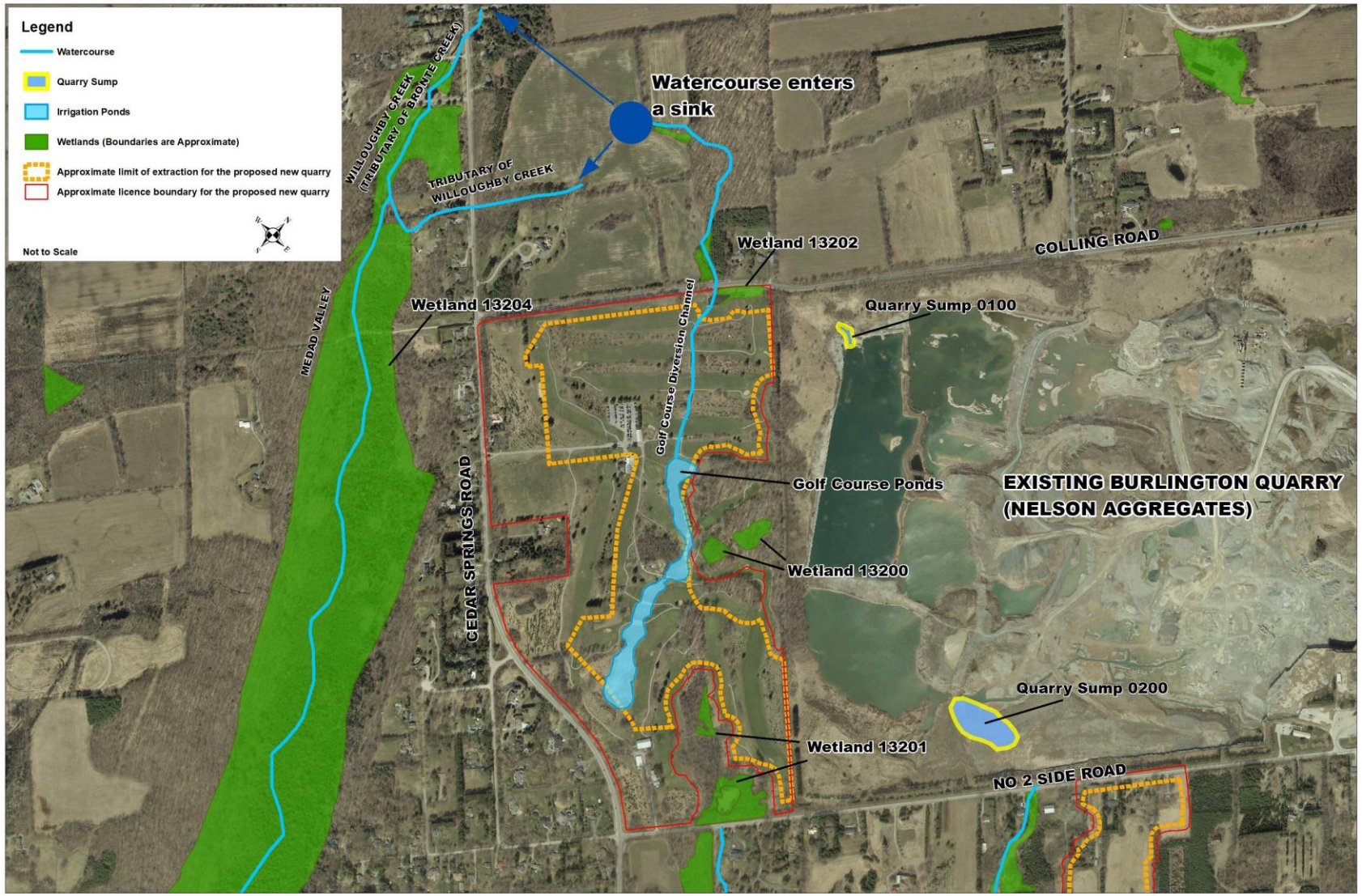

Figure: *watercourses and wetlands of the proposed west extension*
(This map has been prepared to help with geographic location identification for the reader.)

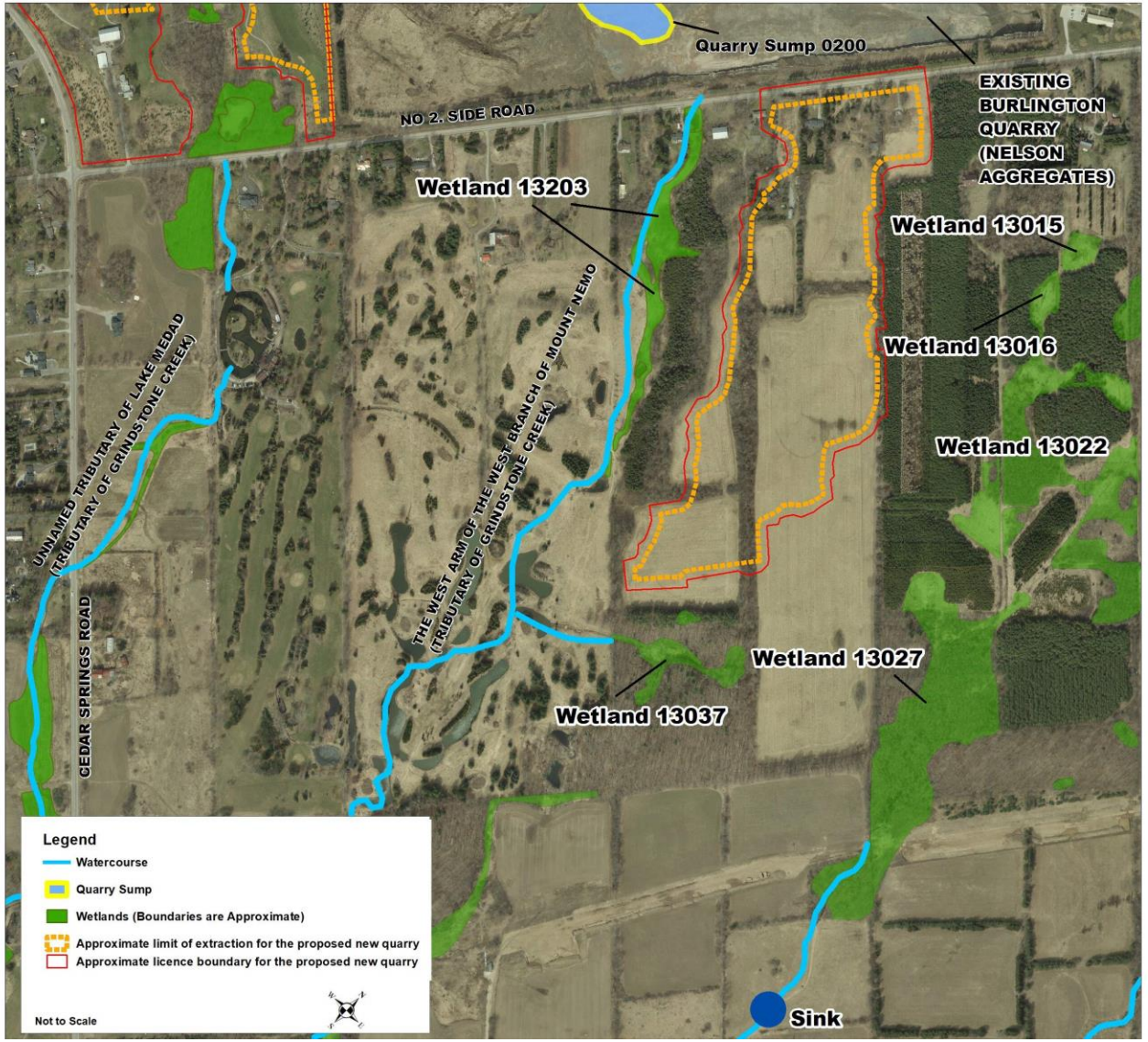

Figure: *watercourses and wetlands of the proposed south extension*
(This map has been prepared to help with geographic location identification for the reader.)

Internal to the existing Burlington Springs Golf Course are a series of irrigation ponds and connecting channels containing warm water species such as Largemouth Bass. The Natural Environment Technical Report (Level 1 and 2) also states that although that ponds and drainage features within the existing quarry and proposed expansion lands contain fish, these systems are not considered fish habitat due to their anthropogenic origin and their isolation from other features, and as a result support no recreational fishery. (Note: the Unnamed Tributary to Willoughby Creek is identified as fish habitat by Nelson in their studies and materials.)

Drainage and surface outflows of the existing quarry operations extend beyond the quarry footprints and are maintained through pumping operations, which are recommended to continue in perpetuity, long after the licence for extraction has been surrendered.

KEY ISSUES RELATED TO FISH HABITAT

The concerns with respect to fisheries relate to the future land use scenarios where extraction activities will continue, and flows will be maintained artificially by pumping. As extraction proceeds to its later stages and progressive rehabilitation takes place, it is the applicant's position that pumping will continue in perpetuity to maintain the flows necessary to maintain the fish habitat that exists within the receiving waters downstream of the proposed west and south extensions (Natural Environment Table: Rows 15, 19, 20, 22 and 23; and AMP Table, Row 23).

Based on the information provided, the fish habitat associated with the proposed south extension appears to be marginal and may benefit from quarry discharge. However, the fish habitat associated with the proposed west extension is more sensitive, as prime salmonid reproductive habitat is present within a relatively short distance (roughly 1 kilometre) from the tributary confluence. Closer examination of the surface water report reveals that within the Willoughby Tributary, the flows within reaches in the vicinity of Colling Road and Cedar Springs Road are generally intermittent, and flows do not become more significant until much further downstream to the northwest to the vicinity of Britannia Road. Although discharge flows from the quarry will be continuing for the foreseeable future, the applicant has stated that continuing to do so is optional, and that the current licence allows the applicant to cease discharge if they chose to do so (Natural Environment Table: Rows 15 and 23).

The future phase of the proposed west extension envisions the creation of a landform and lake habitat that will transform much of the existing Burlington Springs Golf Course into new warm water fish habitat, once the quarrying activities have been completed.

3.10.3 SUMMARY OF CHANGES THROUGH JART REVIEW

The March 2022 version of the site plan includes more details on blasting and natural heritage on the "notes" section. In particular, the areas considered to be fish habitat have been defined and details on blasting monitoring and mitigation measures have been added where blasting may potentially impact fish habitat. The corresponding figures shown on the latest site plan include labelling of the tributaries and waterbodies outside of the quarry that are considered to be fish habitat (Natural Environment Table: Row 21).

3.10.4 Professional Opinion

The impacts to fish and aquatic habitat affected by proposed west and south extension discharges and within the internal quarry footprint vary in terms of sensitivity. The two least sensitive fish habitats are within the extraction footprint and the proposed south extension, and the most sensitive fish habitat is the Willoughby Creek Tributary. There is uncertainty to the classification of fish habitat within the proposed extraction footprint. The irrigation ponds and connecting watercourse system within the Burlington Springs Golf Course are anthropogenic, and therefore not considered fish habitat in the opinion of Nelson's consultant, Savanta. This conclusion requires justification according to the Federal Department of Fisheries and Oceans' definition of fish habitat, and verification that these features do not support habitat for Jefferson Salamander. The discharge outflows to Willoughby Creek Tributary have been part of the ongoing quarry operation, and the proposed west extension intends to maintain this discharge moving forward with the proposed west extension. Finally, the proposed south extension involves maintaining a quarry discharge to an intermittent creek system that supports a marginal fish population (Natural Environment Table: Row 61).

Fish Habitat within the West Extension Quarry Footprint (Burlington Springs Golf Course)

The applicant's view is that "*There is no direct or indirect fish habitat within the proposed Limit of Extraction within either the South or West Extension areas. Therefore, no direct encroachment into any watercourse providing fish habitat will occur and no direct impacts on fish habitat are anticipated within the Limit of Extraction, during any phase of the Project.*" Although sampling efforts reveal the presence of fish, irrigation ponds and associated watercourses within the golf course are not considered to be fish habitat by Savanta. This statement is supported by an email provided by the DFO reviewer based on the artificial fishery created within the irrigation ponds but not in the DFO Letter of Advice. No policy definition is provided in support of this statement (Natural Environment Table: Row 43 and 61).

The Letter of Advice provides further guidance on controlling the quarry discharges to ensure that there is no harmful alteration, disruption, or destruction of fish habitat. Given that there is a hydrological connection to fish habitat downstream, the advice provided puts the onus on the applicant to ensure that discharges meet quality and quantity targets during construction works (Natural Environment Table: Row 43 and 61).

During field visits, firsthand observations reveal that the connecting watercourses and irrigation ponds have the potential to support populations of fish and other organisms such as amphibians. In the case of amphibians, the applicant's team have ruled out the potential for salamanders due to the presence of fish, and not through verification by trapping (Natural Environment Table: Row 61).

Fish Habitat within the Discharge Outflow to Willoughby Creek (West Extension)

The proposed west extension primarily affects the outflow to the Willoughby Creek Tributary and an unnamed tributary that comes from the Medad Valley which are both in the Bronte Creek Watershed. The degree to which fish assessment is discussed is not only limited to within 120 metres, but the fish sampling is limited to areas where Savanta has been given land access, and where they have been able to sample. As the reach of Willoughby Creek north of Colling Road was not sampled or visited due to private

ownership, characterization of fish habitat and fish presence was inferred from past reports and sampling records by Conservation Halton (Natural Environment Table: Row 68).

The concern is the age of the fish data and lack of fisheries information due to limited access to private waters at reaches immediately downstream of the discharge point. It is anticipated that quarrying along the proposed west extension will result in the loss of contributing groundwater to reaches of Willoughby Creek and Tributary near the quarry area. Without knowing more specific details of groundwater seepage habitat along those reaches, impacts to these habitats (including the hyporheic zone) that are dependent on the groundwater is not known. It should be noted that these reaches of Willoughby Creek immediately adjacent to the confluence of the Tributary and mainstem of Willoughby Creek is currently mapped as habitat for Redside Dace, classified as an "endangered "fish species in Ontario (NHIC, accessed in April 2023). Redside Dace are known to rely on groundwater-fed pools for refuge habitat during warm summer months (Natural Environment Table: Row 68).

Fish Habitat within the Discharge Outflow to Mount Nemo Tributary (South Extension)

The proposed south extension primarily affects the outflow to the Mount Nemo Tributary, which is part of the Grindstone Creek Watershed. This tributary is intermittent, and field visits reveal that fish habitat is isolated to a few pooled areas where water depths are sufficient to support fish populations. Due to the intermittent nature of this system, discharges from the proposed south extension may result in greater water residence time, which may be beneficial to fish habitat (Natural Environment Table: Row 47).

Impacts to Fish Habitat

The conclusion that no direct impacts are anticipated with the Limit of Extraction depends on the conclusion that the irrigation ponds and connecting waterbodies within the Burlington Springs Golf Course are not fish habitat under the *Fisheries Act*. Clarification from the applicant is requested with reference to the definitions in the *Fisheries Act* (Natural Environment Table: Rows 14, 61 and 80).

For the discharges to Willoughby Creek, the determination of impact is dependent on the applicant's ability to meet the Department of Fisheries and Oceans' letter of advice conditions for flow supplementation in terms of volume, water quality and quantity in the maintenance of downstream fish habitat. The surface water assessment (Tatham, 2020) acknowledges Willoughby Creek and West Arm as fish habitat, and that baseflows and water temperature are critical to the form and function of the watercourses from a natural heritage and fish spawning perspective. The proposed integrated surface water/groundwater analysis predicts a minor reduction in monthly streamflow due to the lowering of groundwater and suggests maintaining the discharge from the Quarry Sump 0100 to ensure that some reaches of Willoughby Creek does not run dry. The predictive water/groundwater model predicts a measurable reduction in flow of the unnamed tributary of Lake Medad during operations and quarrying.

For the proposed west extension, extraction activities will reduce the size of the sub catchments draining to several of its existing outlets. Extraction and quarry dewatering are predicted to lower groundwater levels surrounding the west extension within 350.0 metres of the extraction face.

Based on the AMP (Version 5.0) provided by the applicant, impacts to fish habitat are expected to be minimal as perpetual pumping from the quarry will maintain the form and function of fish habitat within the Unnamed Tributary of Willoughby Creek and downstream. Within these reaches, the applicant is also of the opinion that groundwater contributions under baseline conditions equate to 1.0 litre/second or less, and that no groundwater supplementation will be required.

For the reaches of Willoughby Creek upstream of the quarry discharge, and along the Lake Medad Valley, the wetlands and flow in the creek are both supplemented by groundwater discharge (seeps and springs) located on the flanks of the valley. It is not clear how the lowering of the groundwater in areas upstream of the confluence will maintain fish habitat or refugia where groundwater seepages currently exist (Natural Environment Table: Row 13). Potential impacts to seepage areas within the riparian zone are possible, due to changes in groundwater levels. The AMP proposes the construction of an infiltration pond to maintain the seeps and springs, which will aid in maintaining the functions of seepage areas within riparian zones of the Medad Valley. The updated AMP contains a monitoring program for water quality and quantity for surface and groundwater but currently does not include biological monitoring of fish habitat impacted by quarry discharges.

Study Areas to Benefit from Better Integration

To have a better understanding of the impacts to fisheries resources, it is recommended that the surface and groundwater studies be integrated with fish habitat descriptions. Challenges to interpreting fish habitat impacts include the following:

1. The fish information available in the downstream reaches such as in Willoughby Creek are based on older baseline data (2004) and no further recent information regarding the fish communities in these areas have been made available. Species at Risk occurrences within this creek should be confirmed (Natural Environment Table: Row 68).
2. Integration of fish habitat impacts as it relates to the receiving waters affected by future drainage and alterations to hydrology and hydrogeology from future expansion is necessary to determine the degree that discharges offset the reduction in groundwater contribution to the Willoughby system (Natural Environment Table: Row 23).
3. The applicant's ability to meet conditions from the Department of Fisheries and Oceans' Letter of Advice (Natural Environment Table: Rows, 23 and 45).

The AMP (Version 5.0) assumes that fish habitat impacts from the proposed west extension will be minimal as negative changes in water quality are not expected given that the watercourse will continue to receive its primary input from quarry discharge. In watercourses and fish habitat currently receiving quarry discharge, predicted decreases in streamflow are very minor and are not expected to have any negative impact on form and function of the watercourse. In areas upstream of the quarry discharge, the applicant has proposed the construction of an Infiltration Pond to maintain seepage in the vicinity of the west extension to maintain levels and groundwater discharge to the Medad Valley.

The applicant's AMP proposes surface and groundwater monitoring but also suggested a very limited biological monitoring program in the vicinity of Medad Valley for wetland vegetation. Specific information on the downstream reaches of Willoughby Creek, including locations of groundwater upwellings (and their significance to fisheries), species composition, species at risk occurrences, distribution, relative abundance, and life history of the fish would be useful to understand the effects of the groundwater drawdown with respect to fish populations. Identification of critical or sensitive habitat with respect to groundwater upwellings and seepages would also be useful in future monitoring programs (Natural Environment Table: Rows 45 and 68).

3.11 Natural Hazards

Conservation Halton reviewed the applications to confirm the following:

1) That the limits of regulated watercourses flooding and erosion hazards with associated regulatory allowances were appropriately delineated on the Site Plan and within the associated technical studies and that all proposed extraction areas were located outside of hazard lands and the associated regulatory allowances;
2) That the technical studies demonstrated that any risks related to natural hazards (flooding and erosion hazards as well as hazardous lands) were addressed, including the prevention or mitigation of those risks; and
3) That the technical studies demonstrated that there would be no risk to public health or safety or of property damage, and that the proposal will not create new or aggravate existing hazards.

Detailed technical comments related to natural hazards are provided in Appendix O (Surface Water Table, Comment Nos. 52, 58, 59, 85, 89, 98, 105, 128, and 151) and Appendix H (Hydrogeology Table, Comment Nos. 2, 213 and 215) to this report.

3.11.1 Review Methodology

Conservation Halton reviewed the following documents as part of the Natural Hazard review:

- Surface Water Assessment, prepared by Tatham Engineering
- Level 1 and Level 2 Hydrogeological Assessment, prepared by Earthfx
- Site Plan prepared by MHBC
- Memorandum Re: Nelson Quarry, Burlington Response to Comments, prepared by Tatham Engineering

3.11.2 Original Findings

Flood Hazards

It was unclear whether a diversion proposed along Colling Road would divert an upstream catchment area that currently drains to the quarry and instead outlet directly to the unnamed Tributary of Willoughby Creek. If this was the case, then there was the potential that it may increase flows and affect the flood hazards along the tributary. Conservation Halton had comments on the event-based model with regards to how the Regional Storm was modelled and inconsistencies on how the quarry discharges and diversion

discharges were applied in different scenarios. In addition, the impact assessment from the integrated model did not include the external catchment diversion.

EROSION HAZARDS

West Arm Tributary: Minimal erosion impact analysis was provided for the West Arm tributary near the proposed south extension. An erosion threshold analysis and/or modelling results (including the requested metrics) were needed to support the statement that there are no impacts to the watercourse in all the various scenarios. Cumulative impacts due to the development of the south extension were not analyzed (e.g., cumulative impacts to sediment transport/erosion when pumping from the existing quarry and from the extension, or during the lake filling scenario).

Willoughby Creek Tributary: Some information on continuous flows was provided for Willoughby Creek; however, the studies did not assess the proposed diversion along Colling Road. Erosion assessments with and without the diversion were requested unless it was confirmed the diversion was not required.

3.11.3 SUMMARY OF CHANGES THROUGH JART

Based on the information submitted, Conservation Halton is satisfied that the proposed development for extraction/excavation will be outside of all hazard lands and associated regulatory allowances.

Furthermore, Conservation Halton received a submission from Nelson, prepared by Tatham Engineering, dated April 13, 2023, which included confirmation that the Colling Road diversion was no longer being proposed, as well as that the Adaptive Management Plan (AMP), and the Site Plan would be updated accordingly. An erosion impact analysis for the West Arm tributary was also provided. After review of these items, Conservation Halton has no outstanding concerns related to flooding and erosion hazards. Full resolution would require the AMP, surface water assessment, hydrogeological assessment, and Site Plan all to be updated accordingly.

3.11.4 PROFESSIONAL OPINION

Conservation Halton staff are satisfied that that the limits of the regulated watercourse flooding and erosion hazards with associated allowances were appropriately delineated and that all proposed extraction areas will be located outside of hazard lands and associated regulatory allowances. Further, Conservation Halton staff is satisfied that any risks related to natural hazards (flooding and erosion hazards as well as hazardous lands) have been addressed, that there should be no risk to public health or safety or of property damage, and that the proposal will not create new or aggravate existing hazards.

3.12 NOISE IMPACT

J.E. Coulter Associates Limited conducted a peer review of the Noise Impact Assessment Study for the Nelson Aggregate Quarry Extension, prepared by HGC Ltd., dated November 15, 2021, and April 22, 2020. The Acoustic Assessment Report of the Halton Asphalt Supply, located in the quarry, dated April 27, 2021, and February 7, 2020, was also reviewed. The Site Plans were also reviewed.

Detailed technical comments and proponent replies are provided in Appendix M to this report.

3.12.1 Review Methodology

The Planning Justification Report and ARA Statement dated April 2020 mentions that Nelson Aggregate Co. is applying for a maximum tonnage of 2 million tonnes per year: however, they plan on extracting an average of 1 million tonnes per year. Per the Ministry of the Environment, Conservation and Parks' Environmental Noise Guideline - Stationary and Transportation Sources - Approval and Planning (NPC-300) guideline, the evaluation should be for the predictable worst case, which would be the peak of the surge of 2 million tonnes per year.

The proposed south and west extensions of quarry were modelled in Computer Aided Noise Abatement (CadnaA) by HGC Ltd. to predict the future environmental noise generated by the quarry operations. The noise model was reviewed and checked to ensure that the sound power levels of the equipment and its corresponding operating time matched the values from the report. The location of the equipment in the quarry was checked to ensure it represented the worst-case operating scenario. The report and noise model were reviewed to ensure the predicted sound levels met the applicable NPC-300 criteria and, if needed, that mitigation measures were implemented to control the sound levels at the nearby receptors. The equipment used in the operations was also reviewed to ensure they met the maximum noise levels for construction equipment as set out in NPC-115 and NPC-118.

3.12.2 Original Findings

The initial review found the extraction volume was not explicitly specified and it was requested that the report clarify the operating tonnage the assessment was based on. For modelling purposes, the report used 83 dBA at 15m maximum for the quarry haul when operating in the quarry. The report did not address the sound levels of operations such as the haul trucks climbing the hill to the at-grade crossing when loaded. The report did not contain the location or heights of the berms that were proposed (Noise Table: Rows 15 and 17).

A quiet drill with a sound power of 109 dBA has been used in the analysis and was assumed to operate at all areas in the quarry. Detailed calculations of the ambient sound levels were not provided to justify the surrounding area designation as Class 2 (Noise Table: Rows 17 and 21).

The report also stated that no vibration was predicted on site. This is a very unlikely scenario during the blasting phase of work. During blasting in close proximity to the residences, it would be expected that certain vibration would be felt. This vibration could fall within the MECP draft vibration guideline and, as such, not be a concern, but it is very likely that some surrounding land uses, including residential land uses, will sense the pulses in the ground (Noise Table: Row 25).

3.12.3 Summary of Changes through JART Review

An updated report was issued by HGC Ltd., dated November 15, 2021. The report clarified the assessment was based on the peak extraction of 2 million tonnes per year. It also addressed the increased sound-level contributions of the haul trucks climbing out of the quarry (Noise Table: Rows 15 and 17).

The report also provided clearer and more detailed figures of the predicted sound levels around the site, including sound level contours for the worst-case operating scenario. The report also contained detailed

locations of heights of the additional berms in Appendix C that would be constructed prior to the commencement of extraction activities. Nelson Aggregate also confirmed that the use of compression release engine brakes (or Jacobs brakes) is not permitted on the site (Noise Table: Row 8).

An ECA was submitted for the hot mix plant on April 27, 2021. It has been noted that the MECP has completed their review of the Acoustic Assessment Report and will issue a certificate of approval, as evidenced by email communication from the MECP noise reviewer. It has been assumed that as MECP has issued a certificate of approval confirming the site is within a Class 2 area the nearby residences are subject to Class 2 exclusion limits (Noise Table: Row 1).

With the proposed mitigation measures in place the predicted sound levels are expected to meet the applicable MECP Class 2 exclusion limits at the nearby residences (Noise Table: Row 18).

3.12.4 Professional Opinion

Adding the licences of the south and west extension and increasing the asphalt plant workload and nighttime shipping operations will increase the sound levels at the nearest receptors around the site. To reduce the impacts at the nearby residences, mitigation measures such as berms, using broadband backup alarms, and quieter drill rigs have been proposed. It is necessary these mitigation measures are in place before either quarry extension is operational. Once either extension is operational, a noise monitoring program should be implemented to corroborate the predicted sound levels at the receptors selected in the report. A monitoring program for the predictable worst-case scenario should be prepared ahead of time and should account for wind direction. The monitoring should be conducted when the quarry is operating at full capacity. A similar monitoring program should be implemented once the other extension is operational. Additionally, if a noise complaint is received, the noise complaint will be responded to and investigated in a timely manner by the licencee in a manner commensurate to the specific context of the complaint (Noise Table: Rows 20, 21, 24, 32).

With the above mitigation measures in place the predicted sound levels are expected to meet the applicable MECP Class 2 exclusion limits at the nearby residences. It is our understanding that the MECP has issued a certificate of approval confirming the Hot Mix Plant is within a Class 2 area. The agreement with a Class 2 designation for the site is conditionally addressed upon receipt of the Certificate of Approval for the hot mix plant (Noise Table: Row 1).

3.13 Progressive and Final Rehabilitation Plan

As part of its application, in the section pertaining to rehabilitation of lands used for aggregate extraction, Nelson has proposed the rehabilitated quarry could be used as a large park in Halton. The Progressive and Final Rehabilitation Plan is a summary document that contains information already contained in the various reports prepared by Nelson. Therefore, comments provided in this summary may be replicated elsewhere in this report.

Multiple peer reviewers and agency technical staff reviewed the Progressive and Final Rehabilitation Plan. Review in this matter was informed by collaboration and discussion amongst peer reviewers and

applicable agency staff. Reviewers assessed whether the Progressive and Final Rehabilitation Plan was comprehensive, and appropriately derived from the findings of the reports.

Detailed technical comments and proponent replies are provided in Appendix N to this report.

3.13.1 Original Findings

Comments are organized by technical area.

Natural Heritage and Ecology

The rehabilitation monitoring plan includes only monitoring of surface and ground water – no terrestrial monitoring of habitat or monitoring of wildlife to determine if the rehabilitated wildlife habitat features are functioning according to their specified purposes. Monitoring of biota should be included.

The Plan relies heavily on pumping of water from the quarry to replace or replicate any surface water deficits that may affect wetlands and watercourses in the future. Given this approach to mitigation, the water quality of quarry water needs to be monitored, as quarry water may have high conductivity, and amphibian larvae are highly sensitive to increased conductivity. Conductivity should also be monitored in ponds maintained by quarry discharge.

The AMP proposes the inclusion of ecological monitoring of seepage dependent vegetation communities within the Medad Valley area in the headwater area of Willoughby Creek to provide water level targets for monitors MP41 to MP44. This concept should be expanded to include other seepage dependent communities such as habitats for terrestrial and aquatic fauna, rather than just wetland plant communities.

Little is known about the aquatic habitat and vegetation communities within the sections of Medad Valley upstream of the Unnamed Tributary of Willoughby Creek discharge confluence. As the reduction of groundwater contribution is anticipated during the extraction of the west extension, baseline inventory of biota should be conducted. The surface and groundwater monitoring should be used to validate the effectiveness of the Infiltration pond that has been included in the AMP.

Hydrogeology

The comparative impact analysis of the two rehabilitation scenarios is not complete. The cumulative impact of the existing quarry has not been considered in this analysis. RHB1 relies upon an unproven infiltration pond whose function has not been demonstrated nor have water quality impacts on down gradient wells been addressed (Rehabilitation Table: Row 11).

The proposed Rehabilitation Plan requires a change to the approved existing quarry rehabilitation plan. There is no discussion of the conformity between the two rehabilitation plans and the justification for changing the approved rehabilitation plan. Note that the assumptions provided in support of the preferred rehabilitation plan are questionable and require substantiation (Rehabilitation Table: Row 12).

The maintenance requirements of the rehabilitation scenario and resulting water quality impacts on surface water and groundwater have not been assessed (Rehabilitation Table: Row 13).

The financial implication of maintaining, in perpetuity, the proposed west extension dewatering, the existing quarry dewatering, infiltration pond system and associated pumping system to maintain wetlands, as well as seepage management beneath Side Road No.2 between the proposed south extension and the existing quarry have not been addressed. In addition, possible future well complaints may need to be addressed and a cost assigned to this possibility. Ongoing responsibilities to supply water to impacted residences will need to be accounted for, in the event of issues arising (Rehabilitation Table: Row 21).

AGRICULTURE

The proposed Rehabilitation Plan now includes a modification to the existing quarry with the addition of approximately 14.0 hectares of land to be rehabilitated to agriculture, an "*area equivalent to* [the] *proposed extraction area of the south extension lands"* (applicant response of June 2022, page 5). Based on the Progressive and Final Rehabilitation Plan as well as the cross-sections (Drawings 3, and 4, dated September 10, 2021), the agricultural lands to be created are isolated in an area to the central west within the existing quarry and surrounded relatively closely on three sides, and farther away on the fourth east side, by the lake.

The description of agricultural rehabilitation on Drawing 3 does not include specific information such as:

1. The variability in soil materials of the "A", "B", and "C" horizons to be transferred from licence number 626477 to the existing quarry (some variability is expected based on the soil surveys by DBH Soil Services, and previously by Stantec, which indicate that there are potentially different soil series that will provide the materials to be transferred to the existing quarry).
2. A discussion on the reasons for the statement that "no livestock operations shall be permitted".
3. Why the statement with respect to "no livestock operations shall be permitted" (#20, Drawing 3) with the Quarry Floor Agricultural Rehabilitation Sequence (Drawing 3) at step 9, *F*inal Implementation Phase, is identified as "Post Extraction Pasture/Crop".
4. The existing microbiome of soils from licence number 626477 relative to the microbiome probable on the lands to be rehabilitated within the existing quarry.
5. The monitoring and proposed methods available to remedy any changes associated with the microbiome.
6. The significance of micronutrients to agricultural crops and the differences in these micronutrients for "made land".
7. The lack of links with other disciplines to address factors such as whether crop and soil management are likely to be affected if the agricultural use of the rehabilitated lands results in changes in the surrounding groundwater.

3.13.2 SUMMARY OF CHANGES THROUGH JART REVIEW

No changes were proposed as a result of JART review. The revised Adaptive Management Plan did address some of these issues:

1. According to the Adaptive Management Plan, monitoring of surface and groundwater is still the only monitoring proposed. Monitoring of biota is not proposed.

2. The Plan continues to rely on pumping of quarry water to wetlands as the principal mitigation proposed for impacts on wetland hydroperiod.
3. The Plan proposes to rely on pumping to maintain streamflows to support aquatic habitat. This pumping does not address the loss of groundwater seepages associated with the proposed west extension. In the AMP, reductions in groundwater contribution with respect to the west extension is proposed to be offset by the construction of an infiltration pond. The ability of the infiltration pond to maintain the aquatic habitat within the upstream reaches of Willoughby Creek is not known.

3.13.3 Professional Opinion

Monitoring of biota should be conducted. Presence/absence and abundance of wetland-dependent wildlife integrates numerous variables related to wetland function. The baseline should include findings from amphibian surveys conducted between 2000 and 2011, since these encompass a range of amphibian species that have not been evident in more recent surveys.

Baseline information regarding seepage dependent terrestrial and aquatic habitat in the upstream reach of Willoughby Creek should be obtained and should be included as part of future monitoring.

Pumping in perpetuity remains a primary consideration for long-term rehabilitation, which requires a robust policy justification or more thorough exploration of alternatives to potentially avoid the uncertainty related to this type of mitigation.

Nelson has not demonstrated that extraction and water table lowering in the proposed west extension will not impact groundwater flow to the Medad Valley, particularly flows to the springs (Hydrogeology Table: Row 60).

Lastly, the Progressive and Final Rehabilitation Study should be revised to reflect the current AMP and Site Plan and the outstanding comments noted above should be addressed in the Progressive and Final Rehabilitation Plan.

3.14 Surface Water Assessment

Ron Scheckenberger, previously with Wood Environment & Infrastructure and now with Scheckenberger & Associates Ltd., was retained to conduct a peer review of the surface water assessment aspects of the application. Conservation Halton staff also conducted a review of the surface water assessment from a natural hazard perspective. This is summarized in the Natural Hazards section above.

Detailed technical comments and proponent replies are provided in Appendix O to this report.

3.14.1 Review Methodology

Mr. Scheckenberger reviewed the Terms of Reference for the Level 1 and 2 Hydrogeologic and Hydrologic Impact Assessment of the Proposed Burlington Quarry Extension report, the Surface Water Assessment itself, and other supporting documentation, including the Tatham VO Model. Mr. Scheckenberger reviewed the updated iterations of the site plan, undertook a site visit, and participated in meetings with both JART and the proponent.

3.14.2 Original Findings

A brief summary of initial findings is provided:

1. The rating curve development for the flow gauging sites is unclear. Given the importance to corroborating modelling results, the approach to establishing rating curves should be discussed in further detail including an indication of potential error bands (Surface Water Table: Row 36).
2. The proposed Colling Road water diversion and golf course weir are central to the future management of quarry water. Additional background information on this proposal is required to determine both feasibility of the approach and what backup strategy exists in the event it is not ultimately feasible or if problems arise during operation (Surface Water Table: Row 37).
3. Rationale as to why runoff parameters for the catchments to the wetlands were not adjusted for the wetland results calibration (validation) should be provided. Further, the methodology to establishing wetland "storage correction factors" should be expanded upon as this is a key aspect of validating the model's performance (Surface Water Table: Row 39).
4. The use of event-based modelling (based on the SCS technique) is more simplistic than a continuous modelling approach, which presents a challenge to ensuring that the potential impacts of the proposal are accurately reproduced in the analysis of surface water (Surface Water Table: Row 40).
5. The integration of the natural systems feature characteristics, and their water needs is not well established. The form and function of these features should be elaborated on and better connected to the results interpretation, including for the period where lake filling is occurring (Surface Water Table: Row 41).
6. The Surface Water Assessment did not demonstrate that the risks related to natural hazards were addressed (more fully explained in the Natural Hazards section above).

3.14.3 Summary of Changes through JART Review

Details on the stream gauge rating curve development were provided which was helpful in corroborating the results of the provided modelling. There remains information outstanding on the level of confidence prescribed to that data. Additional details were provided on the planned Colling Road water diversion pipe (the applicant has since proposed to remove this element from the proposal) and the related weir system, although impacts to the receiving system (with or without the diversion) remain and are not well explained.

It is also understood that model calibration will be updated by Nelson based on additional monitoring data and through the Adaptive Management Plan associated with an approved quarry. However, the risks and sensitivity of applying the current runoff parameters versus any future updated parameters remains outstanding and should be reviewed and discussed in the current reporting. To this end, the applicant was requested to consider a parametric sensitivity analysis to better frame uncertainty associated with the modelling outcomes. No comparison was provided between the event-based results and those derived through continuous modelling, including the use of common timesteps for corroboration of predicted flow responses (Surface Water Table: Rows 2, 36, 37, 48 and 65).

Nelson (through Tatham) provided a Technical Memorandum, dated April 13, 2023, to Conservation Halton which outlined that Nelson is now abandoning the proposal to divert flows along Colling Road in favour of maintaining the existing flow paths whereby the subject catchments would continue to discharge to the quarry and then be pumped to the Willoughby Tributary. Tatham states that the on-site lake has been designed to have sufficient storage to accommodate the system requirements in the absence of this diversion; calculations will be required to confirm this perspective, along with the requisite updates to the AMP (Surface Water Table: Rows 37 and 65).

3.14.4 Professional Opinion

As of the date of writing this report, there remain outstanding questions and concerns with the proposal from a surface water perspective, but not as it relates to natural hazards (see Section 3.13 above). Much of this revolves around a basic premise of documenting the responses provided to JART queries over the commenting period in a logical and consistent manner in the updated reporting to support traceability and moreover support the planned AMP activities. This is particularly evident in the Surface Water report which makes excessive cross-reference to the Hydrogeological Reporting information rather than incorporating this information logically and inherently in the Surface Water report. Another concern is that the action by Nelson to address the various inputs and the tracking of these changes against the Site Plan are not well documented (Surface Water Table: Rows 38 and 42).

A considerable amount of weight is given to the modelling to-date which, as noted by Nelson, is subject to change based upon planned data collection. This is particularly a concern in so far as the wetland storage correction factors used in the modelling which appear to be more of a calibration factor than a results-based or data driven parameter. While the collection of additional data is fully supported through the AMP, decision making without a sound database in place, fully corroborated and supported by the regulators, is not supported. Careful attention to the significance of new data (such as the proposed 3 years of data collection at the new locations cited in 2022) as they are received and the influence on the various management recommendations, will be critical considering the current data gaps. Furthermore, in terms of surface water gauging, high-quality rating curves are instrumental to the accurate and confident use of collected water level data. The applicant is encouraged to continually improve these relationships over the coming years so that the results and predictions can be refined and used accordingly (Surface Water Table: Rows 36, 39 and 49).

The reliance on the proposed infiltration pond as a primary means of impact mitigation remains uncertain and will therefore need to be further assessed as part of future project phases associated with the western extension, fully supported by contemporary data, including the associated threshold conditions for area features as they evolve from the data assessments/analyses (Surface Water Table: Row 115).

3.15 Traffic Impact

CIMA Canada Inc. was retained to provide peer review support related to traffic impact assessment and road safety analysis. To this purpose the following guidelines were considered as part of the review:

- Region of Halton's Transportation Impact Study Guidelines (January 2015)
- Region of Halton's Access Management Guidelines (January 2015)

- Region of Halton's Highway Dedication Guidelines (undated)
- Region of Halton's Aggregate Resources Reference Manual – Regional Official Plan Guidelines (undated)
- Transportation Association of Canada's Geometric Design Guide for Canadian Roads (2017)

Detailed technical comments and proponent replies are provided in Appendix P to this report.

3.15.1 Review Methodology

In February 2021, CIMA+ completed a peer review of the Burlington Quarry Extension Traffic Report and its appendix and provided comments related to items that could benefit from additional review. In response to CIMA+'s comments, Paradigm Transportation Solutions Limited (Paradigm) provided updates in the form or responses and additional attachments to the February 2020 report.

In addition, and following the request received from the Region in June 2021, CIMA+ conducted a peer review of the information contained in Section 5 – Traffic of the Site Plan. Final findings and recommendations were included as part of our letter report submitted to the Region on December 9, 2021.

Elements considered as part of the peer reviews included the following:

- Determination of guidelines, policies, manuals, bylaws, and procedures that the practitioner needed to consider for the preparation of the documentation under review;
- Confirmation that adequate explanation about assumptions made for the preparation of the documentation under review were included and referenced;
- Confirmation of the adequate use of software default values; and
- Confirmation of the consistency between information provided along the document(s) and any appendices or software outputs included supporting recommendations and findings.

In June 2022, a traffic response was provided by Paradigm to review alongside the June 2022 site plan. It should be noted that a revised TIS was not provided, only responses in the comment table.

3.15.2 Original Findings

As stated in the Burlington Quarry Extension Traffic Report, Paradigm reviewed the detailed shipping records containing shipping details from 2014 to 2018. Based on these shipping details, Paradigm estimated trucking levels for a 2,000,000 tonnes per annum scenario. The estimates were used to calculate the annual inbound and outbound truck trips from 2014 to 2018. Additionally, estimates of the future increase to truck volumes were calculated based on the details provided in the shipping records.

Based on the review of the detailed data provided by the proponent, CIMA+ verified that the estimated total future truck levels shown in Table 4.1 of the subject TIS are appropriate estimates for the future peak hour truck volumes.

To verify the estimated volumes CIMA+ examined the 2018 month-by-month total (aggregate, clean fills, and recycling trips) average daily trucks served in 2018. However, CIMA+ was unable to verify the distribution of the estimated total trips between the AM and PM peak hours.

3.15.3 Summary of Changes through JART Review

The responses provided by Paradigm answered a number of questions. An addendum letter was promised by Paradigm to outline potential mitigation measures for the road authorities. That correspondence had not arrived as of the date of writing this report. The detailed breakdown of traffic was provided.

3.15.4 Professional Opinion

Most of the issues identified through technical review have been identified and addressed by Paradigm. These issues had been identified by the peer reviewer just prior to Nelson's filing of appeals. As part of concluding technical review, the need for this information is confirmed. The following issues remain outstanding:

1. The outstanding addendum letter from Paradigm may address mitigation measures for consideration of managing traffic issues (Traffic Table: Row 15).
2. The required 220.0 metre sight distance as identified by the proponent in the TNS report should be included as part of the site plan (Traffic Table: Row 30).
3. The haul truck crossing approaches on No. 2 Side Road shall be designed and constructed to provide an approach sight distance (i.e., visibility triangle) extending, at a minimum of 25 m on each crossing approach to a point 50 m east and west on No. 2 Side Road. This should be reflected in the site plan (Traffic Table: Row 4).

3.16 Visual Impact Assessment (VIA)

MHBC Planning was retained by Nelson to prepare a Visual Impact Assessment (VIA) for Nelson's proposed Burlington quarry extension. NEC's Landscape Architect completed a technical review of the report.

Detailed technical comments and proponent replies are provided in Appendix Q to this report.

3.16.1 Review Methodology

NEC staff completed a review of the VIA submitted as part of the above noted application within the framework of the Niagara Escarpment Plan policies.

3.16.2 Original Findings

Review of the original VIA by Niagara Escarpment Commission staff identified the need for further documentation including details on photogrammetry, inclusion of pertinent Niagara Escarpment Plan policy and terminology, a more comprehensive inventory and analysis of visual impacts and mitigation in relation to Niagara Escarpment Plan policies, and more details and documentation on screening and planting methodology and locations.

3.16.3 Summary of Changes through JART Review

Some of these matters were addressed in the June 2021 submission, while additional requirements were identified relating to Minor Urban Centre overlays in mapping, details on the proposed at-grade crossing of No. 2 Side Road, a need to bring site plan mapping into conformity with the VIA, provision of justification for and documentation on methodology for the proposed landscape rehabilitation, the need for further and improved photo-documentation and photo simulations, and corrections of technical and textual elements in the reports. Comments the NEC provided on the June 2021 VIA submission have largely been addressed by the May 2022 VIA submission.

There remains a lack of details on how the mitigation measures will be implemented that needs to be addressed through a landscape plan and a vegetation protection plan to meet NEC standards. In addition, while the supplementary photo-simulations are suitable they need accompanying photos of exiting conditions and a key map of photo locations and directions. Finally, while formally part of the amended site plan application for the existing quarry, the proposed new entrance to the existing quarry on the north side of No. 2 Side Road is related to the proposed expansion and needs to be incorporated in these landscape and vegetation protection plans, and the ARA amended site plans brought into conformity with VIA guidelines.

3.16.4 Professional Opinion

No substantive outstanding issues remain with respect to the Visual Impact Assessment and NEC staff concur with the proponent that the landscape character requirements of the NEC have been addressed, subject to submission of the items identified in Section 3.16.3 above.

3.17 Adaptive Management Plan (AMP)

Multiple reviewers reviewed the draft Adaptive Management Plan. Review in this matter was informed by collaboration and discussion amongst peer reviewers and applicable agency staff. Therefore, comments provided in this summary may be replicated elsewhere in this report.

JART notes that many updates were made to this document in consultation with Provincial staff led by the Ministry of Natural Resources and Forestry, who have indicated there are no remaining issues with that proposed Plan.

Detailed technical comments and proponent replies are provided in Appendix R to this report.

3.17.1 Original Findings

Comments are organized by technical area.

Natural Heritage and Ecology

1. There was concern that the proposed triggers for groundwater monitoring are vague, and the time lag between the trigger and the response is not clear. The triggers should be more clearly explained by a graphic such as a flow chart. A clear indication of timelines between the trigger and the remedial action should be provided, as it appears the timeline could be a year or more.

2. The AMP does not contain any monitoring of any aspects other than groundwater and surface water. Biological monitoring of remaining woodland and wetland features should be proposed, as the issue of functionality of the wetlands in the vicinity of the quarry is of significant concern.
3. Actions proposed by the AMP are unclear. The AMP chart should clearly identify targets for monitoring (which should include biota), thresholds against which monitoring will be measured, and concrete, meaningful actions to be taken should there be a clear indication that the quarry is affecting biota through impacts on surface or groundwater. The actions should include potential cessation of extraction.
4. The most important, central mitigation technique proposed by the Adaptive Management Plan to mitigate future surface water deficits in wetlands or streams is to maintain them by pumping water from the quarry. This means that if there is uncertainty as to the ability to maintain the pumping in perpetuity then it affects the entire mitigation plan. Concerns remain surrounding the uncertainty of relying so heavily on the ability to maintain pumping, considering uncertainty regarding many factors (e.g., continued water supply and its quality, land ownership, financial viability) decades in the future.
5. The updated AMP contains a monitoring program for water quality and quantity for surface and groundwater but currently does not include biological monitoring of fish habitat impacted by quarry discharges. There is currently no plan to monitor or sample fish populations downstream of the quarry discharges due to the assumption that the current discharges will have similar quality and quantity as the existing flows.
6. Although quarry discharge will be used to maintain the flow regime necessary to maintain fish habitat at the Willoughby Tributary and confluence, it is not clear how the lowering of the groundwater in areas upstream of the confluence will maintain fish habitat or refugia where groundwater seepages currently exist.

HYDROGEOLOGY

1. The comparative impact analysis of the two rehabilitation scenarios is not complete. The cumulative impact of the existing quarry has not been considered in this analysis. RHB1 relies upon an unproven infiltration pond whose function has not been demonstrated nor have water quality impacts on down gradient wells been addressed (Rehabilitation Table: Row 11).
2. For the proposed west extension, no groundwater thresholds are proposed until enough groundwater monitoring data is collected to establish baseline conditions. The missing groundwater thresholds raises questions as to how to appropriately monitor and manage changes.
3. No water quality discussion or threshold levels for groundwater quality are included.
4. Nelson has not demonstrated that the infiltration pond will function as proposed nor that groundwater flows, including springs, to the Provincially Significant Medad Valley will not be impacted. As such, the western extension, should it be approved, must be refilled followed excavation and not maintained as a “shallow lake” as proposed. Further, phasing of the excavation of the western extension should be considered (as two cells) to allow for more rapid filling of at least part of the extension lands.

5. Prior to the surrender of the existing ARA licence, the licencee is required to provide confirmation that any long-term monitoring, pumping, or mitigation will not result in a financial liability to the public. Due to the uncertainty of the proposed mitigation measures for the proposed expansion, this should be confirmed prior to the issuance of the ARA licence.
6. Clarification is needed on what options are available and what process will be followed if a suitable replacement well cannot be installed on properties where adverse well interference from quarry operations has been confirmed.
7. Clarification is needed on how the effects of current climatic conditions on groundwater levels will be evaluated. Details of climatic data collection/monitoring are missing from the AMP.
8. No water level thresholds have been provided for shallow monitoring wells or for existing wells (shown on report figures 4 and 6) that have less than 5 metres of available drawdown.
9. The AMP should identify measures required to address the current decline in groundwater levels in the vicinity of sensitive receptors.
10. The AMP does not fully recognize the interests of local agencies and municipalities in the protection of private water supplies and ecological features. With respect to the proposed Stakeholder Liaison Committee, details are missing with respect to AMP implementation, oversight, and ongoing data access with these agencies.
11. The long-term financial implications of the recommended final site rehabilitation scenario involving perpetual pumping of water have not been addressed.
12. The use of available drawdown as criteria for implementation of mitigation measures does not consider existing well conditions such as well productivity or water quality issues. Available drawdown is relevant to well interference but, as sole criterion, is inadequate for assessing negative impact on private wells

3.17.2 Summary of Changes through JART Review

The AMP changed in many ways from initial submission to 2022. The 2022 AMP provided additional monitoring locations to be collected for a minimum three-year period to determine and provide the appropriate mitigation where necessary for watercourses and wetlands. An on-site climatic station is now proposed, although details are missing on the station and how climatic data collected will be used to assess quarry impacts.

The updated AMP includes proposed biological monitoring of the Medad Valley for vegetation communities within the seepage areas affected by the proposed west extension. Further details on this monitoring, as it relates to the operation of the infiltration pond and groundwater monitoring needs to be provided.

3.17.3 Professional Opinion

1. It is still unclear what the precise trigger is between discovering “confirmed decreasing trend in the bedrock aquifer” and the determination that the decrease is affecting the wetlands more than has been assumed. Development of triggers based on a precautionary approach to groundwater declines is a preferred approach to ensuring that the potential for changes to wetland hydrology

because of changes in groundwater is appropriately assessed. Precision should be applied to the proposed triggers.

2. Biological monitoring of wetland functions, particularly their ability to support breeding of Ambystomatid salamanders and frogs, is the preferred, precautionary approach to ensuring the early detection of changes to wetland function due to quarry activities. The baseline for monitoring should consider the ecological functions that were determined during surveys for the previous quarry extension that were conducted between 2000 and 2011.
3. As noted above, groundwater triggers should be established for wetlands as a precautionary approach. Surface water baseline monitoring should incorporate monitoring results in wetlands conducted between 2000 and 2011, not just use monitoring results for the most recent six years (as well as additional recent monitoring), as proposed.
4. Biological monitoring provides a chronic indication of the health of fish communities directly affected by surface water pumping discharges and should be considered in the AMP. Future impacts can be measured by changes to the fish community (i.e., Fish community diversity, sentinel species composition, SAR species occurrences). This type of study is recommended within the AMP, to determine if the water quality and quantity measures being recommended moving forward are working as intended.
5. For the west extension, extraction activities will reduce the size of the sub catchments draining to several of its existing outlets. Extraction and quarry dewatering are predicted to lower groundwater levels surrounding the west extension within 350.0 metres of the extraction face. Specific information on the downstream reaches of Willoughby Creek, including locations of groundwater upwellings (and their significance to fisheries), species composition, distribution, relative abundance, and life history of the fish would be useful to understand the effects of the groundwater drawdown with respect to fish populations. Identification of critical or sensitive habitat respect to groundwater upwellings and seepages would also be useful in future monitoring programs.
6. Alternatives to perpetual pumping should be fully considered to mitigate the uncertainty related to pumping as a solution.
7. There is sufficient on-site monitoring data and information to question the viability of the proposed mitigation measures for well interference resulting from the proposed quarry extensions. Alternative mitigation measures should be established in the event that the proposed well mitigation measures are insufficient or ineffective.
8. Groundwater quality thresholds should be identified to protect groundwater quality in nearby wells.
9. Within the AMP, identified groundwater and surface water monitoring locations and their respective threshold levels should be established, reviewed, and approved by relevant agencies prior to issuance of an ARA licence.
10. Details are required with respect to climatic conditions and on-site climate data and how these will be used in establishing groundwater and surface water threshold levels and impacts from the proposed quarry operations.

4. CONCLUSION AND NEXT STEPS

After considerable effort, JART has completed its technical review of the plans, studies, reports, and comments provided by Nelson.

Every attempt has been made to ensure a thorough and comprehensive analysis. The detailed record of JART work is contained in the various appendices to this report. JART notes again that any changes to the proposal or advancement on the issues above will require further investigation.

The blast impact, noise impact, and visual impact peer reviewers are generally satisfied with the information provided by the proponent, provided the proposed design measures and monitoring programs are secured.

Conservation Halton staff is satisfied that any risks related to natural hazards (flooding and erosion hazards as well as hazardous lands) have been addressed.

4.1 SUMMARY OF REMAINING ISSUES

In other issue areas, a number of technical issues remain with the proposal as currently designed:

CUMULATIVE EFFECTS AND THE BASELINE FOR ANALYSIS

Nelson's assessment of the cumulative impacts of the proposed quarry uses existing conditions as the baseline for its analysis. JART's peer reviewers have pointed out that, in order to assess cumulative impacts, Nelson must assess the impacts of the proposed expansion together with the impacts of existing development, including the existing quarry.

AGRICULTURAL IMPACT ASSESSMENT

The Nelson application will remove agricultural lands from production in a Prime Agricultural Area. There will be a loss of good agricultural land if the Nelson application is approved.

In the peer reviewer's opinion, the approach taken by Nelson with respect to alternative locations does not consider a broader range of alternative locations, from a soil capability perspective, or a cost-benefit analysis, for example, at various scales from the Province through to the sub-tier municipal level, and subsequently to the neighbours around the proposed expansion area. Therefore, the analysis of alternative locations, required by agricultural planning policy, is flawed.

AIR QUALITY ASSESSMENT

Updated analysis from Nelson is required to demonstrate that compliance with Provincial air quality criteria can be met. The peer reviewer notes that this updated analysis will likely confirm compliance, provided the correct data inputs are made and appropriate updates made to the Site Plan and notes (if required).

ARCHAEOLOGY AND CULTURAL HERITAGE

With respect to the proposed removal of the smaller outbuilding at 2280 No. 2 Side Road, and the stone Ontario Gothic Revival Cottage (golf club house) at 5235 Cedar Springs Road. In both cases, insufficient

evidence has been provided to clearly demonstrate a lack of cultural heritage value or interest. Based on the available information, both of these structures appear to have likely cultural heritage value or interest. Avoidance would mitigate this concern.

Hydrologic and Hydrogeologic Modelling

According to JART's peer reviewers, Nelson's analysis of water and natural environment impacts is highly dependent on predictions generated by a computer groundwater/surface water model. The model is driven by assumptions, as opposed to data generated in the field. JART's peer reviewers have a number of concerns with the validity of the model's predictions.

The cumulative effect of these issues calls into question the model's ability to predict impacts with sufficient accuracy to warrant approval of the proposed quarry expansion. Potential impacts not thoroughly assessed include impacts to wetlands, changes to streamflow in the Medad Valley and impacts to wells along Cedar Springs Road, including the availability of additional drawdown deeper in the aquifer to mitigate any impacts.

The conclusion that none of the wetlands in the immediate vicinity of the quarry receive significant groundwater inflows is contingent on the assumption that the wetlands are hydraulically isolated from the bedrock groundwater system. This has not been conclusively proven.

Impacts to the Medad Valley

The proposed west extension is predicted to cause reductions in flow in the Medad Valley, which is an important natural heritage feature. JART's peer reviewers believe that there is a high degree of uncertainty in these predicted changes and that the actual changes to the water budget for this feature may be significant.

Private Wells

Nelson's groundwater model predicts minor impacts to private wells downgradient from the site. In order to mitigate these impacts, an infiltration pond is proposed. There has been no data or testing to confirm that the infiltration pond will function as proposed. If there are serious impacts to private wells, Nelson proposes to deepen those wells to obtain additional water. However, JART's peer reviewers point out that deeper rock formations in the area likely do not contain sufficient water flow for this to work, and questions remain regarding potentially poor groundwater quality from deeper wells.

Karst Hydrogeology

The Halton Till does not have a uniform hydraulic conductivity (known as "K" in technical literature), is not an aquitard, and has not been appropriately characterized with regard to wetland hydrology and model layer input.

Groundwater flows to the Medad Valley have not been adequately characterized. These flows involve flow through discrete karst conduits (not an equivalent porous medium, or EPM), and impacts to the valley and its wetlands have not been adequately defined.

Golf Course Ponds and Fish

Nelson proposes to remove several human-made irrigation ponds and channels from the area of the west extension. These ponds are known to contain fish. While the Department of Fisheries has not raised concerns with their removal, Nelson has not provided policy justification for doing so. Nelson has also failed to survey these ponds for salamanders, including Jefferson salamanders. Considering these issues, removal of the ponds in question has not been justified. Should ponds and connecting channels be removed, a plan for the relocation and salvage of fish populations and other wildlife should be provided.

Nelson proposes to pump water from the proposed quarry to continue to provide flow to offsite watercourses, which will lose groundwater contributions as a result of the quarry. This will effectively convert groundwater flow to surface water flow. This may not be effective in preserving fish habitat.

The applicant needs to integrate surface and groundwater studies with fish habitat descriptions. Specific information on the downstream reaches of Willoughby Creek, including locations of groundwater upwellings (and their significance to fisheries), species composition, species at risk occurrences, distribution, relative abundance, and life history of the fish would be useful to understand the effects of the groundwater drawdown with respect to fish populations. Identification of critical or sensitive habitat with respect to groundwater upwellings and seepages would also be useful in future monitoring programs.

Perpetual Pumping

Nelson proposes to pump water perpetually in order to maintain the rehabilitated quarry in a dewatered state. This would also maintain the existing flows within the Willoughby Creek and West Arm tributaries. This is a departure from the approved rehabilitation plan for the existing quarry which would stop perpetual pumping and allow the quarry to slowly fill over time. Nelson has not provided sufficient technical justification that perpetual pumping will result in net socio-economic or environmental benefits.

Natural Heritage – Terrestrial

The uncertainty in groundwater impacts leads to uncertainty in impacts on water dependent natural heritage features, including wetlands and fish habitat. There is also a lack of baseline data in certain areas.

The proposed west extension will break the connectivity between a series of woodlands that constitute part of the Regional natural heritage system. Nelson proposes to maintain partial connections to off-site woodlands, but the effectiveness of these connections in maintaining the functions of the woodlands is questionable. The linkage function of the “non-significant” woodlands on the golf course, which are included within Halton’s Natural Heritage System, has not been adequately analyzed, particularly the function of the woodlands to support connection between regionally significant features on and off-site.

Though the revised Rehabilitation Plan shows a connection between the retained Significant Woodlands and the landscape to the south, this connection will be removed during extraction south of the woodland, so the connectivity of the landscape potentially will be impaired for many years (the timing has not been provided). The proposed restoration of the connection is narrow and mainly consists of steep slopes. The connection of the retained Significant Woodland to features within the NHS on the north side of Colling

Road is severed. Impacts of fragmentation within the retained significant woodland have been incompletely analyzed.

Surveys for Blanding's Turtle were conducted in 2021. However, these surveys were conducted only along the proposed west extension. There is potential habitat in the proposed south extension. Snake surveys continue to be recommended, based on MNRF Guelph District protocols for surveying Milksnake, which are recommended for snake species that are not at risk. Concerns remain that salamander trapping was not conducted in the golf course ponds. The ponds should be trapped, as the JART reviewer's latest observations indicated that they are similar to other human-made ponds that have been observed by NSE staff to support Jefferson Salamander and/or other Ambystomatid salamanders. Searches should be conducted for turtle nesting habitat within the study area.

The location of Snapping Turtle, which is a Species at Risk with a status of Special Concern, should be shown in the supporting report, as habitat for Special Concern species is considered a criterion for Significant Wildlife Habitat.

A restoration area for Jefferson Salamander has been proposed south of the south extension. Details regarding this restoration area are minimal within the submission materials. There appears to be no technical support for the feasibility of restoring this area for Jefferson Salamander, since no background studies have been conducted to determine if salamanders move in this direction, or whether suitable habitat could be restored in this location. In addition, the restoration will be within the 120 metre zone of influence of the proposed quarry, where impacts could be more significant, so the JART peer reviewer questions whether this is an appropriate place for restoration of salamander habitat. Concerns remain that such a restoration area could become an ecological sink for Jefferson Salamander.

Progressive and Final Rehabilitation Plan

Monitoring of biota should be conducted. Presence/absence and abundance of wetland-dependent wildlife integrates numerous variables related to wetland function. The baseline should include findings from amphibian surveys conducted between 2000 and 2011, since these encompass a range of amphibian species that have not been evident in more recent surveys.

Baseline information regarding seepage dependent terrestrial and aquatic habitat in the upstream reach of Willoughby Creek should be obtained and should be included as part of future monitoring.

Pumping in perpetuity remains a primary consideration for long-term rehabilitation, which requires a robust policy justification or more thorough exploration of alternatives to potentially avoid the uncertainty related to this type of mitigation.

Lastly, the Progressive and Final Rehabilitation Study should be revised to reflect the current AMP and Site Plan and the outstanding comments noted above should be addressed in the Progressive and Final Rehabilitation Plan.

Surface Water Assessment

The surface water assessment has been conducted in two forms supported by monitoring data, an event based hydrologic model for flooding (regulatory focus) and an integrated surface water – ground water model, to support impact assessment to natural features (water balance). The results of these model exercises have not been cross-checked which is considered a deficiency when interpreting the results. Furthermore, there are several impact management recommendations which are contingent on future monitoring data collection which will be used to set feature-based threshold conditions. These thresholds will then guide the point at which mitigation is required along with the degree of mitigation, which in most cases relates to the need for artificial pumping of storm/groundwater to affected features including area wetlands and watercourses. In the absence of these data at the present time, many of the recommendations and their quantum can only be considered speculative until such time as detailed information is available to corroborate the recommendations, as part of the Adaptive Management Plan.

The assessment places considerable reliance on a replica infiltration pond to offset the loss of recharge associated with the existing golf course ponds, as part of the western extraction. While it is acknowledged that this is several years away (Phases 3 through 6), detailed data collection and associated interpretation is vital in the intervening years to ensure that the database of flow records and water levels is sufficiently robust to support the implementation of the replica pond and also to determine that it will be effective in mitigating predicted impacts. Furthermore, it is unclear as to why the proposed replica infiltration pond is not shown on the Red-lined Site Plan; it is suggested that this be addressed accordingly.

Traffic Impact Assessment

The addendum letter clarification promised by Paradigm should address potential mitigation measures to consider. Points of clarification are requested on the site plan and associated notes with respect to sightline distances along No. 2 Side Road and the appropriate design and construction of the proposed haul truck crossings on No. 2 Side Road.

Visual Impact Assessment

There remains a need for details on how the mitigation measures will be implemented that are to be addressed through a landscape plan and a vegetation protection plan. In addition, while formally part of the amended site plan application for the existing quarry, the proposed new entrance to the existing quarry on the north side of No. 2 Side Road is related to the proposed expansion, and should be incorporated in these landscape and vegetation protection plans.

Adaptive Management Plan (AMP)

Multiple points in the draft AMP call for triggers for intervention based upon post-approvals monitoring. Development of triggers based on a precautionary approach is a preferred approach. There are multiple sources of existing data, including from the previous application, that can inform earlier development of such figures.

Specific information on the downstream reaches of Willoughby Creek, including locations of groundwater upwellings (and their significance to fisheries), species composition, distribution, relative abundance, and life history of the fish would be useful to understand the effects of the groundwater drawdown with

respect to fish populations. Identification of critical or sensitive habitats in respect to groundwater upwellings and seepages would also be useful in future monitoring programs.

Groundwater quality thresholds should be identified to protect groundwater quality in nearby wells.

Within the AMP, identified groundwater and surface water monitoring locations and their respective threshold levels should be established, reviewed, and approved by relevant agencies prior to issuance of an ARA licence.

Details are required with respect to climatic conditions and on-site climate data and how these will be used in establishing groundwater and surface water threshold levels and impacts from the proposed quarry operations.

4.2 Additional Research Areas

A number of technical areas generated greater amounts of public interest relative to other issue areas. The technical reviewers have provided the following additional information for consideration.

4.2.1 Flyrock

Explotech incorporated a section in their updated BIA report of June 16, 2021, under the heading "FLYROCK", pages 22-25 to provide a detailed explanation of mitigation measures and procedures used to address the potential for flyrock from existing the quarry site. Explotech has used the well-known and widely used United States Bureau of Mines model (USBM model) for predicting flyrock range under normal blasting operation at the proposed quarry extension. It must be noted that the potential flyrock distance range is a function of blast design parameters. For any specified range, the blast design parameters can be modified and calibrated to meet the specified range.

Although this flyrock range prediction model is a useful tool used in proper blast design and planning to mitigate flyrock from escaping the site, visual inspection of the rock face, top bench, and communications between the drilling crew and the blasting crew plays a more crucial role. This is because the parameters in the USBM model do not include unexpected sources that may play a major role in the generation of flyrock in each blast. These potential sources include burden depletion along the rock face, loose rock on the top bench, and void(s) within boreholes created during drilling.

These sources of potential flyrock generation can easily be mitigated by visual survey of the site and actions taken by the blaster-in-charge and the quarry operator to eliminate the hazard prior to explosive loading and blasting operations. Nelson's proposal incorporates operational planning for blasting.

4.2.2 Dust Leaving the Nelson Site

Residents have submitted, both to JART and the Ministry of Northern Development, Mines, Natural Resources and Forestry's enforcement team, complaints related to dust leaving the Nelson lands following blasts and excessive dirt on local and Regional Roads. The typical approach for addressing dust management at quarries is through a properly applied dust management plan and appropriate blasting techniques (design/size of blast, plus timing associated with favourable weather conditions).

Residents with complaints about any licenced mineral aggregate operation should be forwarded to the Natural Resources Information Support Centre (1-800-667-1940 or NRISC@ontario.ca), who will direct the complaint to the appropriate enforcement team.

4.3 Future Use and Reliance on this Report

JART member agencies will use the completed JART technical report to support the preparation of planning opinions on Nelson's proposal.

Technical conversations may continue with the proponent by individual agencies to address the remaining issues. This work, or any revisions to the Nelson proposal to address any other objector concerns, will require review and may necessitate updated analysis to be completed.

JART wishes to thank all those who have participated and provided input, including the proponent and members of the public, into the various application process.

Proposed Burlington Quarry Expansion
JART COMMENT SUMMARY TABLE – Agriculture

Please accept the following as feedback from the Burlington Quarry Joint Agency Review Team (JART). Fully addressing each comment below will help expedite the potential for resolutions of the consolidated JART objections and individual agency objections. **Additional, new comments may be provided once a response has been prepared to the comments raised below and additional information provided**.

	JART Comments (February 2021)	Reference	Source of Comment	Applicant Response (June 2022)	JART Response (June 2023)
1.	The golf course lands in the West Extension are within a prime agricultural area, as mapped by both Halton Region and the Province. The Implementation Procedures for the Agricultural System in Ontario's Greater Golden Horseshoe outlines the process for refining the Provincially mapped prime agricultural area. Specifically, section 3.3.1 provides that: "…within the GGH, any official plan amendment to designate, amend or revoke a prime agricultural area must come to the minister of Municipal Affairs and Housing for approval (other than for the purposes of including all of the applicable land within a settlement area). This means that refinements to the agricultural land base mapping must still come to the Province for approval even where they are proposed outside of an official plan review or municipal comprehensive review." Further, section 3.3.2.1 notes that: "During the municipal refinement process, refinements to prime agricultural areas mapped in OMAFRA's agricultural land base map are to be based on consistency with the Agricultural System mapping method, purpose and outcomes, and may be approved in the following circumstances: …Contiguous areas greater than 250 ha of existing, permitted non-agricultural and non-residential uses19 that are unlikely to be rehabilitated to agriculture and are not characteristic of prime agricultural areas. Non-agricultural uses may include commercial, institutional, cemeteries, golf courses, industrial parks, mineral aggregate resources areas below the water table, built-up areas along highways, developed shoreline areas (as per A Place to Grow policy 4.2.4.5), infrastructure (named in A Place to Grow Schedules 5 and 6) that has been developed, large impervious surfaces, and designated employment areas. …Municipalities and the Province will work together to avoid refinements to prime agricultural areas in the agricultural land base map in the following circumstances: …To exclude small pockets of land in non-agricultural uses (e.g., severed lots, small commercial or industrial uses)." In the absence of a refinement to the prime agricultural area approved by the Minister of Municipal Affairs and Housing, the City of Burlington views the West Extension as prime agricultural lands regardless of the	General	City of Burlington	As outlined in planning policy there is a difference between "prime agricultural areas" and "prime agricultural lands". Within prime agricultural areas there can be areas that do not contain prime agricultural lands. While the South Quarry Extension and West Quarry Extension are mapped as a Prime Agricultural Area, the South Quarry Extension contains prime agricultural land and the West Quarry Extension does not. This was confirmed based on the soil addendum submitted to JART. Based on a review of this report OMAFRA agrees that the West Quarry Extension does not contain prime agricultural land. As noted in OMAFRA letter dated June 29, 2021 (**Tab 1**), "*OMAFRA staff have had an opportunity to review the Soil Survey Addendum and the additional information in the response. Based on the soil information and the description of the site provided, it seems reasonable to conclude that the current agricultural capability of the soils on the site are likely not representative of prime agricultural land (CLI 1-3).*" As per earlier discussions with JART Map 1E and Map 1G Region of Halton Official Plan map the property as a Prime Agricultural Area. The Niagara Escarpment Plan and City of Burlington Official Plan do not include "prime agricultural area" mapping. To avoid removing land from the Prime Agricultural Area mapping Nelson agrees to amend the proposed Region of Halton Official Plan Amendment to maintain the "Prime Agricultural Area" mapping on Map 1E and 1G of the Region of Halton Official Plan. The proposed Region of Halton Official Plan Amendment is amended as follows: • Item 4. That Region of Halton Official Plan Map 1E – Agricultural System and Settlement Areas, on land legally described as Part of Lots 1 and 2, Concession 2 and Part of Lots 17 and 18, Concession 2 NDS (former geographic Township of Nelson), City of Burlington is hereby amended by adding an overlay of "Mineral Resource Extraction Area", as shown in Schedule "D" attached hereto and forming Part of this Amendment. • Item 6. That Region of Halton Official Plan Map 1G – Key Features within the Greenbelt and Regional Natural Heritage Systems, on lands legally described as Part of Lots 1 and 2, Concession 2 and Part of Lots 17 and 18, Concession 2 NDS (former geographic Township of Nelson), City of Burlington,	Not resolved.

	use that currently operates on them.			Region of Halton is hereby amended by adding an overlay of "Mineral Resource Extraction Area" on areas designated "Prime Agricultural Areas in the Natural Heritage System" and change the designation of land from "Key Features" to "Mineral Resource Extraction Area" as shown in Schedule "F" attached hereto and forming Part of this Amendment. See **Tab 2** for a copy of the proposed revisions to Map 1E and Map 1G.	
2	The AIA has focused almost exclusively on soil-based agricultural production, or the 'Land Evaluation" component of a LEAR and has not sufficiently addressed the 'Area Review' component, or consideration of the agricultural system as a whole. The study should include indoor horticulture, livestock, equine and other non-soil based types of agriculture. The study should speak to all types, sizes and intensities of agricultural operations that may be viable on the subject lands and surrounding lands, both now and in the future, given the constantly changing and evolving nature of the sector. Similarly, the study should also consider agriculture-related uses and on-farm diversified uses which benefit from close proximity to agriculture and/or cannot located in urban areas due to land use compatibility issues. Recent changes to Provincial policy have opened up a variety of options with respect to permitted uses- the study should speak to this when assessing the long-term productive capacity and overall viability of these lands. The AIA should also provide a definition for the term 'disturbed' to inform a more fulsome evaluation of the rehabilitation potential for the Western Extension lands, in relation to both soil and non-soil based agricultural uses, agriculture-related uses and on-farm diversified uses.	General	City of Burlington	As it relates to the subject site the AIA does focus on the quality of the soils on-site since mineral aggregate operations are a permitted land use within prime agricultural areas and the planning policy varies based on the quality of the soils located on-site. As it relates to off-site impacts the AIA considers and documents all existing agricultural operations ('soil-based' and non 'soil-based') and concludes that the proposed extension will minimize impacts on surrounding agricultural operations. As it relates to the West Quarry Extension, additional soil surveys were completed and it was concluded that the West Quarry Extension does not contain prime agricultural land. To assist JART with its review of the application, the following additional information exchanged between OMAFRA and MHBC has been included: • OMARFA comments dated December 14, 2020 included as **Tab 3**; • MHBC response dated June 1, 2021 included as **Tab 4**; • OMAFRA comments dated June 29, 2021 included as **Tab 1**; • MHBC response August 25, 2021 included as **Tab 5**; • OMAFRA and MHBC email exchange January 20, 2022 to February 2, 2022 included as **Tab 6**; OMAFRA sign-off letter dated February 7, 2022 included as **Tab 7**.	Not resolved.
3.	NEC Staff do not agree with the exclusion of the western expansion lands from the soil assessment. While it is understood the proposal seeks to excavate the majority of the Class 1 & 2 lands present on the site, conclusions of the report with regards to rehabilitation must be substantiated through field investigation. At this time NEC Staff view the western expansion lands as prime agricultural lands regardless of the use that currently operates on them.	General	Niagara Escarpment Commission	A soil assessment for the West Extension was submitted to JART and confirmed the West Extension does not contain prime agricultural lands. As noted in OMAFRA letter dated June 29, 2021 (attached), "*OMAFRA staff have had an opportunity to review the Soil Survey Addendum and the additional information in the response. Based on the soil information and the description of the site provided, it seems reasonable to conclude that the current agricultural capability of the soils on the site are likely not representative of prime agricultural land (CLI 1-3).*"	Acknowledged.
4	The AIA states that fragmentation of prime agricultural lands is minimized as the project is being proposed as an 'expansion' to an existing extraction operation. This argument has merit for the western expansion area, however it is noted that the southern expansion is not contiguous with the existing site and, in NEC Staffs opinion, introduces a fragmenting effect on surrounding agricultural lands. Summary of net impacts table provides 'below water extraction' as justification to avoid fragmentation. This is not a recognized mitigation	General	Niagara Escarpment Commission	Mineral Resource Extraction is permitted on prime agricultural land within prime agricultural areas. The policies of the Niagara Escarpment Plan do not require mitigation to avoid fragmentation. Although not applicable the lands surrounding the South Quarry Extension, include No. 2 Side road to the north and natural features to the east, south and west. Also see MHBC response to OMAFRA dated June 1, 2021 included in **Tab 4**.	Comment acknowledged

	measure nor does it fundamentally address the impact of fragmentation				
5.	The AIA quotes Part 2.8.2 of the NEP which requires development shall comply with minimum distance separation formula; however there is no commentary relative to the proposed rehabilitation plan or the potential for the introduction of new MDS constraints. • Summary of net impacts table provides that 'MDS I and II setbacks are not required for mineral aggregate extraction uses. Are they required for any of the uses proposed in through the rehabilitation plan?	General	Niagara Escarpment Commission	The proposed rehabilitation plan only creates a landform. Any after uses require a future Niagara Escarpment Plan amendment and if applicable consideration of MDS will be considered at that time.	Comment acknowledged.
6.	It is noted that the proposal suggests below water extraction and that the policies of the NEP permits a site with below-water extraction to avoid rehabilitation back to prime agricultural soil conditions. • Part 2.9.11 (i) requires that any remaining areas not subject to such extraction should be prioritized for and maximized as a first priority. NEC Staff notes that the existing Nelson site is subject to this application and that it could contain areas suitable for this type of rehabilitation. Please elaborate as to why this was not explored given the specific wording of Part 2.9.11 (i)? • Currently, there is no consideration of any type of agricultural after-use despite sections of the report identifying that there is a whole suite of ARU and OFDU uses that could be appropriate and that do not require rehabilitation of soils. Were these uses explored as a way to potentially achieve Part 2.9.11 (i)?	General	Niagara Escarpment Commission	As per discussions with JART and OMAFRA, it was determined that the West Quarry Extension and South Quarry Extension lands were not feasible for agricultural rehabilitation unless the sites were filled back to grade. Furthermore, the soils from the West Quarry Extension are not suitable for agricultural rehabilitation. In accordance with the policy requirements other areas were considered for agricultural rehabilitation. Based on these discussions, the proposed rehabilitation plan for the Burlington Quarry was updated to propose an area of agricultural rehabilitation to utilize the soils from the proposed South Quarry Extension. See updated ARA Site Plans for the existing Burlington Quarry and Burlington Quarry Extension.	Comment acknowledged.
7.	Better integration with the direction of the rehabilitation and after-use plan needs to be incorporated into the AIA. Much of the proposed rehabilitation, specifically on the western expansion lands, may result in the lands achieving the criteria for designation as Escarpment Protection Area if the work is successful. Recreation uses are not permitted within this designation but agriculture/ARU/OFDU may be.	General	Niagara Escarpment Commission	Any future after uses will require an amendment to the Niagara Escarpment Plan and only uses permitted within the applicable designation will be permitted. Nelson has proposed to convey the lands to public ownership to form part of the Niagara Escarpment Parks and Open Spaces. Within the Escarpment Protection Area, the Niagara Escarpment Plan permits "uses permitted in the Parks and Open Space System Master / Management Plans that are not in conflict with the Niagara Escarpment Plan." These uses can include recreational uses.	Inclusion of the project area within NEPOSS is speculative, and recreational use is predicated on a supportive management plan.
8.	Summary of net impacts table identifies that the subject lands do not contain any farm infrastructure and makes reference to a storage barn on the western expansion lands. Is there no infrastructure on the southern lands (barn, tile drainage, etc.)?	General	Niagara Escarpment Commission	As noted in the AIA there is no farm infrastructure located within the South Quarry Extension lands.	The absence of built farm infrastructure is acknowledged, though other infrastructure such as farm lanes are present.
9.	Summary of net impacts table could explore the implementation of pollinator gardens/species as broad mitigation.	General	Niagara Escarpment Commission	These mitigation measures were not proposed necessary to mitigate impacts to agricultural resources in accordance with the policy requirements of the Niagara Escarpment Plan.	This response is lacking clarity.

10.	Changes in the type and sensitivity of agricultural uses in the primary and secondary study areas associated with the proposed South and West Extensions will likely be affected by climate change/warming. Agriculture contributes to climate change as does the production and use of aggregate directly or as part of concrete and asphalt. Climate change will affect agriculture on a scale broader than the primary and secondary study areas. Therefore how: i. is the size of the secondary study area sufficient to document off-site agricultural impacts; ii. has the MHBC AIA considered climate change when evaluating agricultural impacts; and, iii. has the MHBC AIA evaluated cumulative agricultural impacts associated with aggregate mining in the context of various scales from Burlington to Halton Region to the Niagara Escarpment as well as to climate change generally?	General	AgPlan Limited	The AIA was completed using the Province's Draft Agricultural Impact Assessment Guidance Document, and OMAFRA has agreed and supported this approach as means to implement the Provincial Plan requirements to complete an AIA. Section 3 of the document outlines the recommended Study Area sizes for new or expanding aggregate operations, 1 km being the recommended size for the Secondary Study area. Additionally, the Guidance Document does not outline or discuss climate change in its recommended Assessment of Impacts section. The AIA was prepared in accordance with this Provincial Guideline document, per the request of OMAFRA.	There is reference in policy to a requirement to consider cumulative impacts. Those impacts need to be defined with respect to kind/characteristics, time, distance and/or area (scale) relative to different kinds of impacts on agriculture. Nothing in my review, presents quantitative cumulative agricultural impact information at different scales related to the lands in the Niagara Escarpment Plan (NEP) area through to the neighbourhood. Therefore, the matter of cumulative impact has not been appropriately discussed by the proponent or by OMAFRA.
11.	Given that the current application South Extension area is similar to the previous application (2004 with modifications to the application at later times), in addition to observations made during the time the current quarry has been in operation, there are previous observations, letters and/or reports available that will assist, in conjunction with other information sources, to ascertain: i. changes, if any, in the type and sensitivity of agricultural activities over time; ii. impacts to agriculture identified by complaint and/or applied mitigation; and, iii. the distance and/or off-site area affected as related to complaint and/or applied mitigation. These previous observations, letters and/or reports need to form part of the impact analysis in the MHBC AIA.	General	AgPlan Limited	The AIA was completed in accordance with the Province's Draft Guidelines. The Draft Guidelines provide a much more fulsome and holistic approach to the Impact assessment than what was required in previous applications, including a statistical representation of agricultural trends in the area using Census of Agriculture data to determine changes in type of agricultural activities over time. The evaluation of this AIA should be based on the most current technical report, which are required by current Provincial and Municipal policy. Previous applications are outside of the scope of this AIA review, as the current AIA follows the guidelines provided by the Province, which includes guidance on what is needed to be reviewed for the report.	Comment noted.
12.	The change in type and sensitivity of agricultural activities will also potentially be affected by the rate and density of urbanization within Halton Region. However, based on the Niagara Escarpment Plan (NEP) and the Greenbelt Plan (GBP) as well as other planning documents, the proposed Nelson South and West Extensions are in an agricultural area (Escarpment Rural Area, Protected Countryside, Prime Agricultural Area) which is planned to remain permanently agricultural within the NEP/GBP. Therefore, agricultural information analyses need to be based on the scale of the NEP/GBP to place the proposed aggregate expansion in that context as well as in the context of Halton and Burlington.	General	AgPlan Limited	The subject lands are designated Escarpment Rural Area in the NEP. Mineral Aggregate operations are a permitted use within the Escarpment Rural Area (Section 1.5.3). As such, the lands are not "planned to remain permanently agricultural" as mineral aggregate is permitted. The AIA satisfies relevant policies within the NEP in section 4.2 of the AIA. The purpose of the NEP is to "provide for the maintenance of the Niagara Escarpment and land in its vicinity substantially as a continuous natural environment, and to ensure only such development occurs as is compatible with that natural environment." Accordingly, policies within the NEP are written with the scale and context of the Niagara Escarpment in mind. Therefore, the AIA addresses the scale of the Niagara Escarpment through its satisfaction of the NEP's policies.	It has been interpreted that agricultural policy in Ontario has, as its base, the need to preserve the better agricultural land by distinguishing what is better and poorer and subsequently saving the better. The Nelson application will remove better agricultural lands from production in a Prime Agricultural Area. Nothing in the information presented on behalf of Nelson that I have reviewed contradicts that conclusion. Therefore, there will be a loss of good agricultural land if the Nelson application is approved and alternative locations for the proposed pit have not been considered at the scales described in the JART Comments column opposite.

13.	The MHBC AIA neglects to address some matters described in policy and/or guidelines. For example, Halton Region's AIA Guidelines include reference to agricultural viability and farm management. The MHBC AIA needs to address these agricultural characteristics in their assessment.	General	AgPlan Limited	The AIA uses the Provincial Draft Agricultural Impact Assessment Guidelines to determine what should be included in the AIA. These Guidelines were developed more recently (2018) than the Region's Guidelines (2014). As such, there is no section dedicated to agricultural viability or farm management. However, throughout the report, comments are made on the viability of the lands/operation through an analysis of characteristics such as fragmentation, surrounding land uses, investment in agricultural infrastructure, size of the lands, etc. The report also includes information regarding the ownership of the lands (Nelson). It can therefore be concluded that the current agricultural operation on the lands is leased. A description of the site also indicates that there is no residence on site.	Comment noted.
14.	Reference has been made within the AIA to reports by other disciplines. However, there is a lack of integration of information from other disciplines. For example, the infiltration of water into the soil profile and subsequent (unsaturated flow of water within the agricultural soil profile which occurs during the time of crop growth) may change because of the pumping of water during the excavation of aggregate materials below the water table. The probability of change will require the integration of information from the disciplines of Hydrology, Hydrogeology, and Agrology (soil physics). Information needs to be integrated either within the AIA or within another report. If the information is described in another (different discipline) report, the other report should be quoted as well as referenced within the AIA.	General	AgPlan Limited	A Hydrogeology Report was completed and referenced in the assessment of impacts section. Their mitigation measures and conclusion of no negative impacts was used to inform the AIA's conclusion that there would be no anticipated negative impacts to surrounding agricultural uses.	Comment noted.
15.	Firstly, based on this peer review, the MHBC Agricultural Impact Assessment and supporting documents provided by DBH lack some information where that information would assist in evaluating whether the proposed change in use has relatively low agricultural impacts and is appropriate and reasonable. Secondly, the current AIA, and supporting documentation, in addition to information requested within this peer review, is needed to establish whether the MHBC AIA and DBH documents address impacts to agricultural characteristics described in the published literature, policy, and guidelines.	General	AgPlan Limited	The AIA was completed in accordance with the Province's Draft Guidelines. The Draft Guidelines provide a much more fulsome and holistic approach to the Impact assessment than what was required in previous applications, including a statistical representation of agricultural trends in the area using Census of Agriculture data to determine changes in type of agricultural activities over time. The evaluation of this AIA should be based on the most current technical report, which are required by current Provincial and Municipal policy. Previous applications are outside of the scope of this AIA review, as the current AIA follows the guidelines provided by the Province, which includes guidance on what is needed to be reviewed for the report.	Which meaning of the word "fulsome" is being used here. Comment noted
16.	In the introduction (page 1), the AIA refers to the West Extension as non- agricultural based on the current golf course use and in the AIA Response, the fact that the golf course is part of a prime agricultural area is recognized. In addition, the AIA Response states that the golf course lands have been substantially disturbed and therefore have no capability rating for the production of common field crops. The level of disturbance can only be ascertained by soil observation. Therefore, the AIA statement with respect to "substantially disturbed" has not been verified.	Page 1 Introduction	AgPlan Limited	A Soil Survey Addendum was completed and provided to OMAFRA, which provided soil information and a description of the site. The addendum concluded that the current agricultural capability of the soils on the site are likely not representative of prime agricultural land (CLI 1-3). OMAFRA's response dated June 29, 2021 confirms this conclusion. See **Tab 1**.	Comment noted

17.	On page 3 it is stated that the potential for impacts will vary and mitigation is dependent on the type and sensitivity of the agricultural activities identified in the primary and secondary study areas. A reasonable statement, but, given the length of time that the quarry "additions" will be in operation, the type and sensitivity of agricultural activities will potentially vary. How this change in type and sensitivity of agricultural activity will be analyzed and mitigated is not described in the MHBC AIA.	Page 3	AgPlan Limited	The AIA partially relies on the results of the technical studies (e.g. Noise, Hydrogeology, Traffic, etc.) submitted with the application to assess and mitigate against the potential impacts. The technical studies largely assumed 'worst-case' scenarios in their analysis, as a result, the anticipated impacts from these activities on agricultural uses has been considered in our assessment of impact under Section 5.0 of our report. As noted in our report, the most significant impact on the agriculture system is the loss of approximately 12.7 hectares of productive agricultural land. In response to this loss, Nelson has agreed to amend their existing Burlington Quarry Site Plan to include approximately 14 hectares of rehabilitated agricultural land on the rehabilitated quarry floor of the existing quarry. This area is equivalent to proposed extraction area of the South Extension lands. This will allow stripped soils from the South Extension to be immediately placed in the existing quarry to facilitate the proposed agricultural rehabilitation. This approach will avoid the need to stockpile/store stripped material for long periods of time, which will help maintain the soil fertility and structure and improve the success of the rehabilitation efforts. See updated ARA Site Plans for the existing Burlington Quarry and Burlington Quarry Extension.	Comment noted.
18.	The AIA (pages 4 and 5) states that the proposed after use vision for the extension and existing quarry is to develop a landform suitable for a future park. As a result, the rehabilitation plan for the South extension includes a beach, lake, exposed quarry faces, wetlands, and forested areas. The rehabilitation plan for the West Extension includes a series of ponds, wetlands, exposed quarry faces and forested areas. There is no discussion how this proposed after use is compatible with agriculture in the context of agricultural use and soil capability in the area potentially influenced or affected by the existing quarry and proposed quarry extensions as well as the NEP, GBP, PPS, Halton, and Burlington plans.	Pages 4 and 5	AgPlan Limited	As noted above, Nelson has agreed to amend their existing license to include approximately 14 hectares of rehabilitated agricultural land on the rehabilitated quarry floor of the existing quarry. This will allow stripped soils from the South Extension to be immediately placed in the existing quarry to facilitate the proposed agricultural rehabilitation. This approach will avoid the need to stock pile/store stripped material for long periods of time, which will help maintain the soil fertility and structure and improve the success of the rehabilitation efforts. A number of recommendations have also been made to the site plan conditions to ensure the rehabilitated agricultural area be returned back to the same average soil capability and production as the South Extension lands. See updated ARA Site Plans for the existing Burlington Quarry and Burlington Quarry Extension. As noted in response to comment #1 Nelson is modifying their application to not remove both extension areas from the Prime Agricultural Areas designation. The intent is to apply an extraction overlay in the Region's Official Plan.	Comment noted for all paragraphs.
19.	It is stated in the AIA (page 5) that; furthermore, a soil survey and Canada Land Inventory (CLI) Evaluation was completed by DBH Soil Services Inc. to document the existing soil conditions and provide a more detailed assessment of the Canada Land Inventory (CLI) classification for the soil resources on both properties. If the assumption is made that the reference to both properties means the South Extension and the West Extension, the quote above is interpreted to indicate that a CLI classification for both extensions has been presented. In addition, the DBH Addendum (November, 2020) states on page 3 that the Addendum soil survey included completion of mapping to illustrate the location of the property, the occurrence of soil polygons and appropriate CLI capability ratings. Subsequently, DBH presents no maps of soil polygons or	Page 5 and DBH Addendum	AgPlan Limited	Both the original soil survey of the South Extension and the addendum soil survey on the West Extension were completed to the Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) Guidelines for Detailed Soil Surveys for Agricultural Land Use Planning, a copy of which may be found at the following link: http://www.omafra.gov.on.ca/english/landuse/facts/soil_survey.htm Further, as per the OMAFRA guidelines, the soil survey referenced the Field Manual for Describing Soils in Ontario (Ontario Centre for Soil Resource Evaluation, 1993), and the OMAFRA document Classifying Prime and Marginal Agricultural Soils and Landscapes: Guidelines for the Application of the Canada Land Inventory in Ontario, a copy of	Comment noted for all paragraphs.

	appropriate CLI capability ratings. The information presented in the DBH indicates: i. There are differences in depth to bedrock, or at least to refusal, when a Dutch auger is used to expose the soil profile (were other methods of exposing the soil profile used to determine the reason for refusal?). ii. There are differences in soil drainage (in the sense that some profiles are identified by DBH as imperfectly drained and others are “unknown”). Differences in vegetation as well as in characteristics within a soil profile are used to distinguish soil drainage class. In those areas planted to grasses, how were water tolerant versus water intolerant grasses differentiated by DBH in the field? DBH also identifies on page 2 of the Addendum that topography information was provided by MHBC Planning. These aforementioned three pieces of information (depth to bedrock, soil drainage class and slope class) could have been used to differentiate soil polygons within the West Extension. Why were soil polygons not differentiated on the basis of these three characteristics?			which may be found at the following link (http://www.omafra.gov.on.ca/english/landuse/classify.htm). As stated in the original soil survey and the addendum (South Extension and West Extension respectively), a Dutch Soil Auger and/or Dutch Stone Auger was used to extract soil material to a minimum depth of one meter (or to refusal). Further, observations, or visual evidence of landforms and rock outcropping was used to determine areas of shallow to bedrock soils. The assessment of drainage class is a function of the degree of soil mottling as based on size of the soil mottle, the relative colour (Hue/Chroma/Value, matrix as compared to mottle), depth of mottling and depth of colour change (Pages 26 and 27 of the Field Manual for Describing Soils in Ontario). There is no consideration within the Field Manual for Describing Soils in Ontario for determining soil drainage class as based on vegetation. It is noted that vegetation may be used an indicator of soil drainage and is a function of the Ecological Land Classification (ELC) as defined by the Ontario Ministry of Natural Resources and Forestry (MNRF). A link to the ELC is provided as follows (https://www.ontario.ca/page/introduction-ecological-land-classification-systems). For the purposes of these soil surveys, the assessment of drainage was conducted as per the Field Manual for Describing Soils in Ontario. The evaluation of soil resources for the South Extension and the West Extension areas was completed to determine the extent of soil resources in both areas. The evaluation determined the location and extent of the soil resources on the South Extension area by defining soil polygons and assigning Canada Land Inventory (CLI) ratings as per the OMAFRA document Classifying Prime and Marginal Agricultural Soils and Landscapes: Guidelines for the Application of the Canada Land Inventory in Ontario. It has been documented within the addendum report (West Extension) that “Due to the scale of mapping, the areas of disturbed soils comprise large portions of the Subject Lands, while the minor areas of shallow to bedrock soils are too small to map. Therefore, the entire site (Subject Lands) is considered as disturbed and is considered as not rated in the CLI system.” As such, the entire site has been mapped as one soil polygon and has been determined to be “not rated in the CLI system”. Therefore, the DBH reports have provided detailed information regarding soils, soil resources, and comment on soil capability rating per the Canada Land Inventory classification system.	
20.	The legend in Figure 4 “Agricultural Land Uses” has various crops listed but they are not visible on the Figure 4 map that the retained consultant has been able to access. The report should be revised to include this information.	Figure 4	AgPlan Limited	Attached as **Tab 8** is a copy of Figure 4, which hopefully is more legible and addresses your comment.	Comment addressed.

21.	On page 7 of the MHBC AIA, the site visit confirmed that there are not many productive and contiguous agricultural operations within the Primary Study Area, as this area is already fragmented by the existing aggregate, recreational, natural and rural residential uses. And then on page 10, in addition to the existing aggregate extraction operations within the Study Area, there are few active agricultural operations within the Secondary Study Area [underlining added]. “Few” and “not many” are not defined and are not put in context, with what occurs on average, or within a specific range of values within different areas or at different scales such as Halton Region, the City of Burlington, and the Primary and Secondary Study Areas. The PPS has the principal determining factor for prime agricultural areas and prime agricultural lands as soil capability. For example, in OMAFRA’s Land Evaluation and Area Reviews (LEAR) for the Greater Golden Horseshoe, (Agricultural System Mapping Method, technical document, January 2018) soil capability was assigned a relative importance of 60.0% and farm production is assigned 30.0% of the score leaving 10.0% for parcel fragmentation. Therefore, the specific meaning of productive and contiguous agricultural operations and active agricultural operations found in the MHBC AIA need to be defined in the context of specific wording in plans, guidelines, and technical documents.	Pages 7 and 10	AgPlan Limited	Noted. As indicated on Figure 4, the Primary Study Area for the South Expansion contains 5 different active parcels within the expansion boundary. The Parcels are not typically shaped (rectangular), which would indicate that the lands within the primary study area are fragmented, and not considered contiguous. It is noted that in the description the study area there is no numerical definition of few, however the parcel fabric information is available on Figure 4. The total size of the 5 parcels is noted as being consistent with the average parcel size in the City of Burlington (p.7). Similarly, a detailed numerical value was not used to define the number of large cash cropping fields or livestock operations. However, the details can be ascertained via the information in Figure 4.	Comment noted.
22.	There are equestrian operations, ranging in size from hobby farms to training facilities is stated in the AIA on page 11. While the use of the phrase “hobby farm” has been in use for at least 50 years, the definition of the phrase has not been provided in the MHBC AIA and is generally not provided, when the phrase is used, in other AIA’s. If a hobby is something that provides enjoyment, and costs more money than it generates, then an argument can be put forward that approximately 80.0% of farms can be classified as hobby given that: • The 80.0% of farms have higher off-farm income than on-farm income; • The off-farm income is necessary to sustain the farm and the farmers operating that farm. Additionally, the PPS (2020) in section 2.3.3.2 states, in prime agricultural areas, all types, sizes and intensities of agricultural uses and normal farm practices shall be promoted and protected in accordance with provincial standards. This can be interpreted to mean that discriminating amongst agricultural uses by type, size, and/or intensity, is prohibited, and therefore, distinguishing a hobby farm use versus an equestrian or common field crop use is inappropriate. Recognizing differences in agricultural land uses is only of importance in the PPS when identifying areas of fruit and vegetable production (which are part of the definition of specialty crop area). The MHBC AIA needs to define the meaning of “hobby farm” and provide a measure of the relative predominance of hobby farms at various scales from the municipal to the regional. As well, the AIA needs to explain why the differentiation of hobby farms is of significance in the context of the wording of planning policy.	Page 11	AgPlan Limited	Noted. The use of the Term “Hobby Farm” was used only to describe the size and nature of the operation when describing the Primary and Secondary Study area. The evaluation of potential impacts on Hobby Farms and larger operations is the same, as is the mitigation measures. The term is not used to differentiate in terms of Planning Policy requirements. Because all agricultural operations identified are considered equally in the analysis of impacts, and proposed mitigation measures, there is no discrimination based on size of operation.	Comment addressed.

23.	The AIA states on page 12 - Based on the site visit, the agricultural lands within the Primary and Secondary Study Areas are significantly fragmented by existing rural residential, natural areas and recreational uses. The parcel sizes are indicative of smaller, hobby-sized farms rather than large cash crop or livestock operations found elsewhere in southern and central Ontario. No extensive farm investment such as tile drainage, irrigation or other specialized cropping practices or equipment were observed or are documented within the Primary or Secondary Study Areas. Following the discussion as already outlined in comment 22 above, the lands still need to be promoted and protected based on the wording of the PPS. Additionally, what does “extensive farm investment” mean and how has that relative investment been compared at different scales (regional, municipal through to site-specific).	Page 12	AgPlan Limited	For comments regarding hobby farms, see response to 22. Extensive farm investment is characterized by tile drainage, irrigation, or other specialized cropping practices or equipment. Identification of these types of investments is used to understand any potential impact the proposal may have to the broader Agricultural System. There were no extensive farm investments identified, which is part of the consideration when determining impact on the agricultural system.	Comment noted.
24.	Limited rural residential uses, natural areas and passive recreational uses are considered complementary uses within prime agricultural areas. It is somewhat misleading to characterize these uses as having ‘significantly’ fragmented a portion of contiguously mapped prime agricultural area. This statement, and others, should be examined in relation to the LEAR scores generated through both the Halton Region and Provincial LEAR studies. While these studies each use different weighting configurations, both have recently confirmed these lands was meeting the criteria for a prime agricultural area, and would have accounted for fragmentation in the scoring. This data should be provided and analyzed in the AIA.	Page 12	City of Burlington	See response to comment # 21. Also mineral aggregate uses can also be considered complementary uses within prime agricultural areas since they are permitted use in accordance with the Provincial Policy Statement.	Comment noted.
25.	“The loss of approximately 12.7 hectares of agricultural land, currently used for cash crop production, will have a negligible effect on the social and economic impacts of agriculture in the City of Burlington, Halton Region and province as a whole.” Without relative comparisons to scale, existing trends of decline and a cumulative impact assessment lens, it is challenging to verify such a statement. For example, the impacts of a changing climate are not addressed anywhere in the study’s evaluation of long-term agricultural viability. The overall system impact of continuously removing small amounts of prime agricultural lands is complicated by the impacts of changing climate, which may compromise agricultural viability and heighten the need to preserve the agricultural land base to enable a strong, diverse agricultural system. Regenerative farming practices and on-farm stewardship can make a significant contribution to mitigating and adapting to the impacts of a changing climate, while supporting the integrity natural heritage system and providing opportunities for passive recreation (i.e. Bruce Trail). The loss of these types of secondary services provided by agricultural lands has not been accounted for.	Page 13	City of Burlington	See response to comment # 6, 17 and 18. The loss of 12.7 hectares of agricultural land is being mitigated.	Comment noted.
26.	The AIA continues on page 13, stating that based on the site visits, the agricultural activities within both the Primary and Secondary study area are indicative of broader agricultural trends in the City of Burlington and the Halton Region. Overall, agricultural uses within both the Primary and Secondary Study Area are representative of normal agricultural production for this area. The loss of approximately 12.7 hectares of agricultural land, currently used for cash crop production, will have a negligible effect on the social and economic impacts of agriculture in the City of Burlington, Halton Region, and province as a whole.	Page 13	AgPlan Limited	The AIA uses two Census years to compare agricultural statistics, 2016 and 2011. This can be seen in the following paragraphs of subsection 2.3: *“The total numbers of farms in Halton Region (451 farms) and the City of Burlington (66 farms) have declined since 2011. The City of Burlington experienced a greater decline (5.7%) in total number of farms when compared to the Region of Halton (3.8%).”* *“The amount of lands in crop production has declined in the both the Region (14.7%) and the City (26.4%). Burlington has*	Comment noted.

	The conclusion in the first paragraph quoted above would appear to be based, at least in part, on the statistical analysis of a single census year. This interpretation is an unnecessary assumption if the AIA report provides information stating what evidence was used in support of the MHBC AIA statement quoted above. Regardless, a one census year analysis is limited because a single year is insufficient to indicate trends. An analysis of trends is necessary because not all components of agriculture are static. Additionally, some of the categories used in that statistical work would appear to be based on the "StatsCan" classification of the predominant use of each farm operation. There are no discussions about the specific Statistics Canada data descriptors used in the MHBC AIA and there is no discussion about the limitations of the classification system. Why weren't direct measures of agricultural uses/activities made based on agricultural census categories for livestock such as total cattle and calves, total hens and chickens etc. (livestock numbers can be calculated per farm operation or per unit area), as well as crops such as total proportionate area of corn, wheat, soybeans, fruit, vegetables etc.? This Statistics Canada information can then be compared at minimum from the regional to municipal scales. Fieldwork could supply the agricultural information from the primary and secondary study areas down to the site- specific scales. Subsequently, the data from the agricultural census and fieldwork can be compared, as an accuracy check for crop production, to area measurements of different crops available from the mapping produced yearly by Agriculture and Agri-Food Canada (AAFC). The data analyses described in this review would provide evidence concerning whether the agricultural activities within both the Primary and Secondary study area are indicative of broader agricultural trends in the City of Burlington and the Halton Region. The description of differences when comparing the Region and City in the analyses presented, could have been entered as numerical data and compared using multi-attribute analysis (a LEAR is an example of one kind of multi- attribute analysis). This kind of analysis, as described in the previous three paragraphs, was not completed, and should be included in the AIA. The second paragraph quoted above concludes that the loss of the 12.7 hectares of agricultural land (the author chose to use number of hectares only in agricultural production, which, suggests incorrectly that land uses such as fence rows have no benefit to, and/or are not part of, agriculture) will have a negligible effect on the social and economic impact of agriculture at three scales - City, Region, and Province. The statistics quoted in the AIA are insufficient to support this conclusion, including context, for the phrase quoted in comment 23 where the agricultural activities within both the Primary and Secondary study area are indicative of broader agricultural trends in the City of Burlington and the Halton Region.			*experienced a stronger decline (5,203 acres to 3,828 acres) in the amount of lands in crop production since 2011 in comparison to Halton Region (61,673 acres to 52,602 acres).”* The use of two census years is to provide a general understanding of broad agricultural trends within the City and Region. For this reason, the number of Farms and total amount of land was sufficient in providing a general agricultural trend. A multi-attribute analysis is outside of the scope of the AIA and is not recommended within the Province's Draft Guidelines. Further, the characterization of the study areas to the City and Region is not an analysis of trends, but a comparison of what is typical in the City and Region. Thus, a single year would be sufficient in justifying that at this given point in time, the Study Areas are indicative of agricultural uses in the City and Region. As previously stated, it is further noted that Nelson has agreed to change the rehabilitated landform of their existing quarry from a lake-based landform to a terrestrial landform, which will include rehabilitated agricultural land equivalent to the to the proposed extraction are of the South Extension lands.	

27.	Figure 5, following page 14, has been reproduced at a scale of 1:25,000. The original mapping, upon which the Land Information Ontario soil shape files are based, were mapped at a scale of 1:63,360 (Gillespie et al., 1971). The scale of the original work is not mentioned in the AIA and the significance of the difference of scale with respect to matters such as minimum mappable area have not been discussed (a map can be accurate to scale but imprecise at a more detailed scale).	Figure 5	AgPlan Limited	Noted. Nevertheless, as you know a detailed soil survey was completed by DBH Soils to confirm the soil classification.	Comment noted.
28.	Tables 2 and 3 on page 15 are based on maps produced at two different scales. Table 2 is based on the work of DBH Soil Services whereas Table 3 is based on the original published information by Gillespie et al. (1971). Therefore, the two tables are not comparable. The AIA analysis on soil capability should compare the two proposed expansion areas based on published information as well as a third table using the more detailed DBH information. Given the need to characterize the soils on the West Extension, the capability comparison should include the current agricultural capability of the golf course lands based on field soil observations as well as to the soil capability of the golf course lands after they have been rehabilitated for agriculture.	Page 15 Tables 2 and 3	AgPlan Limited	The tables are used to present the information. They are not a comparison between one another, and use the most accurate information available. For the South lands, this was DBH's soil sample findings. For the West lands, this was the CLI classification. As you know, an addendum to the Soil Survey was completed by DBH and based on OMAFRA's review of the Addendum OMAFRA staff concluded that the current agricultural capability of the soils on the site are likely not representative of prime agricultural land (CLI 1-3).	Comment noted.
29.	On page 16, there is a discussion in a subsection title indicating microclimate for specialty crop production. However, the discussion does not deal with microclimate including cold air drainage. The data quoted in the AIA are for Crop Heat Units (CHU) mapped at a broad scale. Specialty crop areas mapped by the Province include the Holland Marsh which has similar or lower CHU compared to the Nelson Aggregate site. Therefore, why does the MHBC AIA state that the Nelson Aggregate area has not been mapped as a specialty crop area because of climate?	Page 16	AgPlan Limited	The CHU were used to provide a description of the growing season for the Study Areas, and is one of many characteristics, which are considered in Specialty Crop Mapping. The AIA states that the area has not been mapped as a specialty Crop area as it has not been by OMAFRA, the Region or the City.	Comment noted.
30.	Provincial policy does not provide a hierarchy of interests, only that both are important and must be protected. In this case, assessing long-term local supply and demand for each resource could assist in determining the appropriate prioritization.	Page 18	City of Burlington	See response to comments # 6, 17 and 18. The application has been revised to utilize the prime agricultural land from the south quarry extension. Furthermore, when considering the hierarchy of interests there is a policy framework that permits aggregate extraction within prime agricultural areas, on prime agricultural land and agricultural rehabilitation is not required if certain conditions are satisfied.	Comment noted.
31.	Based on publicly available materials (see link below), the applicant proposes a single/unified rehabilitation plan concept for the existing licensed area (licenses #5657 and #5499) and the southern and western extensions. Recognizing that both the southern and western extensions cannot be rehabilitated if extraction occurs below the water table, the proposed rehabilitation should address opportunities to maximize agricultural rehabilitation in the remaining areas (licenses #5657 and #5499). https://www.mtnemoquarrypark.com/	Page 19	City of Burlington	See response to comments # 6, 17 and 18.	Comment noted.
32.	The MHBC AIA on pages 19 and 20 states that in terms of impacts on surrounding agricultural properties, an expansion of an existing quarry is preferable as it minimizes impacts on the surrounding agricultural system. Why it is preferable to have a larger pit operating over a longer time than several smaller pits over a shorter time has not been explained in the MHBC AIA.	Pages 19 and 20	AgPlan Limited	The expansion is preferable to a new quarry in a new location as it does not introduce new impacts to the area on existing agricultural operations through the use of existing haul routes and processing facilities. An expansion allows the operation to use both licenses collectively, using the same processing equipment, entrance/exit, and existing haul route. This also allows for the comprehensive rehabilitation of the lands.	Comment noted.

33.	There are some questions related to the section in the MHBC AIA discussing the Planning Policy Framework. On page 19, the PPS is quoted relating to extraction below the water table (section 2.5.4.1, d) where agricultural rehabilitation in remaining areas is maximized. This wording is repeated on page 23 of the MHBC AIA when quoting from the Halton Region Official Plan. Subsequently, on page 22, related to the NEP section 2.9.11, the following is quoted: in prime agricultural areas, where rehabilitation to the conditions set out in (g) and (h) above is not possible or feasible due to the depth of planned extraction or due to the presence of a substantial deposit of high quality mineral aggregate resources below the water table warranting extraction, agricultural rehabilitation in the remaining areas will be maximized as a first priority. How does the proposed after use, described in the AIA,demonstrate that the agricultural rehabilitation of remaining areas is maximized and/or agricultural rehabilitation in the remaining areas will be maximized as a first priority? Based on the previous paragraph and description in other parts of this peer review, impacts to agriculture need to be evaluated in the MHBC AIA during extraction, rehabilitation, and post-rehabilitation.	Pages 19, 22, and 23	AgPlan Limited	See response to comments # 6, 17 and 18.	Comment noted.
34.	On page 19 the MHBC AIA states that; it would be difficult to locate any new aggregate operation within the City of Burlington or Region of Halton that would avoid prime agricultural areas. This phrase is an answer to the requirement quoted from the PPS in the MHBC AIA on page 19 as well as repeated in the Halton Region Official Plan (MHBC AIA, page 23). Other alternative locations have been considered by the applicant and found unsuitable. The consideration of other alternatives shall include resources in areas of Canada Land Inventory Class 4 to 7 soils, resources on lands identified as designated growth areas, and resources on prime agricultural lands where rehabilitation is feasible. Where no other alternatives are found, prime agricultural lands shall be protected in this order of priority: specialty crop areas, and Canada Land Inventory Class 1, 2 and 3 lands. However, there are no maps presented demonstrating the relationship between soil capability classes, the location(s) of the same or similar aggregate resources, the presence of other resources, or other factors restricting aggregate mining, used in support of the statement related to the difficulty of locating a new aggregate operation that avoids prime agricultural areas. Additionally, there is no mapping demonstrating where aggregate resources are available and where rehabilitation is feasible. Neither is there mapping to demonstrate the protection of prime agricultural lands relative to the priority outlined in policy. The MHBC AIA needs to contain this mapping as evidence that there are no suitable sites based on the wording of planning policy.	Pages 19 and 23	AgPlan Limited	It is noted that there are no maps pertaining to an evaluation of alternatives. The following is the justification. Although Section 2.5.4.1c) of the Provincial Policy Statement (2020) requires consideration of alternatives on lower quality land (among other areas), the requirement to consider alternatives is based on what is suitable to the applicant (“other alternatives have been considered by the applicant and found unsuitable”). In this regard, it is unsuitable to consider alternatives that are not adjacent to the existing quarry as there has already been a considerable amount of financial and physical resources invested at the existing quarry. As noted in the AIA, expansion of the quarry on adjacent lands will help minimize potential impacts to agriculture as it does not introduce ‘new’ impacts in the area by utilizing established haul routes and existing processing equipment. The new licensed areas will be operated as an expansion to the existing quarry, and does not create further fragmentation of agricultural land in other parts of the Region. It is noted that given the existing physical and land use constraints in the area surrounding the quarry, potential expansion to the quarry is limited to the north, south, and west as the Mount Nemo settlement area is located to the east. Although the focus of this application has been to the south and west extension areas, consideration of expanding in all directions has been given. The following summarizes the land use considerations that have precluded consideration of expanding the quarry in other directions: East/Southeast: Mount Nemo Settlement Area as well as presence of significant Natural Heritage features. Southwest: Existing golf course that is not available for purchase. North/Northeast: Farms are more contiguous and less fragmented by non-agricultural uses and natural features. There is more farm	Agricultural policy involves consideration of alternative locations by the applicant. Nelson Aggregate has taken the view that they, as the applicant, can apply an economic analysis related to the business to eliminate the requirement for an evaluation of alternative locations other than by expansion to adjacent properties. In my opinion, the policy can be interpreted to mean that the applicant is responsible for completing the alternative locations analysis. The approach taken by Nelson does not consider a broader range of alternative locations, from a soil capability perspective, or a cost-benefit analysis, at various scale from the Province through to the sub-tier municipal level, and subsequently to the neighbours around the proposed expansion area. Therefore, the analysis of alternative locations, required by agricultural planning policy, is flawed. For the following paragraphs, comments are noted.

				infrastructure and investment to the north in the form barns, fencing, etc. associated with the 3-4 existing livestock operations. The natural feature along Colling Road from Blind Line to Guelph Line is identified as part of the Regional Natural Heritage System. As noted in the Planning Report, a high pressure gas oil pipeline runs along the Colling Road alignment. The gas line would create operational challenges in terms of cross and working around this established easement. A portion of the Bruce Trail is also located along the north side of the existing quarry along Colling Road. It is noted that protection of the Bruce Trail is identified as a priority in the Niagara Escarpment Plan. Northwest: As noted in the Planning Report, part of the properties between Blind Line and Cedar Springs Road is Escarpment Protection Area and Escarpment Natural Area and would not be available to extraction. Other Rural Areas would be within 200 metres of the Escarpment Brow and aggregate extraction is prohibited in this area. Given the foregoing, the selected locations for expansion are considered more favourable from an agricultural perspective as well as other operational or planning policy perspectives. Lastly, as it relates to the west extension, it is noted that the alternatives test in the PPS does not apply as these land are not considered prime agricultural land (see response to comment 4 below). As a result, the west extension lands are preferred as they are not considered prime agricultural land.	
35.	Impacts avoided would primarily be transportation related (i.e. avoiding the development of new haul routes) but there are other impacts to consider, i.e. the extended duration of use and the intensification of the existing haul routes and activities.	Pages 19, 24, and 27	City of Burlington	The application does not result in the intensification of the existing haul route. The use of the existing haul route is appropriate and is a route that is planned for high volumes of traffic including truck traffic.	Not resolved.
36.	“2.5.3.1 Progressive and final rehabilitation shall be required to accommodate subsequent land uses, to promote land use compatibility, to recognize the interim nature of extraction, and to mitigate negative impacts to the extent possible. Final rehabilitation shall take surrounding land use and approved land use designations into consideration.” Neither the current or proposed extensions sites are currently designated for recreational uses, and nor are any of the surrounding land uses. The broader rehabilitation plan proposed does not align with the current land use designations or demonstrate compatibility with rural area land use objectives.	Page 20	City of Burlington	The rehabilitation plan includes a proposed landform that is appropriate taking into account surrounding land uses and approved land use designations. Furthermore, the current West Quarry Extension is permitted for recreational uses and includes an active golf course. Other recreational uses in the immediate area include the Bruce Trail and the Mount Nemo Conservation Area. Any future after uses will require an amendment to the Niagara Escarpment Plan and only uses permitted within the applicable designation will be permitted. Nelson has proposed to convey the lands to public ownership to form part of the Niagara Escarpment Parks and Open Spaces. The Niagara Escarpment Plan permits “uses permitted in the Parks and Open Space System Master / Management Plans that are not in conflict with the Niagara Escarpment Plan.” These uses can include recreational uses.	Not resolved.

37.	“Assessment of Impact” should address the following: • There is no evidence produced in support of the statement the resulting loss of 12.7 hectares of productive agricultural lands is considered to be a negligible loss (page 28).	Assessment of Impact Page 28	AgPlan Limited	See response to comments # 6, 17 and 18	Comment noted.
38.	“Assessment of Impact” should address the following: • The section on fragmentation does not discuss fragmentation (page 28).	Assessment of Impact Page 28	AgPlan Limited	The Fragmentation section is in reference to the degree of agricultural fragmentation as a result of the proposal. As such, reference is made to the investment, amount of land taken out of production, and compatibility of the rehabilitated landform.	Comment noted.
39.	“Assessment of Impact” should address the following: • The discussion on air quality (page 29) does not quote information related to the monitoring of contaminants during the lifetime of the current Nelson Aggregate pit. There is no evidence provided based on actual performance of no significant health impacts and the reader is not referred to a document that defines the meaning of “significant”. It should be noted that agriculture itself potentially produces dust, noise, odours, light; can or does contribute to problems with water quality and quantity; and has documented accident rates, and occupational health problems. Given matters such as those described in the previous sentence, there is no discussion about the contribution of agriculture relative to the proposed Nelson Aggregate Expansion in the MHBC AIA. Neither is there a discussion about the combined contribution of the proposed expansion plus the contributions of agriculture.	Assessment of Impact Page 29	AgPlan Limited	The Air Quality assessment assessed five maximum emission operating scenarios, which takes into account the operations at the current quarry. The evaluation of significant health impacts is in accordance with the Ontario Ministry of Environment, Conservation, and Parks Guidelines.	Comment noted.
40.	“Assessment of Impact” should address the following: • The section on hydrogeology (page 30) states that the management of water resources is an important consideration for farm operations particularly for watering field/vegetable crops and hydrating livestock. The irrigation of field crops will be soil dependent and the definition of field crops used in the AIA is not specified. Elsewhere in the report, there is a statement that the lands are not suitable for specialty crops, but they have mentioned vegetables (but not fruit) in relation to irrigation use of water resources. The South Extension lands do have potential for producing specialty crops (fruits and vegetables), and the West Extension will have potential for producing specialty crops assuming that not all the area has been disturbed and/or can be rehabilitated (even though The South and West Extensions are not a specialty crop area). There is no mention of previous water quality and/or quantity complaints related to agricultural use and/or aggregate mining in or around the current quarry. Additionally, there is no discussion concerning whether the complainants were satisfied with mitigation applied. The AIA also indicates there is no evidence of irrigation systems or crops that are dependent on extensive irrigation. This statement in the AIA assumes that agriculture in the area will not change during the time of the extraction and rehabilitation.	Assessment of Impact Page 30	AgPlan Limited	The Hydrogeological assessment concluded that surrounding wells will be protected. Vegetable production was identified in this subsection to highlight the importance of Hydrogeology on potential vegetable production, however as indicated in previous sections of the report, there was no specialty crop or vegetable production identified in the Study Areas. According to the PPS, the definition of specialty crop areas is those areas that are ‘designated using guidelines developed by the Province’ in which specialty crops are predominantly grown, resulting from; soils that have suitability to produce specialty crops, or lands that are subject to special climatic conditions, or a combination of both; Farmers skilled in the production of specialty crops, and; a long term investment of capital. DBH concluded that the south and west extension lands do not meet the criteria for specialty crop soils or climate. Additionally, no specialty crop production was identified in the Study Areas, nor was there any significant long-term investment identified. Lastly, and most importantly, there are no specialty crop areas designated in the Primary or Secondary Area.	Comment noted.

41.	“Assessment of Impact” should address the following: • The section on traffic states it is not anticipated that the truck traffic on the haul route will conflict with agricultural traffic on No. 2 Sideroad. While there is one field access along Guelph Line (between No. 2 Sideroad and 1 Sideroad), Guelph Line is designed with wide shoulders that agricultural traffic can use to move between fields, if needed. This opinion further recognizes that neighbouring property owners have been accustomed to the truck traffic patterns from the existing quarry operation in the area. Furthermore, given the limited operating hours of the aggregate operations it is anticipated that any potential impacts/conflicts with agricultural traffic/machinery would be nominal and only concentrated during planting and harvest periods (early spring/ late fall). There is no evidence provided that the road shoulders are wide enough for the farm machinery used in Halton and/or in Burlington. The reference to impacts/conflicts as “nominal”, because they only occur during planting and harvesting, is specious	Assessment of Impact	AgPlan Limited	As stated in the Transportation subsection, Guelph Line is a major arterial road designed and meant to carry high volumes of heavy and light traffic. Agricultural traffic is not anticipated to be high as it would generally avoid high volume routes and be directed toward local roads.	Comment noted.
42.	“Assessment of Impact” should address the following: • Under “blasting impacts” (page 31) the statement is made that while impacts to water quality and production capacity of groundwater supply wells is a common concern for residents near blasting operations, the report emphasizes that blasting operations do not result in any permanent impact on wells outside of the immediate blast zone. The statement begs the question - what intermittent impacts occur, what are those impacts and what is their frequency and duration, and, who or what is affected?	Assessment of Impact Page 31	AgPlan Limited	The Following excerpt is from the BIA (p.23) *There is an intuitive belief that blasting operations have dramatic and disastrous impacts on residential water wells for large distances around such operations.* *Unfortunately, there is no scientific basis for such claims. Outside of the immediate radius of approximately 20-25 blast hole diameters from a loaded hole, there is no permanent ground displacement. As such, barring blasting activity within several meters of an existing well, the probability of damage to residential wells is essentially non- existent.* *Despite the scientific support for the above conclusion, numerous studies have been performed to verify the validity of this statement. These studies have investigated the effects of blasting on varied well configurations and in varied geological mediums to ensure results could be readily extrapolated to all blasting operations. The conclusion of these studies has confirmed that with the exception of possible temporary increases in turbidity, blasting operations did not result in any permanent impact on wells outside of the immediate blast zone of the blast until vibrations levels reached exceedingly high intensities. Applying universally accepted threshold levels for ground vibrations eliminates the possibility for any long term adverse effects on wells in the vicinity of blasting operations.* *In a study by Froedge (1983), blast vibration levels of up to 32.3mm/s were recorded at the bottom of a shallow well located at a distance of 60 meters (200 feet) from an open pit blast. There was no report of visible damage to the well nor was there any change in the water pumping flow rate. This study concluded that the commonly accepted limit of 50mm/s PPV level is adequate to protect wells from any damage. We reiterate, the current guideline limit for vibrations from quarry and mining operations is 12.5mm/s.* Based on the conclusions presented here from the BIA, there are minimal to no intermittent impacts that will occur as a	Comment noted.

				result of blasting from an agricultural perspective.	
43.	"Assessment of Impact" should address the following: • Under "noise impacts", there is no evidence presented about the efficacy of mitigation applied during the lifetime associated with the current Nelson Aggregate pit. Neither is there a review of complaints received associated with noise. On the other hand, as stated previously, agriculture can be a noisy industry and comparatively speaking, can potentially be more or less noisy than the pit operation depending on several factors. The comparison and additive result of noise is not discussed in the MHBC AIA.	Assessment of Impact	AgPlan Limited	Nelson's current and proposed operation are governed by the MECP noise guideline limits. The Noise Impact Study concluded that under worst-case operating scenarios, with recommended noise control measures, the proposed application will comply with the MECP guideline limits. The Noise Impact Study takes into account current noise levels within the respective Study Area. This would account for surrounding Agricultural Operations, and their noise contribution.	Comment noted.
44.	The "summary of net impacts" (starting on page 32) is limited given questions raised previously in this review. For example, the areas planned as buffers have not been demonstrated to be effective through field study and/or the published literature, and the people affected by the current operation have not been interviewed with respect to their opinion about Nelson's "open-door policy" and its effectiveness (or if they have been interviewed/surveyed, their comments are not in the AIA).	Page 32	AgPlan Limited	Buffers and other impact mitigation measures are recommended on the basis of other technical studies to mitigate impacts on surrounding land uses. Each respective report has demonstrated how mitigation measures are effective in mitigating impacts. It is noted that persons who may have been potentially impacted by current operations have not been interviewed on their opinion of the "Open-door policy" and its effectiveness. From an Agricultural perspective, this policy is intended to help educate surrounding landowners of the operations and rehabilitation. Formal complaints regarding Nelson's operations may still be filed with MNDMNRF.	Comment noted.
45.	Conclusions of Section 6 – Proposed Rehabilitation Plan may require updating as a result of the above NEC Staff comments.	Section 6	Niagara Escarpment Commission	The proposed rehabilitation plan for the proposed Burlington Quarry Extension and Burlington Quarry have been updated and included additional considerations and conditions related to agricultural rehabilitation.	Tab not specified or not attached.
46.	Additional information is required to substantiate these proposed benefits. - Are there known flooding hazards/concerns in this area? - Are the surrounding agricultural operations in need of additional irrigation?	Page 37	City of Burlington	Overall this is not applicable to overall policy framework governing the review of the application. Mineral aggregate operations are permitted in prime agricultural areas on prime agricultural lands. From a policy perspective the proposed quarry is permitted to be located on-site and is required to be designed to minimize impacts on surrounding agricultural resources/ operations.	Comment noted.
47.	On page 37, the AIA opines that this final rehabilitated land-use is compatible with the surrounding agricultural uses and operations and will create landscape diversity. The open-water feature can provide benefits to the agricultural uses in the area through flood attenuation and the storage of fresh water for potential irrigation purposes. The MHBC AIA does not describe the probable use of the rehabilitated lands given human behaviour in areas with open water. There is some probability that the rehabilitated lands will be used for recreation rather than open space uses. Under those circumstances, OMAFRA's MDS Document would characterize the proposed rehabilitated use as type "B" because it would have a higher intensity of recreational use (formerly called active recreational use). Therefore, there is evidence that the proposed after use may be less compatible with agriculture if adjacent uses have or will have livestock production. Additionally, there is no discussion about whether open space uses and/or recreational uses will affect water quality. Neither is there any discussion about whether recreational uses	Page 37	AgPlan Limited	The proposed rehabilitation plan only creates a landform. Any after uses require a future Niagara Escarpment Plan amendment and if applicable consideration of MDS will be considered at that time.	Comment noted.

	such as swimming and the necessity for washroom facilities will affect coliform counts.				
48.	The South Extension does contain soils that would support specialty crops such as apples, sweet corn, garlic, cole crops etc. (and the West Extension will support specialty crops in areas where soil profiles have not been disturbed during the creation and use of the golf course or, could support fruit and vegetable production after rehabilitation).	Page 39 Bullet 2	AgPlan Limited	The DBH soil report concluded that the soils in both extension areas are not suitable for Specialty Crop production. The Extension areas are not within climactic conditions, which are unique to specialty crop areas. As such, the extensions are not mapped as Specialty Crop Areas, nor are they considered Specialty Crop areas under the PPS.	Comment noted.
49.	New agricultural impacts may be introduced by the expansions depending on whether there are changes in technology associated with agriculture and/or aggregate extraction.	Page 39 Bullet 4	AgPlan Limited	Noted – The impact assessment considers operational technology as it currently exists.	Comment noted.
50.	There has been no mapped evidence demonstrating that there are no reasonable alternatives in prime agricultural areas and there may be alternatives which avoid prime agricultural land.	Page 39 Bullet 5	AgPlan Limited	It is noted that there was no map produced to demonstrate no reasonable alternatives. For justification, refer to response to comment # 34.	Refer to JART Comment #34. Comment noted.
51.	There may be impacts to the adjacent agricultural uses or operations due to cumulative impacts.	Page 39 Bullet 8	AgPlan Limited	The impact assessment considers the current operation in conjunction with the proposed extensions. There are no other mineral aggregate operations within the Study Areas to contribute to cumulative impacts.	Comment noted.
52.	The proposed after use does not demonstrate that the agricultural rehabilitation of remaining areas [areas not underwater] is maximized and/or agricultural rehabilitation in the remaining areas will be maximized as a first priority. The presence of open water may result in water-based activities and other recreational uses. These active recreational uses have the potential to be incompatible with agricultural use.	Page 39 Bullet 10	AgPlan Limited	See response to comment # 6, 17 and 18.	Comment noted.
53.	The DBH Addendum concludes that the entire West Extension site (identified in the DBH Addendum as the subject lands) is considered as disturbed and is considered as not rated in the CLI system. On that basis, it can be interpreted that no soils that have been disturbed can be rated using the CLI system. Therefore, following that statement, farmlands that have been land levelled (disturbed) to improve surface drainage, for example, so as to improve crop yields, would not be rated under the CLI system. However, the CLI system states that good soil management practices that are feasible and practical under a largely mechanized system of agriculture are assumed and that soils considered feasible for improvement by drainage, by irrigating, by removing stones, by altering soil structure, or by protecting from overflow, are classified according to their continuing limitations or hazards in use after the improvements have been made. Land leveling can be considered as an improvement rather than an indication of disturbance. Secondly, the PPS (2020) defines an agricultural condition with respect to the rehabilitation of mineral extraction areas found within specialty crop areas and prime agricultural land as needing to result in substantially the same areas and same average soil capability for agriculture are restored. Because former quarries and mined aggregate areas, where extraction has not been completed below the water table, have been disturbed, then, following the conclusion of the DBH Addendum, those former quarries and mined aggregate areas could not be rated in the CLI system. Therefore, the lack of the CLI rating would not allow anyone to establish whether the rehabilitated lands could be and/or had been restored to the same average soil capability as required by the PPS (2020). Does DBH take the view that language in the PPS, related to the	DBH Addendum	AgPlan Limited	Noted. OMAFRA staff have concluded that the current agricultural capability of the soils on the West Extension site are likely not representative of prime agricultural land (CLI 1-3).	The viewpoint of those involved in land rehabilitation often is that lands formerly in agricultural production can be returned to that approximate level of production after aggregate extraction and land rehabilitation. There is nothing in the information provided by Nelson and OMAFRA that demonstrate scientifically that the same, or very similar: • range, diversity, and yield of crops, • inputs (water, fertilizer, farm management) requirements, and • ecological effects; have consistently occurred on lands rehabilitated to an agricultural after-use. Therefore, the proposed agricultural rehabilitation plan (currently a road accessible “island” in a lake) cannot be assessed based on the probability of the same, or very similar, crop diversity and yields, inputs/management, and ecological effects.

	level of acceptable rehabilitation, cannot be reached because the CLI capability classification cannot be applied to disturbed soils?				
54.	DBH Soil Services concludes that the West Extension lands should not be considered as Prime Agricultural Land and should not be considered as part of the Provincial Land Base Prime Agricultural Area mapping. The PPS (2020) definition of Prime Agricultural Area means areas where prime agricultural lands predominate. This includes areas of prime agricultural lands and associated Canada Land Inventory Class 4 through 7 lands, and additional areas where there is a local concentration of farms which exhibit characteristics of ongoing agriculture. Therefore, it can be interpreted that a given map polygon defined as Prime Agricultural Area would need to have more than 50.0% by area of Specialty Crop Area and/or CLI Class 1, 2, and 3 lands as well as associated Class 4 through 7 lands and areas of ongoing agriculture. Given the previous discussion in comments 19 and 53 as well as the definition of a Prime Agricultural Area in the PPS (2020), it is unclear how DBH concluded that the West Extension lands should not be considered as Prime Agricultural Land and should not be considered as part of the Provincial Land Base Prime Agricultural Area mapping. Additional explanation is required in support of the conclusion reached in the DBH Addendum.	DBH Addendum	AgPlan Limited	Noted. OMAFRA staff have concluded that the current agricultural capability of the soils on the West Extension site are likely not representative of prime agricultural land (CLI 1-3).	Comment noted.

Proposed Burlington Quarry Expansion
JART COMMENT SUMMARY TABLE – Air Quality

Please accept the following as feedback from the Burlington Quarry Joint Agency Review Team (JART). Fully addressing each comment below will help expedite the potential for resolutions of the consolidated JART objections and individual agency objections. **Additional, new comments may be provided once a response has been prepared to the comments raised below and additional information provided**.

	JART Comments (February 2021)	Reference	Source of Comment	Applicant Response (July 2021)	JART Response (January 2022)	Applicant Response (January 2022)	JART Response (June 2023)
Report/Date: Air Quality Study, March 2020			**Author: BCX Environmental Consulting**				
1.	Their analysis limited the computed air quality impacts by breaking the project up into smaller segments (phases) which were each evaluated separately. The BCX report should clearly indicate whether any of the phases will overlap.	General	Gray Sky Solutions	No, the phases will not overlap.	Comment addressed.		
2.	The dispersion model receptors were restricted to areas immediately surrounding the facility and did not include any receptors at distances further away from the facility, including areas of larger population (and exposure). Most of the larger computed impacts were fairly close to the sources, however it would be useful to also have estimated impacts in a larger geographical area. The modelled receptors should include a broader geographic area, extending to at least 5.0 kilometers from the facility.	General	Gray Sky Solutions	Typically the study area for an air quality study for an aggregate quarry is 1km because the highest concentrations fall close to the property line. For this study, BCX conservatively chose approximately a 3km study area to demonstrate to residents in the vicinity of the quarry that air quality criteria will be met. Within the 3km, the highest concentrations occur at the closer receptors to the quarry and are below the air quality criteria. At 5km the concentrations are lower and will still be below the air quality criteria. At 5km, the concentrations are close to background levels. (i.e. the quarry has little or no impact on air quality at 5km) The air quality study is not intended to be a risk assessment/population exposure study.	Comment addressed.		

3.	The analysis appears to include a fairly thorough inventory of all the various emission- generating activities in each phase, however they relied almost entirely on US EPA AP-42 emission factors, many of which have very low data quality ratings, and some of which are not directly applicable to the source in question at the proposed facility. The AP-42 document makes it very clear that these lower rated emission factors should only be used as a last resort, and it is highly recommended that source-specific emission factors should be sought, either from source testing at the facility, or from directly applicable source tests from similar nearby sources. Although there may not be are any better (textbook) or more recent data sources for some of these activities, many of the AP-42 emission factors were obtained from very old sources (over 40 years old) and are only marginally related to the activities at the proposed Burlington site. Using such low quality emission factors will likely result in significantly large uncertainties in the modeled air quality impacts. A range of potential emission levels (and exposures) should be developed based on lower and upper bound emissions factors (which generally exist in AP-42 and its supporting documents). A careful review of each of the emissions factors used in the BCX analysis should be conducted to determine those emission factors that are not representative of actual emission levels at the proposed site, and the potential errors (and possible underprediction) due to the use of the emission factors to estimate emission levels. Source testing of existing operations at the facility should also be conducted where applicable. The SO_2 emission factors that were used for diesel-fired engines are rated (in AP-42) as quality D (marginal), and the B(a)P emissions factors for diesel engines are rated E (marginal). The emission factors for Sand and Gravel processing were obtained from AP-42, Section 11.19.2 (mistakenly quoted in BCX Appendix B as Section 11.9.2), where it is stated that "The emission factors for industrial sand storage and screening presented in Table 11.19.1-1 are not recommended as surrogates for construction sand and gravel processing, because they are based on emissions from dried sand and may result in overestimates of emissions from those sources. Construction sand and gravel are processed at much higher moisture contents." PM emission factors for controlled tertiary crushing and controlled and uncontrolled screening were taken from AP-42, Section 11.19.2, and are all rated E (marginal). As stated in AP-42 (Section 11.19.2.2), "Factors affecting emissions from either source category [stone quarrying or processing] include the stone size distribution and the surface moisture content of the stone processed, the process throughput rate, the type of equipment and operating practices used, and topographical and climatic factors." PM emission factors for conveyor transfers and rock truck unloading were also taken from AP-42 (Section 11.19.2) and are all rated E (marginal). Estimates of emission rates using emission factors from AP-42 that are rated D or E cannot be considered reliable for the Burlington Quarry facility.	General	Gray Sky Solutions	US EPA AP-42 emission factors are standardly accepted by the Ontario Ministry of the Environment, Conservation and Parks (Ministry) for air quality studies and Environmental Compliance Approvals (ECAs) for aggregate sites. The key to using these emission factors is to ensure that the emission scenarios assessed are conservative (i.e. they represent maximum emissions scenarios). For this study, the following conservative assumptions were made: 1. All operations were assumed to occur simultaneously at their maximum rates unless specifically limited. In reality, this will not occur. 2. Truck volumes used were very conservative. 3. Assumed all NOx emissions are converted to NO2 (i.e. the ozone limiting methods (OLM) were not used). 4. Wet/dry depletion options were not used in modelling. 5. Met anomalies were not removed as is permitted by the Ministry. 6. Conservative background concentrations were added to the maximum concentrations at sensitive receptors. Based on this, emission estimates are expected to be conservative.	The US EPA AP-42 emissions factors may, in fact, be accepted by the Ontario Ministry of the Environment, Conservation and Parks (Ministry), however that doesn't mean that the emission factors are applicable to this quarry, or even marginally accurate. Within the documentation (appendices) provided in AP-42 is important information regarding the sources of the data that were used to develop the emissions factors, including ranges of values that were obtained from source tests at various sources. These data could be used to evaluate the potential range of emission factors that may be appropriate for the quarry and could therefore be used to develop an analysis of the uncertainty of the emissions factors and the resulting uncertainty of the modeling results (which may be considerable) that were obtained using the AP-42 emissions factors. An uncertainty analysis would provide a range of potential air quality concentration impacts, rather than a single estimate of the impacts. AP-42 clearly states that those emissions factors that are rated as marginal in quality should only be used as a last resort, if no local or site- specific data are available. The quarry has been operating for a number of years, and site-specific source test data could have easily been obtained that would provide better emission factor estimates than those from AP- 42. The list of reasons that were provided that purportedly provide evidence that the estimated air quality impacts were "conservative" do not include any consideration of the emission factors that are the most important component of the emissions estimates.	The emission factors used in the AQS contains a range of data quality ratings (above average, average, marginal) and not, as implied only marginal. BCX analysed the contribution of various data quality rated emission groups to the receptor with the maximum PM2.5 (24hr avg) concentration. The contribution of the marginal data quality group is approximately 38%. If the contribution of the marginal data quality group is conservatively doubled, the PM2.5 (24hr avg) modelling result is still predicted to be below the PM2.5 (24hr avg) criterion. Please see attached sheets for details. While it may be feasible to obtain source test data for some emission sources such as stacks, source testing of fugitive sources such as crushers is not a simple task as implied. Further, in Ontario, source testing that has not been Ministry approved is rated Marginal or Uncertain. Obtaining Ministry approved data is significant undertaking and the Ministry only uses their resources for regulatory compliance purposes (i.e. not for general Air Quality Studies). As previously stated, the emission estimates were conservatively developed and are consistent with normal practices for both general Air Quality Studies and regulatory compliance assessments in Ontario.	BCX examined the emission factors that were used to develop emission rate estimates which had marginal ratings. They stated that the contribution of the sources in which marginal emission factors were used accounted for 38% of the total modeled $PM_{2.5}$ concentration (maximum 24-hour average). An attached table shows their calculation in which they identified three sources for which marginal emission factors were used (PTOS_QA, PTOS_QE, and BH-HMA). The table shows the modeled maximum 24-hour $PM_{2.5}$ concentration at the maximum impacted receptor location. From their modeling files, I was able to determine that the modeled maximum 24-hour $PM_{2.5}$ concentration (3.63 µg/m^3) occurred at receptor (UTM: 590803.61, 4806333.49) on December 2, 2017 (using the variable hourly emissions modeling scenario for morning truck trip emissions from sources PTOS_QAV and PTOS_QEV, identified as Scenario 2 in the discussion of Issue No. 7, below). The table shows the maximum 24-hour $PM_{2.5}$ concentration and the data quality rating used for nine modeled sources, however it is noted that the maximum concentration for each source may not (and, in fact, does not) occur on the same day (nor at the same location) as the modeled maximum 24-hour average $PM_{2.5}$ concentration for all sources. The maximum 24-hour average $PM_{2.5}$ concentrations for the nine modeled sources do not match the provided modeling output file. The source PTOSHMAV was included in their list (with a non-zero $PM_{2.5}$ contribution) despite the fact that emissions for that source were modeled with zero emissions. In addition, three of the modeled POINT sources (GEN1_QEX, GEN2_QEX, and GEN_HMA), which had non-zero modeled emissions, were not included in their list of sources (and no information on the data quality for these sources is included). I recalculated the fractional contribution from the sources with marginally rated emission factors to the maximum 24-hour $PM_{2.5}$ concentration using the modeling results (from Scenario 2, as described in Issue No. 7, below), as

4.	Although the estimated (modeled) levels of particulate matter (PM) were below acceptable “air quality criteria”, there are still potential health effects (mortality and morbidity risk) associated with the emitted PM and these additional risks should be evaluated.	General	Gray Sky Solutions	This air quality study (AQS) relies on air quality standards set by the province or Environment Canada where provincial standards are not available. This AQS considers the health effects of PM by comparing PM2.5 modelled concentrations against the Canadian Ambient Air Quality Standards (CAAQS). The PM2.5 standards have been set by the Canadian Council of Ministers of the Environment (CCME) to be protective of health. The assessment very conservatively compares the maximum 24-hour and annual concentrations to the CAAQS which are in fact based on a 3-year average of the annual 98th percentile of the daily 24-hour average concentrations and 3-year average of the annual average of the daily 24- hour average concentrations, respectively. The maximum concentrations of PM2.5 at the property line and at all sensitive receptors are below the CAAQS. The AQS is not intended to be a risk assessment.	Comment addressed.		

5.	The background level for B(a)P was obtained from monitoring data collected at Newmarket and Simcoe (Barrie), which are located 78.0 kilometres and 109.0 kilometres, respectively, from the Nelson quarry, and are likely not representative of the air quality in the vicinity of the quarry. Further analysis of these data needs to be performed to justify their use in establishing background B(a)P levels, including potentially collecting local B(a)P data to determine background B(a)P levels.	General	Gray Sky Solutions	The background level for B(a)P was obtained from the Simcoe National Air Pollution Surveillance (NAPS) ambient monitoring station located in the township of Simcoe (not Barrie) approximately 65km southwest of the Nelson Quarry. This station is located in a reasonably similar rural/suburban location to the site. Air quality studies (AQS) in Ontario rely on background data from ambient stations and this AQS follows the accepted approach in Ontario. B(a)P data is also available from one closer ambient monitoring station, the Toronto West MECP ambient monitoring station (approximately 50km away). This station is within the City of Toronto adjacent to a major highway. A comparison of the B(a)P data from both stations shows that the background levels are similar. The background chosen is, therefore, considered representative and fairly consistent across Ontario.	Comment addressed.		

6.	The meteorological preprocessor for the AERMOD model (AERMET) has been updated (in 2011) to include a separate processing tool (AERMINUTE) that is recommended to be used to account for calm wind speeds when using hourly wind data from nearby airports. The BCX report should indicate where the meteorological data were obtained (and assess whether it is close enough to reliably represent conditions at the Burlington site), and whether one-minute (ASOS) wind data were used to reduce the number of calm winds (using AERMINUTE). The AERMOD computer files that were received do not include the AERMET processing files.	General	Gray Sky Solutions	The regulatory body, Ontario Ministry of the Environment, Conservation and Parks (Ministry) processed the surface and upper meteorological data using AERMET to develop an AERMOD ready site- specific met set to be used for this site. The Ministry has their own procedure to treat calm hours from the met data set. The Ministry does not include the AERMET processing files when they provide the AERMOD ready site- specific met set.	Comment addressed.		
7.	The BCX modeling report indicates that the traffic was represented in the modeling using a “typical shipping” assumption. However the traffic report for the proposed quarry extension (Paradigm Transportation Solutions Limited, report dated February 2020) indicates that “the site’s the weekday AM peak hour truck generation is forecast to be 111 truck trips…”, which is significantly greater than the average daily truck traffic and would therefore generate much higher emissions during morning hours. The modeling therefore needs to include a non-uniform diurnal distribution of traffic emissions that includes the peak AM traffic density.	General	Gray Sky Solutions	Per the Traffic Study (Feb 2020), 111 truck trips means 56 inbound and 55 outbound trips (i.e. one-way trips). Trucks/day or trucks/hr in the Air Quality Study (AQS) means a two-way round trip of those trucks for the purposes of emission estimates. 111 truck trips will be equivalent to 56 trucks/hr in the AQS. Using a 24-hr average emission rate is an acceptable method per the Ministry guidance documents for contaminants with 24-hr average standards such as PM2.5. For this AQS, the daily truck emission rate (daily truck traffic emissions over 24 hrs is assumed to occur equally over 24 hrs. Since, dispersion is typically poor at night and truck traffic will be minimal at night, this approach will result in a similar or more conservative 24-hr average concentration than if a non-uniform diurnal distribution of traffic emissions was assumed. Furthermore, daily trucks entering the site assumed in the air quality study was 469 to 681(trucks/day depending on the month), which is very conservative compared to the approximate equivalent of 400 trucks per day in the traffic study.	It is a fairly simple task to include a diurnal profile of emissions in the AERMOD model to address the non- uniform distributions of hourly truck traffic. Although (as the MHBC response states) dispersion is typically poor at night (resulting in higher concentration impacts per truck trip for those hours), dispersion is also often poor in the early morning hours which would potentially increase the impacts significantly during those hours when peak traffic densities are expected to occur. The modeling needs to be revised to account for the peak hourly truck traffic (111 trips per hour).	As requested, the maximum hourly trucking of 112 truck trips per hour were updated in the calculation sheets. BCX confirmed with the Traffic Study consultant that the AM Peak hour does not mean maximum trucks entering the quarry at that specific hour. The AM Peak Hour per the traffic study means the maximum car and trucks on the public road. (e.g. rush hour traffic) The maximum hourly trucking distribution is attached. Maximum hourly trucks actually occur in the 8am to 3pm time range. Notwithstanding, BCX tested the sensitivity of trucking variable emissions for PM2.5 (24hr) in AERMOD for two scenarios: 1. Peak hourly traffic was very conservatively concentrated into morning hours as requested. 2. Actual expected truck distribution per hour as provided in Appendix B of the Traffic Study. Modelling results PM2.5 (24hr) shows that there would be negligible change and that the AQS conclusions remain unchanged (i.e. PM2.5 24-hr avg concentrations remain below the criteria)	Examination of the AERMOD modeling input files shows the two different scenarios that were run by BCX to include the diurnal profile of trucking emissions: Scenario 1, using constant (maximum hourly) emissions during all morning hours, and Scenario 2, using expected “actual” emissions for each hour (as provided in Appendix B of the Traffic Study). In the latest BCX response, there is an attached table showing the factors (multipliers) that were used to scale the hourly emissions for Scenario 1 (which match the factors used in the AERMOD input control file for sources PTOS_QAV and PTOS_QEV). A factor of 1.0 was used for hours 6 through 12 representing 112 truck trips for each hour, and a factor of 0.082 was used for hour 13, which was obtained by dividing the 70 truck trips for that hour by 854 (total daily truck trips). The hour 13 multiplier appears to be incorrect; if the truck trips during that hour were 70, the hourly emissions scaling factor should be 70/112 = 0.625 (not 0.082). The 24 hourly emission scaling factors used in the

				The AQS assumed for contaminants with 1-hr average standards (e.g. Nitrogen Dioxide (NO2)), an hourly truck rate of 67 to 84 trucks/hour (depending on month). The AQS 67 to 84 trucks/hour is equivalent to 67x2=134 to 84x2=168 truck trips in the Traffic Study. The hourly truck number used for the AQS is much higher than the 111 truck trips (peak hour) in the Traffic Study. The AQS did not use a "typical shipping" assumption and used a very conservative worst case shipping assumption. BCX worked in collaboration with Paradigm Transportation Solutions Limited and was aware of the conservative AQS truck assumptions compared to the traffic study. BCX purposely kept the theoretical worst case assumptions to be conservative.		Please see attached sheets and modelling file for details. As explained in the previous BCX response, contaminants with 1-hr average standards (e.g. Nitrogen Dioxide (NO2)) have already been modelled conservatively using more than the peak hourly traffic trips (>111) and assuming the peak hour can occur any hour in the 24 hour day. Per the Traffic Study, peak traffic counts are expected in the time range of 8am to 3pm and would not be occurring every single hour of the day	modeling for sources PTOS_QAV and PTOS_QEV were: **Scenario 1**: 0.0 0.0 0.0 0.0 0.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 0.082 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 **Scenario 2**: 0.0 0.0 0.0 0.0 0.0 0.0 0.4 0.6 0.98 1.0 0.96 0.88 0.85 0.94 0.9 0.67 0.35 0.33 0.02 0.0 0.02 0.0 0.0 0.0 There is also an attached table for Scenario 2, in which the hourly distribution of truck trips is shown assuming a daily maximum of 427 truck trips (according to Appendix B of the Traffic Study). The emission scaling factors, however, are computed based on the maximum hourly truck trips (during hour 10) being equal to 112 trips/hour. The daily (24 hour) totals of the modeled daily emissions scaling factors are **7.082** for Scenario 1 and **8.900** for Scenario 2. This implies that the modeled total daily truck trips for Scenario 2 is 1,073 truck trips (not 427). Other than the hourly emission factors, the model inputs were identical between Scenario 1 and Scenario 2: both had the same source parameters and emission rates for seven (non-zero) open pit sources and four point sources, identical building downwash parameters for the four point sources, identical wind speed emissions scaling for the two PTDR open pit sources (PTDR_HMA and PTD_QE), identical monthly emissions scaling (January through March had zero emissions for sources PTOS_HMA, BH_HMA, and GEN_HMA), the same five-year meteorological data (2014-2018), and the same

set of receptor locations. The locations of the 11 modeled sources and 323 modeled receptors are shown in Figure 1, below. The spatial distribution of receptor locations appears to adequately capture peak concentration impacts.

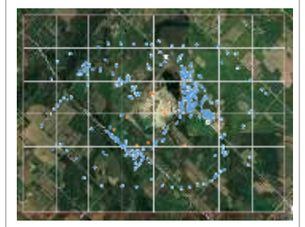

Figure 1. Modeled source locations (red) and receptor locations (blue)

The maximum modeled hourly total $PM_{2.5}$ emissions (for all sources) for both modeled scenarios is 4.19 lb/hour.[1] Considering (1) the hourly wind speeds during the peak modeled day (December 2, 2017) for sources PTDR_HMA and PTDR_QE, and (2) the diurnal scaling factors for sources PTOS_QAV and PTOS_QEV, the modeled average hourly $PM_{2.5}$ emission rate during the peak modeled day was 3.52 lb/hour for Scenario 1, and 3.56 lb/hour for Scenario 2. The modeled maximum 24-hour average $PM_{2.5}$ concentration for Scenario 1 (constant hourly morning emissions) was 4.33 µg/m^3. The modeled maximum 24-hour average $PM_{2.5}$ concentration for Scenario 2 ("actual" emissions across 14 hours each day) was 3.63 µg/m^3. Scenario 2 had higher overall daily emissions than Scenario 1, however the modeled

[1] The maximum hourly emissions rate assumes the highest wind speed category. Emission rates for two of the modeled sources (PTDR_HMA and PTDR_QE) were adjusted downward within AERMOD based on the hourly wind speed. The emissions scaling factors were 0.04 for wind speeds between 0.0 and 1.54 m/s, 0.10 for wind speeds between 1.55 and 3.09 m/s, .019 between 3.10 and 5.14 m/s, 0.35 between 5.15 and 8.23 m/s, 0.50 between 8.24 and 10.80 m/s, and 1.00 for wind speeds above 10.80 m/s.

							maximum 24-hour average $PM_{2.5}$ concentration for Scenario 1 was 19% higher than for Scenario 2. This is due to the higher emissions for Scenario 1 that occur during the early morning hours when dispersion tends to be lower (causing higher downwind concentrations). The background 24-hour $PM_{2.5}$ concentration used by BCX was 12.04 µg/m^3 which brings the total $PM_{2.5}$ concentration to 16.37 µg/m^3 for Scenario 1 and 15.67 µg/m^3 for Scenario 2, which are both under the criteria (standard) of 27 µg/m^3. I re-ran the AERMOD model for Scenario 1, with the hour 13 scaling factor adjusted to account for the apparent error, as described above (the hour 13 multiplier was changed from 0.082 to 0.625). As expected, adjusting the minor error barely changed the modeling results, increasing the modeled maximum 24-hour average $PM_{2.5}$ concentration from 4.332 µg/m^3 to 4.339 µg/m^3. The modeled maximum 24-hour average PM concentration was 56.5 µg/m^3 for Scenario 1 and 45.4 µg/m^3 for Scenario 2. When added to the assumed background concentration (48.17), the total PM was 104.7 µg/m^3 for Scenario 1 and 93.57 for Scenario 2. Although these modeled total PM concentrations are both under the criteria (standard), the Scenario 1 results are 87% of the standard level, which represents a significant modeled impact

Proposed Burlington Quarry Expansion
JART COMMENT SUMMARY TABLE – Archaeology

Please accept the following as feedback from the Burlington Quarry Joint Agency Review Team (JART). Fully addressing each comment below will help expedite the potential for resolutions of the consolidated JART objections and individual agency objections. **Additional, new comments may be provided once a response has been prepared to the comments raised below and additional information provided**.

	JART Comments (January 2021)	Reference	Source of Comment	Applicant Response (June 2021)	JART Response (December 2021)	Applicant Response (June 2022)	JART Response (June 2023)
1.	The 2020 Stage 1-2 Archaeological Assessment of the West Extension lands is an interim report. Stage 2 fieldwork and reporting has not been completed for the entirety of the study area and is required. The Golder Report identifies approximately 11.1 ha of lands associated with the golf course lands that require a Stage 2 Archaeological Assessment. What is the status of the Stage 2 Archaeological Assessment?	General	Addressed by September 15, 2020 Submission	Stage 2 archaeological assessment was completed for the outstanding 11.1 ha of land. See Stage 1-2 archaeological assessment report dated 15 September 2020. See attached clearance letter from Ministry of Heritage, Sport, Tourism and Cultural Industries dated May 14, 2021 confirming the Province has reviewed the archaeological assessment and have no further archaeological concern.	MHSTCI is not the approval authority, and the attached letter dated May 14, 2021, does not comprise documentation that the licensing requirements of the subject reports have been met. The letter of review and entry into the Ontario Public Register of Archaeological Reports from the Archaeological Review Officer should be attached for the consideration of the NEC and other JART approval authorities.	As requested attached as **Tab 1**, please find the letter from MHSTCI, Archaeology Review Officer, dated February 4, 2021 confirming review and entry into the Ontario Public Register of Archaeological Reports.	These comments have been addressed.
2.	The Interim Stage 1-2 AA fails to take into account the study area's location on the Mount Nemo Plateau and incorrectly states the study area's location in relation to the Escarpment.	General	LHC	Data related to the West Extension Lands 'proximity to physiographic features was based and consistent with geoscience data provided through the Ministry of Energy, Northern Development and Mines (https://www.mndm.gov.on.ca/en/mines-and-minerals/applications/ogsearth).	This comment has been addressed.		
3.	It is unclear why the earlier archaeological assessments undertaken for the South Extension Lands were not reviewed as part of the assessment and why, although more than 300 m from the current West Extension Lands study area, the previously identified sites were not considered to be indicators of archaeological potential, given the setting and their likely relevance to the archaeological potential of the West Extension Lands.	General	LHC	Per Section 1.1 of the Ministry of Heritage, Sport, Tourism, and Culture Industries' (MHSTCI) 2011 *Standards and Guidelines for Consultant Archaeologists*, previous archaeological assessments within a radius of 50 m around the project limits are required to be reviewed. The South Extension Lands are greater than 50 m from the West Extension Lands limits. Section 1.3.1 and 1.4 of the MTSTCI (2011), state that previously registered archaeological sites within 300 m are considered features of archaeological potential. The sites within the South Extension Lands are greater than 300 m, and, therefore, do not contribute to the archaeological potential of the West Extension Lands.	This comment has been addressed.		

4.	The descriptions of AiGx-238 and AiGx-239 (Table 2) do not correspond with their descriptions in the Stage 4 AA prepared by Archaeologix in 2004. Notwithstanding these omissions, the identification of areas of archaeological potential have captured all undisturbed lands within the study area and the report appears to conform with the *Standards and Guidelines for Consultant Archaeologists* (S&Gs). It should be stressed that the Interim Stage 1-2 AA was required prior to Stage 2 AA fieldwork being under taken on 11.1 hectares of the Licence Boundary area along the western boundary of the West Extension Lands (see attached Map 5). Stage 2 fieldwork is still outstanding for this portion of the West Extension Land sand the entire study area has not been cleared of further archaeological concern (This is noted in the report).	General	LHC	The description provided of AiGx-238 and AiGx-239 are consistent with the data provided within the MHSTCI archaeological sites database. Per Section 1.1 of the MHSTCI (2011), the background study must include research information from the following source: • The most up-to-date listing of sites from the MHSTCI's archaeological sites database for a radius of 1 km around the property. Stage 2 archaeological assessment was completed for the outstanding 11.1ha of land. See Stage 1-2 archaeological assessment report dated 15 September 2020.	This comment has been addressed.		
5	The 2003 Stage 1, 2 & 3 AA predates the S&Gs.	General	LHC	The South Quarry Extension archaeological assessments were reviewed by the Ministry of Culture and in a letter dated November 19, 2004 the Ministry of Culture, asper	This comment has been addressed.		
6.	Similar to the 2020 Interim Stage 1-2 AA, the 2003 Stages 1, 2&3 AA does not adequately address the setting of the study area nor does it provide a robust pre-contact or historical context.	General	LHC	Section 48 (1) of the Ontario Heritage Act and Ontario Regulation 170/4, confirmed that they had no further concerns for the archeological site documented within the subject property. In February 2009, JART accepted the sign off by the Ministry of Culture with respect to the archaeological investigation. See attached excerpt from the February 2009 JART Report.	This comment has been addressed.		
7.	Notwithstanding this, the Stage 1 findings are consistent with the current requirements and resulted in Stage 2 survey (test pits at 5-meter intervals) and pedestrian survey of the entirety of the study area. Stage 2 fieldwork methodologies and recommendations, similarly, appear to be generally	General	LHC		This comment has been addressed.		
8.	The Stage 3 AA fieldwork methodology, although consistent with standard practices at the time, does not conform to Section 3.2.3, Standard 1 (Table 3.1) the S&Gs; however, because all three of the registered sites underwent Stage 4 AA, this would not have resulted in a different outcome under the current S&Gs. The boundaries of the Stage 3 excavation of all three sites are consistent with the current	General	LHC		This comment has been addressed.		

9.	The Stage 4 AA documents the full excavation and documentation of registered sites AiGx-238, AiGx- 239, and AiGx-240. The Stage 4 AA report does not appear to be the most up to date version of the report and cites an incorrect "CIF" number on the title page. A search through the MHSTCI Past Portal database identified a 2005 report - *A.A. (Stage 4), Nelson Aggregate Quarry Expansion, Lot 17 & 18, Con. 2 NDS, Geo. Twp. of Nelson, City of Burlington, R.M of Halton, Ontario* under the Project Information Number (PIF) P001- 160. It is likely that the report includes revisions or additional information requested by the MHSTCI, at the time of their review. As such, the 2005 Stage 4 AA should be submitted as part of the application. As a general note, no Indigenous engagement appears to have been undertaken as part of the Stage 3 or 4 assessment of the cultural heritage value or interest of AiGx-238, AiGx-239, and AiGx-240.	General	LHC	See response above.	This comment has been addressed.		
10	The area is identified as being within historic Anishnaabe and Haudenosaunee territory. Were indigenous communities consulted during the undertaking of any of the archaeological assessments and reviews?	General	Niagara Escarpment Commission n	In 2004, consultation with indigenous communities was not undertaken as part of the archaeological assessment. It is our understanding that during the review of the previous application MNRF conducted First Nation circulation and to our knowledge no concerns were identified. Despite this, during the current application, Nelson did conduct indigenous consultation and the entire application package including the August 2004 Stage 4 report was circulated and both Six Nations and Mississauga's of the Credit First Nation have confirmed in writing to Nelson that they have no outstanding concerns with the west and south extension applications. See attached correspondence from Six Nations and Mississauga's of the Credit First Nation.	MNRF circulation associated with a prior application does not preempt the need for First Nations engagement for a new application. First Nations engagement in the archaeology context is scoped to archaeological and not Treaty or Land Claim interests. Clarification on whether comment from the Haudenosaunee/Six Nations Longhouse Council and Huron-Wendat has been sought may confirm that this archaeology licensing criterion has been met.	As noted in our previous response, NDMNRF requested that Nelson circulate Six Nations and Mississauga's of the Credit First Nation on the review of the Burlington Quarry Extension application. This circulation included the entire application package which included the August 2004, Stage 4 report. Based on this engagement both Six Nations and Mississauga's of the Credit First Nation have confirmed they have no outstanding concerns with the application. Ultimately the requirement for the Duty to Consult is the responsibility of the Province and Nelson has completed the circulation requested by the Province.	These comments have been addressed.

11.	The following provides a summary of the key findings related to deficiencies with theStage1-2 Archaeological Assessment, prepared by Golder Associates Ltd.(Golder) datedSeptember2020(herein the Stage 1-2 AA). a) The Interim Stage 1-2 AA fails to take into account the study area's location on the Mount Nemo Plateau and incorrectly states the study area's location in relation to the Escarpment (see Section 1.4.2). b) It unclear why the earlier archaeological assessments undertaken for the South Extension Lands were not reviewed as part of the assessment and why, although more than 300m from the current West Extension Lands study area, the previously identified sites were not considered to be indicators of archaeological potential, given the setting and their likely relevance to the archaeological potential of the West Extension Lands. c) The descriptions of AiGx-238 and AiGx-239 (Table 3) do not correspond with their descriptions in the Stage 4 AA prepared by Archaeologix in 2004. The identification of areas of archaeological potential appears to have captured all undisturbed lands within the study area in conformance with the *Standards and Guidelines for Consultant Archaeologists* (S&Gs). The Stage 1-2 AA resulted in the identification of one (1) Euro-Canadian historical archaeological site dating from circa 1850s to the early 20th century. This site has been registered as Inglehart-Harbottle and assigned the Borden number AiGx-462. A total of 1,074 artifacts were recovered from 18 positive test pits (seven of these being intensified pits at 2.5 m intervals around one of the positive test pits) and one test unit. The positive test pits were distributed over an area measuring approximately 40 m (north-south) by 20 m (east-west). Analysis of the assemblage dated four of the artifacts to the 20th century and a total of 27 artifacts were faunal material.	General	LHC	a.) See response to Item 2. b.) See response to Item 3. c.) See response to Item 4.	These comments have been addressed.		

	The Stage 1-2 AA applies the MHSTCI's 2014 Rural Historical Farmsteads bulletin (the bulletin) to its determination of the Cultural Heritage Value or Interest (CHVI) of the site, recommending no Stage 3 AA because: approximately 33% of the site dates to before 1870; the site have been continuously occupied since c.1850 (the historical background information presented in Section 4.4.1 of the Stage 1- 2 AA dates the earliest occupation to 1844); additional historical research was presented in the Stage 1- 2 AA; and, the survey was intensified through the excavation of a test unit and eight additional test pits at 2.5 m intervals around one of the positive test pits. Based on our review, LHC identified the following concerns with the report and its findings:						
12.	1. Approximately 33% of the site dates before 1870 (Executive Summary and Section 4.5 Conclusions). The Stage 1-2 AA determines that no Stage 3 AA is required because less than 80% of the assemblage dates to before 1870 and states that 33% of the site dates to pre-1870. Although several diagnostic artifacts and artifact types and their dates of manufacture or popularity are discussed in Section 3.2 of the Stage 1-2 AA, very few examples are securely dateable and the analysis that resulted in the determination that approximately 33% of the assemblage is pre-1870 is not presented. Per Section 6.1 of the bulletin some examples of characteristics of an assemblage that might support the argument that the site is of no further CHVI include: • Many of the artifacts in the assemblage could be dated to either the 19th or 20th century, but there are only a few artifacts which can be clearly attributed to only the early to mid-19th century • The artifacts are all or mostly from one item (e.g., 20 fragments from one vessel) • The artifacts datable to the early to mid-19th century are widely spatially dispersed within a larger distribution of later-dated artifacts without evidence of a cluster of the earlier-dated 19th century artifacts within the overall distribution • The earlier-dated 19th century artifacts form a very small proportion of the total assemblage	General	LHC	The report states, "less than 80% of the site's occupation dates to before 1870 (approximately 33% of the site dates before 1870). This data was determined based on archival data and the Stage 2 artifact collection. The artifact collection alone was not considered, and occupational dates can often be well determined based on the archival data. The artifact collection dates from the mid-19th century to the early 20th century; therefore, the site can be attributed to the Inglehart, Thomas, Fraser, Eaton, and Harbottle families. The Inglehart family occupied the property from 1844-1876, Thomas family from 1876-1884, Fraser family from 1884-1888, Eaton family from 1888-1910, and the Harbottle family from 1910-1961. Based on the artifact collection (mid-19th century to early 20th century) and settlement of the property by the aforementioned families associated with these artifacts (1844 to 1961), it was determined that less than 80% of the site's occupation dates to before 1870. The approximate 33% of the site's occupational date dating to before 1870 was determined based on an 1844 (Inglehart settlement date) to c.1920s (approximate terminal date of artifacts) timeframe. No early concentrations (pre-1870s) of artifacts were encountered.	This comment has been addressed.		

13.	2. The site has no further cultural heritage value or interest. Per the bulletin, The ministry expects the available evidence to be incorporated into the report to make a recommendation of no further CHVI. This includes: • an analysis of the complete artifact assemblage (see comment 1, above) • all available historical documentation • any information from extant built heritage • the local and regional context • any information regarding site integrity Additional information is missing from the analysis presented in the Stage 1-2 AA which would support the finding that AjGx- 462 The conclusions further state that "the Inglehart family is not affiliated with the early settlement of Nelson Township"; however, this assertation has been made without taking into account the historical context of the site with respect to its location on the Mount Nemo Plateau. The local context has thus not been taken into consideration in the determination of the site's CHVI. Furthermore, the site's integrity and its dense distribution of the artifacts have not been addressed in the analysis or recommendations, nor does the Stage 1-2 AA make any reference to how the location of the test unit was selected or how the boundaries of the site were determined. With respect to the distribution of artifacts, supplemental documentation was not submitted with the Stage 1-2 AA, so test pit locations cannot be cross-referenced with counts from the catalogue. It is, therefore, unclear why this specific positive test pit was selected for intensification and test unit excavation and not one or more of the other ten positive test pits, as this is not addressed in Section 2.0 Field Methods. Although it is not necessary to excavate more than one test unit where multiple positive test pits are encountered, the decision to excavate only one test unit over one positive test pit should be justified in the Stage 1-2 AA. Per the bulletin, Test unit placement should be determined by: • the distribution of artifacts including concentrations of earlier dating artifacts or activity areas; • test pits that provide information about site integrity; and, • The most productive test pits.	General	LHC	Section 1.3.4.1 of the report provides local context to the settlement of Nelson Township. The initial Euro-Canadian settlement of the Township was in 1800 by the Bates family, and the next influx of settlers arrived in 1807. By 1817, 476 inhabitants and 68 houses, two grist mills, and three sawmills were located in the Township. The site can be attributed to the Inglehart, Thomas, Fraser, Eaton, and Harbottle families. The Inglehart family occupied the property from 1844-1876, Thomas family from 1876-1884, Fraser family from 1884-1888, Eaton family from 1888-1910, and the Harbottle family from 1910-1961. Initial land early settlement of Nelson Township happened in 1800. The Inglehart family, the earliest occupants of the AiGx-462 site, settled the property approximately 44 years after the early settlement of the Township. Therefore, the site is not affiliated with the early settlement of the Township. Based on the Stage 2 assessment data, the site's integrity (i.e., its cultural layer) appears to remain intact. Artifacts were disturbed over an area measuring 40m by 20m, and no early concentrations were identified. The location of the test unit was selected per MHSTCI (2011), *Section 2.1.3, Standard 2, Option A*. There are no standards within the MHSTCI (2011) that requires providing a rational for how the location of the test unit was selected. Nevertheless, the test unit location was selected based on a combination of criterions including, artifact concentration, artifact dates, activities areas, positive test pit distribution, artifact type, and stratigraphy. The site's Stage 2 boundary was determined per *Section 2.1.3* of the MHSTCI (2011). The positive test pits were disturbed over an area measuring 40m by 20m. See Section 2.2 and Section 3.2 of the report. A supplementary documentation is not required for sites that do not have further cultural heritage value or interest (CHVI).	This comment has been addressed.		

				Site AjGx- 462 does not have further CHVI. Per MHSTCI (2011), justification to excavate only one test unit over one positive test pit does not require justification, nor is it a standard.			
14.	Finally, the Stage 1-2 AA provides no commentary on the presence of occupation-specific features, strataormiddens. This is particularly of interest given the productivity of the site, proximity to thec.1844-1851 residence, and the length of continuous occupation.	General	LHC	The Stage 2 archaeological assessment did not identify any occupation-specific features or middens. Also, no early concentration of artifacts was encountered.	This comment has been addressed.		
15.	With respect to the Interim Stage 1-2 AA, the reporting has failed to accurately take into account the West Extension Lands study area's location on the Mount Nemo Plateau and has not captured the results of the previous archaeological assessment of the South Extension Lands. The Stage 1-2 AA does not provide analysis to support the finding that only 33 % of the artifact assemblage of the Inglehart-Harbottle site(AiGx-462) dates to before1870 and the subsequent recommendation that the site has no further CHVI and no Stage 3 AA is warranted. It is recommended the report be revised to include the additional analysis used to determine the percentage of the assemblage dating to pre-1870 occupation and to include supplemental information regarding the integrity of the site, distribution of artifacts, the determination of the approximate site dimensions/boundaries, and analysis of the site's CHVI as it relates to its local context. It should be noted that the MHSTCI the authority responsible for licensing archaeologists in the province, and are not an approval authority. The City may – as an approval authority - choose to require Stage 3 AA notwithstanding the baseline requirements outlined in the S&Gs. With respect to the Cultural Heritage Impact Assessment (CHIA), additional information provided in the Stage 1-2 AA as a result of accessing the property, indicates that the property at 2015 No. 2 Side Road has potential CHVI as a built heritage resource. Photographs from there are of the structure clearly indicate that portions of thec.1844-1851 one-and-a-half-storey Inglehart farmhouse are extant. As such, 2015 No. 2 Side Road should be included in the CHIA.	General	LHC	See response to Item 2. The determination that less than 80% of the artifact assemblage of AiGx-462 dates to before 1870 is provided within Section 3.2	This comment has been addressed.		

Proposed Burlington Quarry Expansion
JART COMMENT SUMMARY TABLE – Cultural Heritage

Please accept the following as feedback from the Burlington Quarry Joint Agency Review Team (JART). Fully addressing each comment below will help expedite the potential for resolutions of the consolidated JART objections and individual agency objections. **Additional, new comments may be provided once a response has been prepared to the comments raised below and additional information provided**.

	JART Comments (January 2021)	Reference	Source of Comment	Applicant Response (June 2021)	JART Response (December 2021)	Applicant Response (June 2022)	JART Response (June 2023)
Report/Date: Cultural Heritage Impact Assessment, April 2020				**Author: MHBC**			
1.	When reviewed against the submitted Terms of Reference, the Cultural Heritage Report is lacking "statements of significance of cultural heritage value and heritage attributes for any identified cultural heritage resources".	General	As per Comment 2 below	2280 No. 2 Side Road has been confirmed to have heritage value, with information related to the significance and attributes found in 5.2 and 5.4 of the MHBC report. See revised Cultural Heritage Impact Assessment dated June, 2021.	5235 Cedar Springs is representative of the Gothic Revival Cottage, as stated in the report, and associated with Nelson Twp. Historically and to the overall pastoral surroundings. Please refer to JART response #24. 2280 No. 2 Side Road has been addressed through the revisions.	Noted re: 2280 No. 2 Side Road. Disagree regarding 5235 Cedar Springs. The building was evaluated and found to not have cultural heritage value.	The contradiction between 5235 Cedar Springs being described in the report as being representative of the Gothic Revival Cottage and having no CHVI has not been addressed.
2.	The CHIA does not provide sufficient historical research of the general area of the subject site against which to evaluate Cultural Heritage Value or Interest (CHVI) under *Ontario Regulation 9/06: Criteria for Determining Cultural Heritage Value or Interest*.	General	LHC	This research of the general area is meant to be high-level and describe the development of the surrounding area. The level of detail is sufficient to understand the area. In addition, correspondence has been received from the Ministry of Heritage, Sport, Tourism and Culture Industries (MHSTCI) indicating they have no concerns with the content or recommendations. See Attachment 1.	This comment has been addressed. Note, for clarification, MHSTCI is not the approval authority.	Noted, thank you. Regarding MHSTCI, it is agreed they are not the approval authority for the applications, however their authority as the Provincial review agency and experts related to cultural heritage matters should be acknowledged and their opinions taken into account (note also for subsequent mentions of MHSTCI).	Agreed, MCM is not the approval authority on these matters.
3.	Insufficient analysis or rationale has been provided to support the evaluations of built heritage resources and cultural heritage landscapes.	General	LHC	Disagree. The level of detail in the report is sufficient to understand and evaluate the area. In addition, MHSTCI has indicated they are satisfied with the report content and recommendations.	This comment has been addressed Note, for clarification, MHSTCI is not the approval authority.	Noted, thank you.	
4.	Although two late 20th century built heritage resources are evaluated within the report, the CHIA does not include any evaluation of the golf course lands as a significant cultural heritage landscape.	General	LHC	The golf course was considered as part of the evaluation of cultural heritage landscapes. It is referenced when describing the development of the subject lands and surrounding area, and was also reviewed as part of the historical air photo / mapping review. Through the initial screening exercise, the golf course was determined not to have	This comment has been addressed.	Noted, thank you.	

				cultural heritage value or potential as a significant cultural heritage landscape. As such, it was not carried through in the report for further evaluation specifically as a cultural heritage landscape. The golf course is not associated with a significant golf course architect or persons, does not contain significant built heritage features, is not valued by the community, and is not identified as a cultural heritage resource by the City (including through the 2015 Mount Nemo HCD Study). The evaluation carried through in the report for the overall subject lands concluded the property did not have cultural heritage value or qualify as a significant cultural heritage landscape.			
5.	The summary of heritage character presented in section 5.4 does not include all of the content required of a Statement of Cultural Heritage Value or Interest.	General	LHC	Section 5.4 has been updated. See revised Cultural Heritage Impact Assessment dated June, 2021.	This comment has been addressed through revisions.	Noted, thank you.	
6.	Although the proposed extraction are is within approximately 15 m of the house at 2280 No. 2 Side Road, the impact assessment does not address the potential for indirect impacts due to vibrations and it is unclear how blasting will be designed to ensure the integrity of the building is being retained.	General	LHC	Direct and indirect impacts are addressed in Section 7 of the report, and blasting is mentioned. No revisions are required. Blast design is further addressed in the blasting report, with a recommendation that vibration not exceed 50 mm/s at these structures. See blasting recommendations on the Aggregate Resources Act Site Plans.	This comment has been addressed.	Noted, thank you.	
7.	It is unclear when the site visit(s) were undertaken and if all of the properties discussed in this report were accessed during those site visits. In the event that site visits were undertaken from the public ROW, this should be stated as a limitation, as it would affect the evaluation.	General	LHC	During the site visit, all properties were accessed by the project team. Field areas were walked and buildings were reviewed in a non-intrusive manner. Due to site conditions (e.g. vegetation), clear photos of some buildings were not possible.	This comment has been addressed.	Noted, thank you.	

8.	It is unclear why the golf course has not been evaluated as a cultural heritage landscape when 2292 No. 2 Side Road and 2300 No. 2 Side Road have been evaluated as built heritage resources. Given that the proposed development results in the removal of the golf course lands, its potential CHVI should be addressed.	General	LHC	See response to #4.	This comment has been addressed.	Noted, thank you.	
9.	The following aspects of *cultural heritage landscapes* need to be explored in the Cultural Heritage Impact Assessment • Heritage landscape as it relates to indigenous community history. The report identifies historic ties to the Anishnaabe and the Haudenosaunee peoples • Heritage landscape as it relates to known archaeological sites identified in the submitted Stage 1-4 Archaeological Assessments • Interrelationships between known archaeological sites, indigenous community heritage, and natural heritage features present in the study area. • How the UNESCO designation applied to the properties affects the cultural heritage value of the area, as well as the principles of the Man in the biosphere program and how they apply to interrelationships of all aspects contained within the definition of cultural heritage landscapes provided by the NEP (2017). • How the cultural heritage landscape is defined by existing viewsheds, specifically, but not limited to, the Mount Nemo Plateau.	General	Niagara Escarpment Commission	The Cultural Heritage Impact Assessment has been updated to include additional information related to indigenous community history. See Section 3.1 of the revised report. In addition, both Six Nations and Mississaugas of the Credit First Nation have confirmed in writing to Nelson that they have no outstanding concerns with the west and south extension applications. See Attachment 2 which includes correspondence from Six Nations and Mississaugas of the Credit First Nation.	The response has not addressed bullets 4-5, nor fully 1-3. ○ Bullet one provides Indigenous settlement history, but not its relationship to the cultural heritage landscape ○ Bullet two should discuss cultural heritage landscapes in relation to stage 2 farmstead and Indigenous sites ○ Haven't addressed bullet three ○ Haven’t addressed UNESCO comment (see item 12) ○ Haven’t defined cultural heritage landscape elements comprehensively	Disagree that the additional matters specifically relate to the scope of this report to assess the proposed development of a portion of the subject lands for a quarry. Additionally, see previous response regarding UNESCO designation.	Not addressed.
10.	Broadly, the report does not incorporate findings of other submitted reports (VIA, Archaeological, Planning, Natural Heritage) that directly contribute to the understanding of the *cultural heritage landscape* of the area.	General	Niagara Escarpment Commission	The archaeological report was reviewed as relevant background when completing this assessment. The other technical reports do not directly contribute to the understanding of the cultural heritage landscape of the area.	The VIA, Natural Heritage and Planning reports encompass natural and cultural landscape features that have a direct bearing on cultural heritage landscape values and are not discussed in this report.	Disagree – applicable information has been included in this report as relevant. The report is included as **Tab 1**.	Identification and evaluation of potential cultural heritage landscapes is not documented.
11.	Photographs of the known/potential built heritage resources and cultural heritage landscapes discussed in this report do not adequately document/depict existing conditions. Photographs are limited to one or two elevations, are sometimes obstructed by trees, and all appear to have been taken from a distance.	General (Photograph)	LHC	In our opinion the photos appropriately document the site and existing conditions, and are in line with other similar projects. As noted above, site conditions (e.g. vegetation) made photos of some features challenging. Of note, the MHSTCI has indicated they are satisfied with the report content and recommendations.	With the understanding that the properties were also accessed by the project team, this comment has been addressed.	Noted, thank you.	

12.	A review of PPS policies suggests that the properties “have not been identified by provincial, federal or UNESCO bodies”. The lands are recognized through UNESCO as being within the Niagara Escarpment Biosphere Reserve and subject to the Man in the Biosphere program. Please address and consider the designation within the context of the cultural heritage landscape.	Section 2.2 (Page 4)	Niagara Escarpment Commission	The PPS references identification by UNESCO as a heritage site. This property has not been identified by UNESCO as a heritage site. The World Heritage Site program is different from the World Biosphere Reserve program.	The reference cited by the proponent confirms that the Niagara Escarpment overall is not a “protected heritage property”. However, recognitions of the Niagara Escarpment by the NEP and UNESCO Niagara Escarpment Biosphere Reserve meet the PPS definition of Cultural Heritage Landscape by their inclusion on “an international register” and by being managed through another land use planning mechanism. The UNESCO Niagara Escarpment Biosphere Reserve explicitly acknowledges the Niagara Escarpment’s diverse landscapes under the category of Socio-Economic characteristics. As such, the acknowledgement of these properties within the NEP and UNESCO Niagara Escarpment Biosphere must be acknowledged and addressed.	There is agreement the properties are not protected heritage properties, which is the focus of 2.2 referenced in this comment. The PPS definition referenced varies from the NEP definition of CHL, which specifically references the World Heritage Site program. The 2020 PPS refined the language of the definition but the intent is the same. CHL evaluation is carried out further in the report, and it was determined the properties do not constitute a significant CHL.	As noted in the PPS 2.6.3, the NEP is one among “other land use planning mechanisms” that are used to identify cultural heritage landscapes in Ontario, and a landscape evaluation study was carried out for the NEP.
13.	The statement that “An onsite building” is listed on the City’s Heritage Register and is therefore considered to be a built heritage resource is not entirely accurate. Although the 1830 one-storey rubblestone Regency structure at 2280 No. 2 Side Road is described in the Register, Section 27, Part IV of the OHA applies to the property, as a whole.	Section 2.2 (Page 4) Last Sentence	LHC	Agreed that the whole property is ‘listed’. However, the register listing specifically mentions the house as being part of the listing, hence the focus on the building.	This comment has been addressed.	Noted, thank you.	
14.	Policies of the NEP (2017) are only stated with no real analysis provided. This lack of analysis is not rectified within the Planning Justification Report.	Section 2.3	Niagara Escarpment Commission	The policy reference is provided here for context. The balance of the report provides the analysis, and then the conclusion on the matter.	Specific responses to policies are needed: notably, to provide a comprehensive inventory of the heritage resources identified to date, and in particular to address cultural heritage landscape inventory gaps: therefore the response provided to date warrants further documentation, evaluation, and analysis. Further, NEP Policies 2.9.3.b) and c) are not described or addressed in this study.	As noted previously, the report itself provides the required analysis to demonstrate how the policies are complied with. The report concludes the proposal complies with applicable policy direction. For clarity on the matter, the report has been expanded to specifically note the NEP cultural heritage policies for aggregate operations and conclude they have been addressed (see pgs. 5 & 40 of report). The report is included as **Tab 1**.	While introducing the NEP policy 2.9.3.b) on page 5, the conclusion that there are no cultural heritage landscapes within the study area is contradicted by the study itself (Tab 1), which describes cultural heritage landscapes within the study area.

15.	This background is very high-level and is not sufficient to adequately address O.Reg. 9/06 criteria related to historical or associative value. The history of Mount Nemo, for example, is not addressed.	Section 3.1	LHC	This section is meant to be high-level and describe the surrounding area. Of note, the MHSTCI has indicated they are satisfied with the report content and recommendations.	This comment has been addressed.	Noted, thank you.	
16.	The lack of buildings depicted within the study area is not likely the result of there being no structures at the time. Often, only subscribers' residences were depicted and the extensive landownership in the area, subdivision of farm lots, and lack of structures depicted in the majority of surrounding lots (coupled with the knowledge that at least one stone structure is understood to have been extant in the 1830s at present- day 2280 No.2 Side Road) indicates that this is the case here.	Section 3.2 (Page 11) Last Sentence	LHC	Noted. We agreed that the historical atlas project did not capture all buildings. A notation has been added to Section 3.2 of the revised report.	This comment has been addressed through revisions.	Noted, thank you.	
17.	Given the likelihood that the 1858 atlas did not depict all of the extant resources, comparison with the 1877 does not necessarily reflect changes through the middle of the 19th century. This is particularly the case where individual owners did not change, or where the property remained in the family.	Section 3.2 (Page 12)	LHC	This is true, however the comparison is still useful to make.	This comment has been addressed.	Noted, thank you.	
18.	No sources other than the two atlases and the 1954 & 1988 air photos appear to have been reviewed as part of the background research for the site history. Census records and/or LRO documents should be reviewed – particularly for the Pitcher/Freeman and John Buckley properties. This site history does not provide sufficient information to adequately address O.Reg.9/06 criteria.	Section 3.2	LHC	The level of research is sufficient to show the development of the area and document the history of the properties. Of note, the MHSTCI has indicated they are satisfied with the report content and recommendations.	This comment has been addressed.	Noted, thank you..	
19.	The discussion of the historical atlases and air photos does not explicitly address any of the extant structures. There is no discussion about when extant structures may have been constructed or by whom.	Section 3.2	LHC	The discussion addresses the area as a whole, to show how it evolved and was built out. The level of detail is sufficient for the purposes of this report and evaluation.	This comment has been addressed.	Noted, thank you.	
20.	The study identifies the importance of *cultural heritage landscapes* as identified in the NEP, PPS, local and Regional OPs. However, the landscape setting and context only describes the landscape in terms of building clusters and agricultural lands.	Section 4.2	Niagara Escarpment Commission	The section is structured in the manner to address building clusters and agricultural lands, since those are most relevant to address in the context of the site and proposed development.	The PPS and Ontario Heritage Toolkit provide examples of cultural heritage landscape features and their constituent elements. Infosheet #2 provides explicit guidance on such elements and the different scales at which such inventories and analyses are to be carried out to provide a comprehensive inventory and impact assessment, as is required here	Noted. The report has followed the required scale and methodology as appropriate for the study undertaken. The report is included as **Tab 1**.	Not addressed.

21.	It is unclear what the c.1860s date of construction is based upon.	Section 4.3.1 (Page 20) Line 1	LHC	This is based on the architectural features of the building, as well as the historical atlas information which shows no building in 1858 and a building by 1877.	This comment has been addressed.		
22.	The photographs presented do not provide any detail of the features of the structure. Only two elevations are presented and those photographs are very small.	Section 4.3.1 (Page 20)	LHC	The photos are sufficient to conclude regarding the building characteristics and potential value. MHSTCI staff have also indicated they are satisfied with the report content.	This comment has been addressed. Note, for clarification, MHSTCI is not the approval authority.		
23.	The smaller outbuilding is described as being generally in poor condition; however, the view of the structure shown in Photo 15 (presumed to be correct structure) is obstructed by trees. It is unclear if the evaluation of the poor condition is based on closer evaluation of the structure.	Section 4.3.1 (Page 20) Last Paragraph	LHC	Yes, the building was more closely inspected by the project team. As noted above, vegetation made clearly photographing the building difficult.	The November 24, 2021 site inspection and documentation by JART representatives indicates that the smaller outbuilding at 2280 No. 2 Side Road, despite its condition, may meet O.Reg.9/06 criteria as a component of a grouping of buildings – including the house and larger barn. See comment #33.		Not resolved.
24.	The discussion of criterion 1.i. is incomplete. The analysis only addresses whether the style, described as Ontario Gothic Revival Cottage architectural style, is rare or unique, but does not address whether it is representative or early example, nor does it address whether it is a rare example of the style in stone. Despite additions to the structure, it appears to retain a number of characteristic features. It is unclear if the property was accessed and if the structure was reviewed up close. Evaluation of the degree of craftsmanship would be affected by lack of property access. The discussion of criterion 2 is incomplete. The background presented in sections 3.1 and 3.2 did not provide a basis to determine whether or not this property has any historical or associative value. Given that the development proposal results in the removal of this structure, its potential CHVI must be adequately addressed.	Section 5.2 (5235 Cedar Springs Road)	LHC	The level of detail within the report is sufficient, as agreed by MHSTCI staff in their recent letter.	This comment has not been addressed. 5235 Cedar Springs is described in the report as having heritage potential, representing the regionally common (presumably heritage) structure of the Gothic Revival Cottage type, associated with Nelson Twp. historically and to the overall pastoral surroundings. When using O.Reg 9/06 criteria, they must be considered as a whole, and being a representative structure fulfils one criterion: in doing so, heritage potential is confirmed.. Of note: MHSTCI is not the approval authority. (NEC) Given the potential direct impact of demolition, the analysis does not address the potential for the	Do not agree. The report reviews and evaluates the structure, determines it has been altered in form and context, therefore does not have cultural heritage value. Although the level of detail is considered appropriate, additional information can be added re: #2 in order to address the comment. Unclear how comment #33 relates to this point, since they are different properties.	Not resolved.

					property to meet criterion 1(i) as a representative example of the style, nor has any evidence been provided to inform the analysis of the rarity of this example of this type for its stone construction. Insufficient property-specific research was provided to assess criterion 2. In addition, the November 24, 2021, site inspection and documentation by JART representatives indicates that the structure may meet additional O.Reg 9/06 criteria and warrants further evaluation. See comment #33.		
25.	The report states that the property type is somewhat rare within the broader area. It is unclear if this refers to the Regency style, or stone construction. It is unclear if the property was accessed and if the structure was reviewed up close. Evaluation of the degree of craftsmanship would be affected by lack of property access. The discussion of criterion 2 is not supported by the background research presented in Sections 3.1 and 3.2. The discussion of criteria 1 and 2 does not address the barns. The small barn, in particular, is proposed to be removed. Its CHVI, as an individual built heritage resources and as it relates to the house and large barn, should be evaluated.	Section 5.2 (2280 No. 2 Sideroad)	LHC	The reference to the property being somewhat unique was mentioned in the HCD Study completed on behalf of the City, which we took to mean both the style and type of construction. The barn was reviewed up close, although access to the interior of the building was not undertaken. The evaluation in the report is sufficient, as agreed to by MHSTCI staff.	The November 24, 2021 site inspection and documentation by JART representatives indicates that the smaller outbuilding at 2280 No. 2 Side Road, despite its condition, may meet O.Reg.9/06 criteria as a component of a grouping of buildings – including the house and larger barn. See comment #33. Note, for clarification, MHSTCI is not the approval authority.		Not resolved.
26.	The summary of heritage character presented in section 5.4 does not include all of the content required of a Statement of Significance/Statement of Cultural Heritage Value or Interest and list of heritage attributes as outlined in the *Ontario Heritage Toolkit.* It is unclear if the barn complex refers to the large barn, or to both barns described in Section 4.3.2.	Section 5.4	LHC	2280 No. 2 Side Road has been confirmed to have heritage value, with information related to the significance found in 5.2 and 5.4 of the Cultural Heritage Impact Assessment. The revised report dated June, 2021 has expanded the description.	This comment has been addressed through revisions.	Noted, thank you.	

27.	The site plan and figures depicting the proposed development suggest that a portion of houses extend into the License Boundary. This should be confirmed. This is the c.1830s Regency portion of the structure.	Section 6	LHC	A portion of the house is within the License boundary; however, it is outside the extraction area. The space is required for berming.	This comment has been addressed.	Noted, thank you.	
28.	The CHIA makes a number of references to the rehabilitation of lands, post-extraction, to a level suitable to recreational use. • The report makes limited reference to whether this rehabilitation plan and after-use would be in keeping with the cultural heritage landscape of the area. NEC Staff note that this analysis would have to be predicated on a more thorough detailing of the cultural heritage landscape. • The report seems to refer to the recreational after-use as the definite after-use. It would be more appropriate to provide an assessment of the after-use from a cultural heritage lens instead of reviewing on the basis that it is appropriate and will be accepted. Germane to this work would be a consideration of alternative after- use plans that might be better aligned with the existing and historic cultural heritage landscape (once described) if necessary.	Sections 6 (Page 32) and Section 9 (Page 37)	Niagara Escarpment Commission	The report concludes the extension lands are not a significant cultural heritage landscape. Therefore, additional details are not necessary. Alternative forms of development are described in the report, although not deemed necessary. Of note, the MHSTCI has indicated they are satisfied with the report content and recommendations.	Shortcomings in the identification, evaluation, analysis and mitigation of impacts to heritage resources is identified above, which in turn influence rehabilitation strategies and potential future uses that should be addressed. MHSTCI is not the approval authority.	Do not agree. As noted, the area is not a significant CHL. Level of detail in report is appropriate and follows accepted standards for such studies. Mitigation and alternatives were considered as appropriate.	Not addressed.
29.	It is stated in a review of impacts that: *The area of the site proposed for aggregate extraction does not contain any built heritage resources or cultural heritage landscapes, therefore there are no direct or indirect impacts anticipated.* NEC Staff contend this conclusion is premature given that a description and assessment of the cultural heritage landscape does not consider multiple components contained with the provided NEP and PPS definition that are present on and in proximity to the subject lands.	Section 7	Niagara Escarpment Commission	In our opinion, the report conclusion is appropriate. MHSTCI staff share the same opinion, as evidenced by their recent letter.	Shortcomings in the identification, evaluation, analysis and mitigation of impacts to heritage resources is identified above, and until these are addressed the conclusion is premature. Where cultural heritage resources such as 2280 # 2 Sideroad have been acknowledged, it is noted that the Ontario Heritage Act defines heritage property as real property, and all buildings and structures thereon – impacts to that real property on which the building and structures are situated is acknowledged on page 30 of the June 2021 report. As such, the conclusion that there are no direct or indirect impacts heritage is not accurate. Of note, MHSTCI is not the approval authority.	Do not agree. Heritage value of the property has been identified and the report included attributes and description of the heritage place. There are changes planned to the property, but that does not necessitate an impact on the heritage attributes (as noted in the report). The report conclusion is appropriate.	The conclusion that there are no built heritage resources or cultural heritage landscapes within the study area is contradicted by the study itself (Tab 1), which describes built heritage resources and cultural heritage landscapes within the study area.

30.	Extraction is proposed within ±15.0 m of an identified heritage resource located on 2280 No. 2 Sideroad. This seems very close to protect the structure(s) from vibration and dust generated by the extraction use. It is stated that blasting will be designed to ensure the integrity of the building is retained. Designed how? • Recommendation # 2 of the Blasting Impact Analysis suggests monitoring for ground vibration and overpressure but the CHIA provides that the blasting itself will be designed in a way to protect the resource. There seems to be a discrepancy in the two reports regarding mitigation vs. monitoring. • The Blasting Impact analysis doesn't provide direction for a 15.0m setback being appropriate for protection of the resource. How was this proposed setback deemed appropriate?	Section 7.1 (Page 33)	Niagara Escarpment Commission	Blast design is further addressed in the blasting report, with a recommendation that vibration not exceed 50 mm/s at these structures. The key is to maintain the structural integrity of the buildings, and the expertise of Explotech has been relied upon in this regard. See blasting recommendations on the Aggregate Resources Act Site Plans.	Reference to the specialist report on blast design would be appropriate in this section, along with provision of such summary details.	More specific reference to the blasting report as well as site plan language has been added to the report (see Section 7.1; pgs. 36-37).	Acknowledged.
31.	The proposed extraction area is approximately 15 metres from the house (and small barn) indirect impacts resulting from vibrations have not been addressed in the impact assessment. It is unclear how blasting will be designed to ensure the integrity of the building is retained (blasting is not addressed in the Noise Impact Assessment). What measures are being implemented? Figure 8 suggests that an acoustic and visual berm may be erected between the license boundary and the line of extraction. The berm and its construction have not been addressed in the impact assessment.	Section 7.1 (Page 33) Paragraph 4, Last Line	LHC	Blast design is further addressed in the blasting report, with a recommendation that vibration not exceed 50 mm/s at these structures. The key is to maintain the structural integrity of the buildings, and the expertise of Explotech has been relied upon in this regard. The proposed development was addressed broadly in this report. However the specifics of the berm are more appropriately addressed in the visual impact report.	This comment has been addressed.	Noted, thank you. In order to address NEC comment (above), some additional information has been added as noted above.	
32.	In general, the conclusions of the report are not shared by NEC Staff. Broadly, NEC Staff would identify that the definition of the *cultural heritage resource* provided by the NEP (2017) includes *cultural heritage landscapes.* Any broad conclusion made on the topic of *cultural heritage resource* needs to be supported by a better analysis of the cultural heritage landscape of the area as detailed in the above comments.	Section 9	Niagara Escarpment Commission	Noted. The MHSTCI has indicated they are satisfied with the report content and recommendations.	Shortcomings in the identification, evaluation, analysis and mitigation of impacts to heritage resources are identified above. MHSTCI is not the approval authority.	Do not agree. Report structure and conclusions are appropriate.	Not addressed.

33.	During the November 24, 2021 site inspection and documentation by JART representatives, a large barn was noted in the southwest half of Lot 17, Concession 2 NDS (2416 No.2 Side Road). This barn – although located within the cultural heritage study area, was not evaluated in Section 4.3.2 of the report. This barn may be associated with Andrew Cairns/Robert Spence's farmstead, as depicted in Figures 3 & 4 of the June 2021 report. It is unclear why this barn – and any associated components – were not evaluated in the Cultural Heritage Report.	Section 4.3.2	LHC			This area of the site was not included in the detailed assessment, since it was not identified as being of interest, is not a listed property on the City's heritage register, and is outside the excavation area. It was included in the initial historic research however.	Not resolved.

Proposed Burlington Quarry Expansion
JART COMMENT SUMMARY TABLE – Blast Impact Analysis (BIA)

Please accept the following as feedback from the Burlington Quarry Joint Agency Review Team (JART). Fully addressing each comment below will help expedite the potential for resolutions of the consolidated JART objections and individual agency objections. **Additional, new comments may be provided once a response has been prepared to the comments raised below and additional information provided**.

	JART Comments (January 2021)	Reference	Source of Comment	Applicant Response (June 2021)	JART Response	Applicant Response (June 2022)	JART Response (June 2023)
Report/Date: Blast Impact Analysis, March 24, 2020 & April 23, 2020				**Author: Explotech Engineering Ltd.**			
1.	The introduction recommends that a vibration monitoring program be continued and maintained for the duration of all blasting activities. Is this a requirement of the MECP Certificate of Approval? Are there securities or other legal assurances that the monitoring will take place? Is it possible for the language of the Official Plan Designation to include this recommendation?	General	City of Burlington	The MNRF Provincial Standards require that all new licenses monitor all blasts for ground vibration and blasts over pressure to ensure compliance with provincial guidelines. It is our understanding that provided the requirement for vibration and overpressure monitoring is included as a site plan condition, this requirement becomes legally binding. It is further our understanding that the recommendations of the Blast Impact Analysis (Pages 32– 33) will be fully transcribed onto the final site plans thereby providing a vehicle for enforcement.	Request is for that monitoring to be done by a third- party engineering company independent of the explosive supplier and/or blasting contractor.	This request is not warranted. All monitoring is completed by experts independent of Nelson and conducted and reported in accordance with required standards and protocols.	
2.	In the BIA report no mention is made regarding presence of any identified water body within the proposed extraction areas or within 500.0 meter standoff distance outside the extraction areas. There are water bodies in the area.	General	DST Consulting Engineers Inc.	Please refer to the supplemental technical memorandum addressing fish bearing waterbodies in direct vicinity of the Burlington Quarry dated January 19, 2021 based on additional information provided by project biologists. In response, Explotech has revised the Blast Impact Analysis. Refer to revised BIA dated June 16, 2021	Comment addressed.		
3.	It is noted that the version of site plan drawings appended to BIA is missing the “Note” section. The same version of site plan drawings provided to the retained consultant by Halton includes “Notes” on the drawings.	General	DST Consulting Engineers Inc.	In response, Explotech has revised the Blast Impact Analysis to include the newest version of site plans dated April 2021. Refer to revised BIA dated June 16, 2021	Comment addressed conditional upon the site plan notes being updated to address the recommendations.	The Burlington Quarry Extension Site Plans dated March 2022, included as **Tab 1**, include the recommendations from the updated BIA dated June 16, 2021, included as **Tab 2**.	Comment addressed.

4.	The impact of blasting in the context of production of vibration and overpressure and their effect on neighboring sensitive receptors located at various standoff distance are considered by the BIA report. The BIA report identifies a number of these receptors to be owned by the applicant, and hence considers them as non-sensitive receptors for the purpose of predictive vibration and overpressure impact calculations. Should these be considered as sensitive receptors given current use and design?	General	DST Consulting Engineers Inc.	Nelson Aggregates has advised that upon commencement of extraction in the extension lands, the owned properties will be non-sensitive either as a result of their demolition, conversion into commercial space, or suspension of active use. As such, these properties would be exempt from the guidelines set out in NPC 119. For informational purposes, Explotech has included the vibration calculations anticipated at these properties as part of the BIA report.	Comment addressed.		
5.	In order to mitigate the potential vibration and overpressure on surrounding existing sensitive receptors, the BIA uses a well-known predictive model, namely the Bureau of Mines (BOM) prediction formula or Propagation law. The BIA states that this model has been used by Golder Associates (Golder) to develop a site-specific attenuation formula based on a study carried out at the existing Burlington Quarry in 2006. However, the attenuation curves referred to in the Appendix C of the report are dated 2004. The BIA solely relies on the site- specific attenuation curves established by Golder for the existing Burlington Quarry for their assessment of the impact of blasting on surrounding sensitive receptors in the proposed Burlington Quarry Extension area with no new data added, even though the new data is available.	General	DST Consulting Engineers Inc.	The attenuation study referenced in the Explotech BIA incorporates information gained through the attenuation study undertaken by Golder Associates in 2004 as part of an unrelated study at that time. Given the fact that this analytical effort was previously undertaken and there has been no change in material characteristics or blasting practices, it was determined that undertaking a duplicate study would provide no new information or insight. While compliance monitoring data is available for the period from 2014-2019, the majority of the data is lacking critical information regarding the location of the blasts and/or the location of the seismographs relative to the blast which is necessary to accurately append the data to the earlier attenuation study. Inclusion of this data into the attenuation equation would result in a less reliable model for predicting ground vibrations and air overpressures.	Comment addressed. Explotech has included the complete Golder's report in Appendix C of their updated BIA report of June 16, 2021 and has been reviewed by DST.		

6.	The BIA report under the heading “EXISTING CONDITIONS” identifies seventy-eight (78) sensitive receptors with respective standoff distance from the extraction zones comprising of residential dwellings and a Golf Course known as Camisle Golf Course. The civic addresses and the land use of these properties are also identified in the BIA report. Of the seventy-eight sensitive receptors, eleven (11) dwellings are presently owned by the proponent and may be converted to offices, in which case will be eliminated from the list of sensitive receptors. The properties owned by the proponent are amongst the closest to the proposed extraction areas. The BIA identifies Buildings located at 2280 No. 2 Side Road presently owned by the proponent as structures classified as “culturally significant” and will be vacant at the time of extraction, and thus will not be considered as sensitive receptors. Should all of these building be considered as sensitive receptors given current use and design?	Existing Conditions	DST Consulting Engineers Inc. and Halton Region	Please refer to the answer in question 4. Additionally, the heritage structure located at 2280 No. 2 Side Road was given special consideration in the BIA due to its heritage status regardless of its status as a receptor. Specifically, the BIA recommends that “In order to safeguard the structural integrity of the structures located at 2280 No 2 Side Road, ground vibrations shall be maintained below 50mm/s (>40Hz) in accordance with research performed by the United States Bureau of Mines (USBM RI8507). The closest structure located at 2280 No 2 Side Road shall be monitored for ground vibration and overpressure when vibration calculations suggest vibrations in excess of 35mm/s”. This recommendation is based on the understanding that the building need not be subject to the MECP nuisance criteria as it will be vacant but should be subject to the damage criteria so as to prevent any adverse impacts on the structure(s).	Comment addressed.		
7.	Page 7 recommends that vibrations at 2280 No. 2 Side Road be maintained below 50.0 millimeters/second, and the closest structure on the property shall be monitored for ground vibration and over pressure when vibration calculations suggest vibrations in excess of 35.0 millimeters/second. Page 8 indicates Nelson Quarry is the owner of the property, please confirm that the vibration monitoring equipment will be or has been installed and monitored	Page 7	City of Burlington	The BIA prepared by Explotech recommends that all blasts shall be monitored for both ground vibration and overpressure at the closest privately owned sensitive receptors adjacent the site, or closer, with a minimum of two (2) instruments – one installed in front of the blast and one installed behind the blast. Additionally, it is recommended that the …structure located at 2280 No 2 Side Road shall be monitored for ground vibration and overpressure when vibration calculations suggest vibrations in excess of 35mm/s. Provided this recommendation is included on site-plans, this will be a condition of site plan approval in the	Comment addressed conditional upon the site plan notes being updated to address the recommendations.	The Burlington Quarry Extension Site Plans dated March 2022, included as **Tab 1**, include the recommendations from the updated BIA dated June 16, 2021, included as **Tab 2**. Regarding the request related 2280 No. 2 Side Road this has requirement has been included in Blasting Note 2 c).	Comment addressed

				extension lands. Monitoring practices at the existing license can be confirmed by others.			
8.	Page 10 provides recommendations on blast monitoring, please provide confirmation on where the vibration monitors will be (or are currently) installed (municipal address, and location on property) and if necessary (for non-owned properties), provide written confirmation from landowners that they have given permission for the vibration monitors to be installed on their property.	Page 10	City of Burlington	The BIA prepared by Explotech recommends that all blasts shall be monitored for both ground vibration and overpressure at the closest privately owned sensitive receptors adjacent the site, or closer, with a minimum of two (2) instruments – one installed in front of the blast and one installed behind the blast. Specific installation locations can only be determined at the field level in response to each individual blast locations and orientation. Location of seismographs provided in the 2014 - 2019 blast documentation are provided on Page 26 of the BIA.	Comment addressed conditional upon the site plan notes being updated to address the recommendations.	The Burlington Quarry Extension Site Plans dated March 2022, included as **Tab 1**, include the recommendations from the updated BIA dated June 16, 2021, included as **Tab 2**.	Comment addressed.
9.	Page 20 references the Sun Canada Pipeline. The BIA report provides a detailed assessment of the impact of blasting on the Sun Canadian High Pressure Oil Pipeline and recommendation on changes in the blast design parameters to protect the pipeline based on the Sun Canadian vibration limit policy. GIS mapping indicates there is also an Enbridge Pipeline and Imperial Oil Pipe line south of the south expansion, have any of those agencies been contacted to see if there are any precautions or requirements for blasting in proximity to the pipelines?	Page 20	City of Burlington	The Enbridge specification “Third Party Requirements in the Vicinity of Natural Gas Facilities” states that Enbridge must be notified of blasting operations if they are undertaken within 300m of the pipeline. Similarly, Imperial Oil requires notification of blasting operations if they encroach within 300m of the pipeline. Given the approximate 430m from the closest point of the southern extraction area to both the Enbridge and Imperial Oil Pipelines these agencies are not required to be contacted. Additionally, both pipelines fall further removed than the Sun Canadian Pipeline and hence the Sun Pipeline will govern from both a compliance and blast design perspective.	Comment addressed.		

10	The BIA report under the heading “REVIEW OF HISTORICAL BURLINGTON QUARRY DATA” states that vibration and overpressure data has been collected in recent years for all blasts conducted at the Nelson Aggregate Burlington Quarry (for 2014 through 2019) and provided to Explotech as part of their analysis. The historical vibration and overpressure data are included in Appendix C of the report. As part of their analysis, the BIA further confirms that the data reveals occurrence of 18 exceedances over the period from 2014 to 2019. List of exceedance occurrences, their location, exceedance level, date and time are presented in Table 5 of the BIA report. Although the data has been reviewed, it is not used in the BOM model prediction model for predicting expected vibration and overpressure levels for the quarry extension. If the prediction formula established by Golder is used for calculation of predicted vibration and overpressure levels for the new extension, then the data collected from actual quarry blasting during the period of 2014 to 2019 should have been incorporated in the model.	Review of Historical Burlington Quarry Data	DST Consulting Engineers Inc.	Please refer to the answer in question 5.	Comment addressed. Please refer to JART comment #5.		
11.	The Recommendations section (pages 28/29) does not address warning clauses, are there any warning clauses recommended for surrounding residential properties and/or to be included in the Official Plan Designation?	Pages 28-29	City of Burlington	At this time Explotech is not aware of any warning clauses recommended for surrounding residential properties. MHBC advises that for new or expanded mineral aggregate operations, warning clauses are not put in place on surrounding residential properties and it is the applicant’s responsibility to operate in compliance with provincial guidelines to ensure no adverse impacts to surrounding properties. When the subdivisions were approved in the area (Paletta, Illingsworth and Bunkowsky), as part of that approval, the Owners were required to include in all Offers of Purchase, Agreements of Purchase and Sale, or Lease and Reservation Agreements a warning clause regarding Nelson’s operation. The following is the excerpt from the Paletta subdivision. The other approvals included a similar warning clause: *"Purchasers are advised that Nelson Aggregate Company (“Nelson”) is the owners of lands located in Lots 1 and 2, Concession 2 and 3, N.S., City*	Comment addressed.		

				of Burlington, in the Regional Municipality of Halton and which lands are in proximity to those lands being developed for residential purposes by Paletta International Corporation. *The Nelson lands are presently licensed and operated for aggregate extraction industrial purposes and it is the intention of Nelson, through its licensees, agents, successors and assigns, to use the lands for the purpose of extraction, processing, manufacturing and transportation of aggregates.* *(i) Purchasers are also advised and acknowledge that noise, vibrations, dust, visual unsightliness, large equipment, maneuvering and permitted working hours are all incidental to the lawful operation of aggregate extraction site and the lawful operation of heavy vehicles on the public roads.* *(j) Purchasers are further advised that even though noise and vibration control features may be incorporated within the development area, noise and vibration levels may be of potential concern."*			

12.	The BIA report under the heading "RECOMMENDATIONS" provides nine (9) recommendations as the condition of blasting in the proposed Nelson Aggregates Burlington Quarry Extension areas. The following needs to be addressed: • Critical conditions recommended by the BIA be included in the site plan notes.	Recommendations	DST Consulting Engineers Inc.	Explotech has reviewed the site plans and all required conditions are included and MHBC will be further updating the site plans to include the additional recommendations found in the revised BIA dated June 16, 2021	Comment addressed conditional upon the site plan notes being addressed. Please refer to comment #21 for the site plan recommendation related to flyrock. The critical conditions have since been revised to include conditions of approval (with the exception of reference to latest Explotech's BIA report, please refer to Explotech's BIA report of June 16, 2021, Nelson__Blasting_Response_to_JART_June_2021_Package).	See Response to Comment # 21.	Comment addressed.
13.	The BIA report under the heading "RECOMMENDATIONS" provides nine (9) recommendations as the condition of blasting in the proposed Nelson Aggregates Burlington Quarry Extension areas. The following needs to be addressed: • The Golder Associates vibration attenuation study report referred to in the BIA report be provided for ease of technical review and cross reference.	Recommendations	DST Consulting Engineers Inc.	In response, Explotech has revised the Blast Impact Analysis. Refer to revised BIA dated June 16, 2021	Comment addressed. Please refer to JART comment #5.		
14.	The BIA report under the heading "RECOMMENDATIONS" provides nine (9) recommendations as the condition of blasting in the proposed Nelson Aggregates Burlington Quarry Extension areas. The following needs to be addressed: • The source of the Nelson Quarry vibration and Air Attenuation Curves included in Appendix C (Figures 5 and 6) of the BIA report be identified.	Recommendations	DST Consulting Engineers Inc.	In response, Explotech has revised the Blast Impact Analysis. Refer to revised BIA dated June 16, 2021	Comment addressed. The source of the Nelson Quarry vibration and air attenuation curves has since been identified by Explotech in their updated June 16, 2021 and reviewed by DST.		
15.	The BIA report under the heading "RECOMMENDATIONS" provides nine (9) recommendations as the condition of blasting in the proposed Nelson Aggregates Burlington Quarry Extension areas. The following needs to be addressed: • Vibration and overpressure data collected in the first 12 months of the proposed quarry extensions be incorporated in the data attenuation data base to develop a more reliable and new site-specific attenuation formula.	Recommendations	DST Consulting Engineers Inc.	In response, Explotech has revised the Blast Impact Analysis to include the following recommendation: Vibration and overpressure data collected during the first 12 months of extraction in the proposed quarry extension lands will be used to calibrate and update the 2004 Golder Associates attenuation equation. The proponent shall ensure information collected includes all relevant blast and monitoring details to permit and facilitate inclusion of the data in the attenuation data and resultant equation.	Comment addressed. Explotech in their updated BIA report of June 16, 2021, has addressed this concern by adding the following recommendation: • "Vibration and overpressure data collected during the first 12 months of extraction in the proposed quarry extension lands will be used to calibrate and update the 2004 Golder Associates attenuation equation. The proponent shall ensure information collected includes all relevant blast		

					and monitoring details to permit and facilitate inclusion of the data in the attenuation data and resultant equation.”		

16.	The BIA report under the heading "RECOMMENDATIONS" provides nine (9) recommendations as the condition of blasting in the proposed Nelson Aggregates Burlington Quarry Extension areas. The following needs to be addressed: • Provide the rational why the attenuation formula established by Golder in 2004 was used, but the historical vibration and overpressure data from the same site was not incorporated in formula.	Recommendations	DST Consulting Engineers Inc.	Please refer to the answer in question 5	Comment addressed. Explotech has provided explanation regarding the exclusion of the historical vibration and overpressure data obtained during the 2014-2019 blasting campaigns. The exclusion is due to lack of details of blasting parameters required to establish site-specific attenuation equation. Recording of details are generally not required when vibration and overpressure monitoring are conducted for compliance purposes. DST is satisfied with Explotech rational after reviewing the historical data.		
17.	The BIA report under the heading "RECOMMENDATIONS" provides nine (9) recommendations as the condition of blasting in the proposed Nelson Aggregates Burlington Quarry Extension areas. The following needs to be addressed: • According to the "Level 1 and Level 2 Natural Environment Technical Report, April 2020, page 60, Fish Habitat Summary" conducted by SAVANTA, there are potential direct fish habitat within 120.0 meters of the adjacent lands, and no fish habitat within the extraction areas. A review of historical supporting information and current Level 1 and Level 2 Natural Heritage Reports provided by the applicant was also carried out by the Halton Region Environmental Consultants Matrix Solutions Inc. (MSI). "This review provides the following overview of fish habitat within 500.0 meters of the proposed Burlington Quarry Extension areas: • West Arm of the West Branch of Mount Nemo Tributary of Grindstone Creek • East Arm of the West Branch of Mount Nemo Tributary of Grindstone Creek • Willoughby Tributary of Bronte Creek In addition to these, there are waters containing fish within the existing quarry and proposed extension areas. Within the existing quarry, it can be assumed that all pond features contain fish. In historical reports	Recommendations	DST Consulting Engineers Inc.	Please refer to the technical memorandum dated January 19, 2021 addressing fish bearing waterbodies in direct vicinity of the Burlington Quarry based on additional information provided by project biologists. In response and for continuity, Explotech has revised the Blast Impact Analysis to include the details of this technical memorandum. Refer to revised BIA dated June 16, 2021	Comment addressed. In their updated BIA report of June 16, 2021, Explotech has included a section under the heading "Blast Impact on Adjacent Fish Habitats'. This section provides mitigation procedures and set back distances required by DFO to allow blasting operations in the vicinity of fish habitats. DST has reviewed this section and is satisfied with Explotech's recommendation.		

	prepared by ESG International (October 2000) the following features were noted: • Pond 1 – support a largemouth bass population • Pond 2 – supports a stickleback and pumpkinseed population • Pond 3 – supports a largemouth bass population • Pond 4 – supports largemouth bass, pumpkinseed and stickleback population Although there are fish within these features, earlier reports do not classify these as “fish habitat” due to the isolation of these watercourses. According to MSI, the applicant has been requested to provide DFO concurrence that this is the case. Within the West Extension area, largemouth bass is present in all of the irrigation ponds within the golf course. Although the fish are present within these watercourses, they are currently not viewed as “fish habitat” by the applicant. These irrigation ponds are hydrologically connected to Willoughby Creek Tributary. The applicant has been requested to provide DFO concurrence that this is not fish habitat”. In the case that DFO confirms that the above noted features are considered as “fish habitat”, the applicant’s blasting consultant should revise their BIA to include a section addressing the impact of blasting on these features and recommend mitigation measures to address the potential impact on the fish habitat in accordance with the “Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters”. The document can be sourced online at https://www.racerocks.ca/wp-content/uploads/2015/09/DND-explosive- guidelines.pdf. The potential impact of blasting may be insignificant on the fish habitat within 120.0 meters of the adjacent lands considering the proposed blasting parameters. However, the potential impact should have been addressed by the BIA. The Location of these water bodies are also shown in the site plan drawings and described as “Water Features”.						

18.	The BIA report under the heading "RECOMMENDATIONS" provides nine (9) recommendations as the condition of blasting in the proposed Nelson Aggregates Burlington Quarry Extension areas. The following needs to be addressed: • Considering that the proposed blasting operations at one point will approach a standoff distance of 12.8 meters from Sun Canadian Pipeline corridor, all requirements of their blasting specifications outlined in Appendix 2, section 8.3 to 8.5 under the heading "Vibration and Blasting Control" be implemented (copy attached for reference).	Recommendations	DST Consulting Engineers Inc.	In response, Explotech has revised the Blast Impact Analysis. Refer to revised BIA dated June 16, 2021. Blast Impact Analysis now includes recommendations to follow the blasting specifications outlined in Appendix 2, Section 8.3 to 8.5 under the heading "Vibration and Blasting Control" be implemented.	Comment addressed conditional upon the site plan notes being addressed. Please refer to comment #21 for the site plan recommendation related to flyrock. Explotech has incorporated the requirements of the third-party pipeline company, namely Sun Canadian Pipelines guidelines for vibration and blasting control in their updated BIA report of June 16, 2021, which satisfies the pipeline companies concerns. Comment addressed condition upon the site plan notes incorporating these recommendations.	The Burlington Quarry Extension Site Plans dated March 2022, included as **Tab 1**, include the recommendations from the updated BIA dated June 16, 2021, included as **Tab 2**. Also see Response to Comment # 21.	Comment addressed.
	JART Technical Comments (November 2021)	**Reference**	**Source of Comment**	**Applicant Response (May 2022)**			**JART Response (June 2023)**
19.	Item 1 and item 7 in the response matrix refers to a "site plan" and "site plan approval", to ensure vibration monitoring but the response matrix for Registered Agreement & Reference Plan, item 1 states "the proposed quarry application does not include site plan control." If there is no site plan approval required, how will vibration monitoring be ensured?		City of Burlington	The proposed Burlington Quarry Extension does not require Site Plan approval from the City of Burlington, however there will be an Aggregate Resources Act Site Plan that is approved and enforced by NDMNRF. This site plan includes the required vibration monitoring and therefore it will be a requirement to implement. See Burlington Quarry Extension Site Plans dated March 2022 included as **Tab 1**.			
20.	At the Region's statutory public meeting, a delegate raised the issue of a 2005 blast that exceeded a vibration limit. Are there any monitoring or other records from this blast and any subsequent investigation, or any monitoring records for blasts carried out by Nelson since that time?	Raised at Public Meeting	Halton Region	General practice while completing a blast impact analysis is to review the trailing five (5) years of monitoring records from the quarry in question. As such, the June 2021 Blast Impact Analysis, included as **Tab 2**, contains the monitoring results from the 2014-2019 blasting campaigns. While monitoring records for the quarry would exist prior to 2014, Explotech has not reviewed these records for the purpose of this report and as a result cannot comment on the events that took place in 2005.			Comment addressed. Explotech has done their due diligence in respect to review of historical vibration monitoring data.
	JART Site Plan Comments (November 2021)	**Reference**	**Source of Comment**	**Applicant Response (May 2022)**			**JART Response (June 2023)**
21.	As of January 1, 2022, the aggregate Resources Act will require a licensee or permittee to take all reasonable measures to prevent flyrock from leaving the site during blasting if a sensitive receptor is located within 500 meters of the boundary of the site. Although this flyrock range prediction model is a useful tool used in proper blast design and planning to mitigate flyrock from escaping the site, visual inspection of the rock face, top bench, and communications between the drilling crew and the blasting crew plays a more crucial role. This is because the parameters in model does not include unexpected sources that may play a major role in production of flyrock in a given blast. DST recommend that the notes on the following Site Plan Drawings be revised to incorporate the changes in Explotech's updated BIA report of June 16, 2021: 1. Drawing Sheet 1 of 4, Existing Features, H. Technical Reports – References, Item 7.		DST Consulting Engineers Inc.	As confirmed by NDMNRF the revised Aggregate Resources Act effective January 1, 2022 does not apply to the proposed Burlington Quarry Extension. Regardless, Explotech has reviewed and is in agreement with DST's recommendation. Drawing 1 does not require an update since it references the date of the current Blasting Impact Assessment. Drawing 2 includes the blasting requirements and the Burlington Quarry Extension Site Plans dated March 2022 will be further updated to include the following condition: "The licensee shall take all reasonable measures to prevent flyrock from leaving the site during blasting."			Comment addressed conditional upon site plan notes being addressed.

	2. Drawing Sheet 2 of 4, Operational Plan, N. Report Recommendations, Item 2.				

Proposed Burlington Quarry Expansion
JART COMMENT SUMMARY TABLE – Financial Impact Study

Please accept the following as feedback from the Burlington Quarry Joint Agency Review Team (JART). Fully addressing each comment below will help expedite the potential for resolutions of the consolidated JART objections and individual agency objections. **Additional, new comments may be provided once a response has been prepared to the comments raised below and additional information provided**.

	JART Comments (February 2021)	Reference	Source of Comment	Applicant Response (June 2021)	Altus Report Response (September 2021)	JART Response (February 2022)	Altus Response (June 2022)	JART Response (June 2023)
			Report/Date: Financial Impact Study, April 2020 Author: Nelson Aggregates Co. & Fiscal Impact Study, September 2021 Author: Altus Group					
1.	The Progressive and Final Rehabilitation Monitoring Study suggests the rehabilitated quarry lands, including water management system, be conveyed to Conservation Halton or another public agency. No formal discussion has taken place with Conservation Halton on future land ownership. How will the Licensee ensure that the long-term monitoring and pumping will not result in financial liability to the public? How will adequate securities be put in place? The Financial Impact Study should be revisited and refined once significant issues with all other reports and the after use have been resolved.	General	Conservation Halton	If Conservation Halton or another public agency are interested in the future ownership of the land then discussions with that public agency will take place to ensure no financial liability to the public for long-term monitoring and pumping.		Noted. The Financial Impact Study should be revisited and refined to address this comment once significant issues with all other reports and the after use have been resolved.	Financial impact study is limited in scope to impacts on City and Region. If Conservation Halton or another public agency are interested in the future ownership of the land then discussions with that public agency will take place to ensure no financial liability to the public for long-term monitoring and pumping.	Acknowledged.
2.	In general, the financial impact study focusses on revenues the municipalities will receive (e.g. property taxes, TOARC fees, etc.) however, does not discuss the anticipated expenditures in any detail. Further, the financial impact study appears to be based on an economic impact analysis completed in 2008. As the economic impact study is 13 years old, it is suggested that newer data be utilized in this assessment.	General	Watson & Associates Economists Ltd.	As confirmed to JART, Nelson has retained Altus to complete an updated financial impact study. This report should be completed in July and will be provided to JART upon completion.	This report is based on 2019 data (or more recent, where appropriate). This report includes an analysis of net change in anticipated municipal expenditures from the proposal.	The Altus report updates the analysis with more current information and does discuss impacts on expenditures, however, see other items for additional revisions required.	See other responses.	Comment addressed

3.	Areas for Further Analysis: Water Supply: It is unclear if there may be any potential impacts and what the financial implications would be. It is noted that the proximity to the community of Mount Nemo and the Mount Nemo Christian Nursing Home should be taken into consideration.	General	Watson & Associates Economists Ltd.	Potential impacts to wells are not anticipated. Regardless of this conclusion Nelson has a well interference protocol and if a well was impacted by the quarry Nelson would be responsible to restore the water supply at its costs. Furthermore the quarry has been operating since the 1950s and to our knowledge there hasn't been any financial impactions to the public authorities related to water supply as result of the quarry operation.		The Altus report notes that all expenditures related to impacts of the water supply would be funded by Nelson.	Addressed.	Comment addressed
4.	Areas for Further Analysis: Road Network: There are no impacts identified with respect to the increased truck traffic. This should be reviewed further upon the peer reviews being completed by the consulting team. If there is additional truck traffic due to increased extraction volumes, this may result in impacts to the roads along the haul route (either capacity or maintenance).	General	Watson & Associates Economists Ltd.	Issue resolved. As confirmed during our meeting the quarry will not result in an increase in traffic.	It is understood that the redevelopment will effectively replace existing truck traffic, resulting in no net new truck traffic in the area.	Issue resolved. No net new truck traffic results in no anticipated additional incremental costs to the City and/or Region	Addressed.	Comment addressed
5.	Areas for Further Analysis: Road Crossing: Although Nelson plans to incur the capital and maintenance costs of the road crossing, the specific works being undertaken have not been identified. These should be identified and quantified in the study.	General	Watson & Associates Economists Ltd.	Issue resolved. As confirmed in our meeting, the detailed design for the road crossing will not be completed until such time as the land use is approved. Despite this Nelson has committed the pay for the cost to upgrade the section of the proposed road crossing and maintain this crossing while in use by the South Quarry Extension. This is a requirement	The report confirms that Nelson has agreed to upgrade and maintain a crossing on Sideroad 2 to allow trucks to access the proposed southern extension of the main quarry.	No further comments regarding the financial impact of the crossing as it will be constructed and maintained by the applicant.	Addressed.	Comment addressed

				of the proposed ARA Site Plans. As a result there will be no financial liability to the public.				
6.	Areas for Further Analysis: Impacts on Other Services: There was no estimation of the incremental operating costs for other services such as fire, police, ambulance, etc. These costs to the City and the Region should be estimated and included in the annual financial impact to the municipalities.	General	Watson & Associates Economists Ltd.	Issue resolved. As confirmed in our meeting the quarry is not increasing capacity and therefore there will not be an increase in incremental Operating costs. If anything once the golf course is no longer in use there would be a decrease in costs to the City and Region for these services. Furthermore Nelson works cooperatively with the local fire department and police to provide a location for training at the Nelson Quarry.	This analysis was incorporated into this version of the study.	The impacts of expenditures were estimated, however; In estimating the impacts to the municipalities' budgets, a review of incremental operating expenditures (net of revenues) was undertaken. The basis for the operating expenditures is the Region and City's Financial Information Returns (FIRs). This is consistent with the information that Watson would utilize in this analysis. The Altus Report uses incremental property assessment to estimate the change in operating expenditures. This approach is not typically utilized by Watson; however, it was noted that this approach has been used and accepted at the LPAT (now known as the OLT). As a result, Watson would not comment on the validity of this approach. Within Altus' analysis, an assumed growth factor is used to identify how each service's expenditures would change with the addition of the development (and corresponding loss of	See memorandum included as **Tab 1**, for sensitivity analysis of suggested changes to growth factors.	Based on the latest submission, Altus has updated their analysis to "zero out" any decrease in operating costs they have assumed. This is a more conservative approach than Watson's suggested revisions, however, it is acceptable in this instance.

						the existing properties). As the overall assessment is decreasing, the analysis assumes a decrease in operating expenditures. There are a few services where further rationale should be provided: • Fire & Police: it is assumed that for every dollar of assessment lost, the operating cost of fire and police services will be reduced proportionately. How would the operations of these services decrease with the change in assessment? A more reasonable assumption may be to reduce the 100% growth factor as the reduction in assessment here may not have the same effect as adding the same dollar amount of assessment elsewhere in the City and Region. Roads & Winter Control: it is assumed that these services will also decrease proportionately, however, there is no reduction in the City and/or Region's road network. As a result, the municipalities operating cost of maintenance, snow clearing, etc. on municipal roads would not be anticipated to change. All Other Services: similar to fire and police, a more reasonable assumption for a reduction in operating costs would be to reduce the growth factor. This should be reviewed for each service		

7.	Areas for Further Analysis: Tax Revenue: The revenues were based on 2008 data and should be updated. Additionally, the loss of tax revenue for the existing uses should be estimated and netted from the tax revenue calculations.	General	Watson & Associates Economists Ltd.	As confirmed to JART, Nelson has retained Altus to complete an updated financial impact study. This report should be completed in July and will be provided to JART upon completion.	This comment was addressed and incorporated into the analysis presented in this version of the study.	This information was updated in the analysis, however the tax revenue estimated appear to be overstated. Please see Watson January 12, 2022 memo. Below is a summary of the response: **1. Assessment Samples:** The approach to sampling properties should be revised to survey properties within the vicinity of the quarry. This survey can be used with the Altus survey (subject to our suggested revisions regarding different data and an outlier) to include a range of anticipated assessment and tax revenue. **2. Tax Class Assumptions:** The current golf course property includes industrial assessment in the Altus report; however, this should be residential. Further, the additional revenue estimated is based on industrial and farm/managed forest tax classes only. Based on the sample of quarries utilized, all have a portion of their properties assessed as residential. It appears that the area of extraction should be assessed as industrial, the remaining licensed area as residential, and the remaining total site area as farm/managed forests **MPAC Adjustments:** no adjustments were made for proximity and abutting residential properties to the quarry. An analysis should be undertaken on the properties affected, as noted in the Watson	1) The survey would be extremely time consuming likely with little impact on the calculations. The report finds that the lands removed from the 1km area around the quarry would offset the lands to soon be within 1km of the new quarry. Therefore, no adjustments were made. Furthermore, based on the conservative nature of the Report, any minor adjustments would not affect the overall conclusion and there would be no financial liability to both the Region and the City. The tax classes for the existing golf course is based on the tax records provided by the client, with the majority of the golf course classified as “IT” for tax purposes.	Based on Altus’ June 2022 responses, only item 3 was addressed. In Watson’s opinion, items 1 and 2 were not addressed and remain outstanding. These are discussed further in the following section. With respect to item 3 (MPAC adjustments), Altus suggests that the analysis would be time extremely time consuming and not likely to change the outcome of the analysis. In our opinion, with the use of GIS, the properties could be mapped out relatively easily and the tax information exported to Excel. The process would be estimated to take a few hours. If the tax revenue calculations were as presented by Altus, the rationale for not undertaking the detailed analysis may be acceptable in this instance, however, further discussion of the impacts is provided in Section 3 of this memo, which suggests the analysis be undertaken.

						memo.		
8.	Areas for Further Analysis: Overall Financial Impact: The financial impact study does not provide an overall financial impact to the municipalities. The study provides information for revenues, while neglecting to assess the incremental costs. A fulsome annual net financial impact to each municipality should be estimated.	General	Watson & Associates Economists Ltd.	As confirmed to JART, Nelson has retained Altus to complete an updated financial impact study. This report should be completed in July and will be provided to JART upon completion.	This comment was addressed and incorporated into the analysis presented in this version of the study.	An overall financial impact was estimated, however, it appears adjustments should be made as follows: 1. Revise impact on operating expenditures 2. Revise anticipated tax revenue calculations 3. Remove aggregate levy as this is not additional incremental revenues *(note: elsewhere it was mentioned that costs related to truck traffic were not included as there was no incremental truck traffic. Similarly, the aggregate revenue should not be included)*	For 1) and 2) See response to # 6. 2) For 3) the aggregate levy revenues are appropriate to include as without the new quarry, these levies would not occur. To be consistent with the above assumption, the memorandum included as **Tab 1** includes the continuation of truck traffic and operating costs.	Altus has now clarified that the scenario undertaken is a continuation of operations and the impact on the budget provides for the additional revenues received relative to the scenario whereby the quarry operations cease. As a result, the operating cost impacts have been adjusted to be zero.
9.	Areas for Further Analysis: In addition to the above, a review of the other peer review documents will need to be undertaken to assess any impacts to municipal services not identified in the financial impact study. This would include any impacts on roads, water, sanitary, or other municipal services and may include identification of additional capital and/or operating costs.	General	Watson & Associates Economists Ltd.	The other peer reviews have not identified other potential impacts to municipal services.	This comment was addressed and incorporated into the analysis presented in this version of the study.	These impacts were discussed in the Altus report	Addressed.	Comment addressed

10.	Purpose of the Financial Impact Study: To demonstrate that the proposal will have a minimal negative financial impact on the Region or taxpayers from the cost of providing services such as road maintenance, long term monitoring and replacement water supplies among other matters. The financial impact analysis discusses the road needs with respect to the crossing on No. 2 Sideroad, however, does not address the financial impact on the road network due to increased truck traffic. The study notes that fees cannot be charged for maintenance of the roads along haul routes but does not estimate the financial impact to the City and the Region. Any increases in extraction and truck traffic should be confirmed and incorporated into the analysis. With respect to water supply, the report addresses the responsibility of providing temporary water supply solutions, however, it is unclear of broader potential impacts. Based on a review of the consultant team's submissions, this may need to be reviewed.	General	Watson & Associates Economists Ltd.	Issue resolved. See response to Comment # 3 and 4.	It is understood that the redevelopment will effectively replace existing truck traffic, resulting in no net new truck traffic in the area.	The financial impact study now provides a net impact to the Region and City budgets, however, revisions are suggested. See comment #8. Additionally, the estimated long-term costs upon the closing of the quarry should be identified (e.g. long-term monitoring, pumping, and any other costs). Although this is a cost to be funded by the applicant, should the applicant no longer own/maintain the property in the future (e.g. through bankruptcy or other means), the City and Region should understand the potential annual costs to continue with long-term monitoring, pumping, and any other related cost.	See response to #8 above. Aggregate sites are under the jurisdiction of the Province and long-term monitoring, pumping and any other cost will not be the responsibility of the Region or City and therefore has been excluded from the analysis.	Altus has noted that the long-term monitoring, pumping, and other costs are the jurisdiction of the Province. It appears that TOARC fees fund a program for rehabilitation of quarry sites called the Management of Abandoned Aggregate Properties (MAAP). The rehabilitation of any site can only be undertaken with the consent of the property owner and is paid for entirely from the 3% portion of the tonnage fee paid by aggregate producers. However, it is not clear how the Region and City may access these funds and that these funds could be used for long-term monitoring, pumping, and other costs. Further, an estimate of long-term monitoring and pumping costs should still be identified as it is a potential financial risk to the municipalities (although this cost does not need to be included in the net financial impact to the municipal budgets).
11.	Purpose of the Financial Impact Study: To demonstrate that extraction will occur in a manner that minimizes social, economic and environmental impacts. The financial impact study does not appear to address the social or environmental impacts.	General	Watson & Associates Economists Ltd.	Measures to minimize social and environmental impacts are addressed in other technical reports. These measures are implemented at the expense of Nelson and do not result in any financial liability to the public.	The estimation of social or environmental impacts are beyond the scope of this study, and would be better addressed by other qualified consultants.	As noted, other technical reviews are addressing social and environmental items, however there are items outstanding in other reviews (e.g. water monitoring and pumping) that could have financial impacts. The financial impact study should note the potential cost of these items to meet the purpose of the financial impact study.	See response to #8 and # 10 above.	Comment addressed subject to comment on #10 above

12.	Purpose of the Financial Impact Study: To demonstrate that there will be no public costs associated with the proposal throughout extraction, complete rehabilitation and any long term continuing mitigation and monitoring requirements, and to demonstrate that there will be adequate securities put in place, through an agreement or legislation, to ensure that the public and agencies will not be put at financial risk as a consequence of the approval. The study does not demonstrate there will be no public cost associated with the application. Although there is mention of TOARC fees and other revenues paid to the municipalities, the study fails to address the increased expenditures that will be incurred.	General	Watson & Associates Economists Ltd.	As confirmed to JART, Nelson has retained Altus to complete an updated financial impact study. This report should be completed in July and will be provided to JART upon completion.	An analysis of increased municipal expenditures was incorporated into this version of the study.	The financial impact study now provides a net impact to the Region and City budgets, however, revisions are suggested. See comment #8. Additionally, the estimated long-term costs upon the closing of the quarry should be identified (e.g. long-term monitoring, pumping, and any other costs). Although this is a cost to be funded by the applicant, should the applicant no longer own/maintain the property in the future (e.g. through bankruptcy or other means), the City and Region should understand the potential annual costs to continue with long-term monitoring, pumping, and any other related cost.	See response to #8 and # 10 above.	The estimated long-term costs upon the closing of the quarry should be identified (e.g. long-term monitoring, pumping, and any other costs). Although this is a cost to be funded by the applicant, should the applicant no longer own/maintain the property in the future (e.g. through bankruptcy or other means), the City and Region should understand the potential annual costs to continue with long-term monitoring, pumping, and any other related cost.
13.	Purpose of the Financial Impact Study: To demonstrate to what degree the proposal will create direct and indirect financial benefits or costs to the municipalities affected. As noted above, the study notes anticipated revenues but does not provide an analysis with respect to additional municipal costs.	General	Watson & Associates Economists Ltd.	As confirmed to JART, Nelson has retained Altus to complete an updated financial impact study. This report should be completed in July and will be provided to JART upon completion.	An analysis of increased municipal expenditures was incorporated into this version of the study.	The financial impact study now provides a net impact to the Region and City budgets, however, revisions are suggested. See comment #8.	See response to #8 above	Comment addressed
14.	Purpose of the Financial Impact Study: To demonstrate what financial benefits to the community may be created as a consequence of the approval. The study does provide that a number of indirect jobs may be created as well as that a large portion of the aggregate goes to businesses in the Halton Region.	General	Watson & Associates Economists Ltd.	Comment noted.		An economic impact analysis was included in Altus' report. However, it should be clarified that the employment is a continuation of the existing employment, and no net new jobs are anticipated.	While there may be no net new jobs, the continued operation of the quarry will allow existing jobs to be retained, rather than lost once the existing quarry is exhausted or annual production is significantly reduced.	Altus confirmed that the analysis presents a continuation of jobs, relative to the scenario whereby these jobs are lost if the quarry closes.

15.	Objectives of the Financial Impact Study: To quantify the amount of assessment to be generated as a consequence of the approval of the application (compared to loss of existing use i.e. farmland). The analysis utilizes outdated information to provide assessment and tax revenue estimates. Further, there is no identification of the assessment and tax revenue lost due to the change in use from existing developed lands.	General	Watson & Associates Economists Ltd.	As confirmed to JART, Nelson has retained Altus to complete an updated financial impact study. This report should be completed in July and will be provided to JART upon completion.	The base-year for this study is 2019, given the availability of municipal financial data from that year.	The analysis was updated; however, the assessment and tax revenue estimates appear to be overstated. See section 2.2 of Watson's January 2022 memo.	See above responses.	As stated in comment #7 above; the assessment and tax revenue estimates appear to be overstated and the item was not addressed in the latest resubmission.
16.	Objectives of the Financial Impact Study: To identify what the economic impacts may be. The report provides a discussion on the economic impacts; however, this is based on a 2008 analysis.	General	Watson & Associates Economists Ltd.	As confirmed to JART, Nelson has retained Altus to complete an updated financial impact study. This report should be completed in July and will be provided to JART upon completion.	This part of the analysis has been updated to be as current as possible.	An economic impact analysis was included in Altus' report. However, it should be clarified that the employment is a continuation of the existing employment, and no net new jobs are anticipated.	See response to #14 above.	Comment addressed.
17.	Objectives of the Financial Impact Study: To estimate how much in license fees will be provided to the affected municipalities. This information was included in the study; however, it appears the study includes outdated rates. These should be updated.	General	Watson & Associates Economists Ltd.	As confirmed to JART, Nelson has retained Altus to complete an updated financial impact study. This report should be completed in July and will be provided to JART upon completion.	This part of the analysis has been updated to be as current as possible.	This information was included in the analysis, however, should not be considered as part of the net financial impact to the Region's and City's budgets, as this revenue is not additional incremental revenue.	See response to #8 above	Comment addressed.

18.	Objectives of the Financial Impact Study: To determine what impacts the additional truck traffic will have on the cost of providing maintenance on affected roads. Although the report mentions that Nelson would be responsible for the maintenance of the road crossing on No. 2 Sideroad, there is no commentary or analysis with respect to the impacts on the broader road network due to increased truck traffic.	General	Watson & Associates Economists Ltd.	Issue resolved. As confirmed during our meeting the quarry will not result in an increase in traffic.	It is understood that the redevelopment will effectively replace existing truck traffic, resulting in no net new truck traffic in the area.	Issue resolved. No net new truck traffic results in no anticipated additional incremental costs to the City and/or Region	Addressed.	Comment addressed.
19.	Objectives of the Financial Impact Study: To determine whether the proposal if approved will impact on the timing and/or need for road improvements to be paid for by the municipality. The study does not indicate if there will be road improvements required, however, this should be reviewed in concert with the peer review being conducted on the traffic impact analysis.	General	Watson & Associates Economists Ltd.	The only road improvements required as part of the proposed Burlington Extension application are the upgrades to No. 2 Sideroad at the location of the proposed crossing. As confirmed in our meeting, the detailed design for the road crossing will not be completed until such time as the land use is approved. Despite this Nelson has committed the pay for the cost to upgrade the section of the proposed road crossing and maintain this crossing while in use by the South Quarry Extension. This is a requirement of the proposed ARA Site Plans. As a result there will be no financial liability to the public.	It is understood that the redevelopment will effectively replace existing truck traffic, resulting in no net new truck traffic in the area.	Issue resolved. No net new truck traffic results in no anticipated additional incremental costs to the City and/or Region	Addressed.	Comment addressed.

20.	Objectives of the Financial Impact Study: To identify the financial benefits that may occur generally as a consequence of the approval (i.e. TOARC payments for road improvements). The study generally speaks to the financial benefits appropriately (except as noted above).	General	Watson & Associates Economists Ltd.	Comment noted. As confirmed to JART, Nelson has retained Altus to complete an updated financial impact study. This report should be completed in July and will be provided to JART upon completion.		The financial impact study now provides a net impact to the Region and City budgets; however, revisions are suggested. See comment #8.	See response to #8 above	Comment addressed.
21.	Objectives of the Financial Impact Study: To identify the potential cost of any long-term monitoring and mitigation on the site and the responsibility for that monitoring and the liability to any public authority or agency associated with that responsibility. The study does not identify the cost of any long-term monitoring and does not identify the responsibility or liability associated with the responsibility.	General	Watson & Associates Economists Ltd.	If a public authority is interested in the future ownership of the land then discussions with that public agency will take place to ensure no financial liability to the public for long-term monitoring and pumping. It is also important to note that the Burlington Quarry Extension application does not rely on ongoing dewatering of the site. As JART is aware the existing approved rehabilitation plan for the Burlington Quarry requires dewatering to stop and the site to naturally flood to a lake with no off-site discharge. As part of the Burlington Quarry Extension application, Nelson has agreed to modify the existing quarry rehabilitation plan to maintain off- site pumping to improve conditions for surrounding lands compared to existing approvals and maximize land area for future after uses. The proposed modification to the	All costs will be the responsibility of the owner and will not impact the Region and City.	The Altus report notes that all costs will be the responsibility of the applicant, however, the objectives of the study are: *"To identify the potential cost of any long-term monitoring and mitigation on the site and the responsibility for that monitoring and the liability to any public authority or agency associated with that responsibility."* Although these costs are to be paid by the applicant, the costs should be estimated for the Region and City's information.	See response to # 10.	Altus has noted that the long-term monitoring, pumping, and other costs are the jurisdiction of the Province. It appears that TOARC fees fund a program for rehabilitation of quarry sites called the Management of Abandoned Aggregate Properties (MAAP). The rehabilitation of any site can only be undertaken with the consent of the property owner and is paid for entirely from the 3% portion of the tonnage fee paid by aggregate producers. However, it is not clear how the Region and City may access these funds and that these funds could be used for long-term monitoring, pumping, and other costs. Further, an estimate of long-term monitoring and pumping costs should still be identified as it is a potential financial risk to the municipalities (although this cost does not need to be included in the net financial impact to the municipal budgets).

				existing quarry rehabilitation also results in the West extension being maintained in a dewatered state. The proposed South Extension will not be maintained in a dewatered state and will be rehabilitated to a lake. The operation of the existing quarry and west extension in a dewatered state is straight forward and consistent with current operations. Water is discharged to the north and south of the site at the existing approved discharge points by two pumps. The costs associated with dewatering will be maintained by Nelson until such time as the license is surrendered. Following license surrender the cost of operating two pumps will be the responsibility of the owner at the time.				
22.	Methodology Overview The purpose of the financial impact analysis is to provide the municipalities with the financial impact on their tax-supported and rate-supported budgets. The approach utilized by Watson was devised by the firm and used for over 35 years to evaluate fiscal impact for more than three dozen landowners, various quarries and mining operations, the Ministry of Municipal Affairs, the Ontario Land Corporation, Canada Mortgage and Housing Corporation (C.M.H.C.), and various municipalities. Essentially, the methodology involves an operating and capital cost analysis. The operating cost analysis involves calculating the Region's and City's tax and non-tax figures with the addition of the proposed development. Note that for the purposes of the analysis, the most recent Financial Information Return (F.I.R.) data would be used as it provides the most up to date data on actual spending and received revenues for each municipality.	General	Watson & Associates Economists Ltd.	As confirmed to JART, Nelson has retained Altus to complete an updated financial impact study. This report should be completed in July and will be provided to JART upon completion. Altus and Watson Associates have spoken and agreed upon the base year for the updated analysis.	The methodology presented in this report is generally consistent with the approach recommended by Watson & Associates.	The methodology is generally consistent. In Watson's February 8, 2021 peer review report, a schematic of a financial impact model was included in Appendix A.	Addressed.	Comment Addressed

	The data for employment would be based on the confirmed net employment increase resulting from the quarry expansions. For the evaluation, revenues and expenditures attributable to the development would be estimated on an incremental basis. That is, revenue and expenditure dollars are assigned to the project, only in accordance with anticipated variations it would create from the base year, upon completion. Sunk costs would be ignored and service levels are planned as remaining generally constant. The capital cost analysis discusses the funding sources available to the municipalities. This would include costs for all works required due to the development and include annual lifecycle cost estimates attributable to the development. The financing methods and the resultant charges involved are variable, depending on ultimate servicing solutions, municipal financial policy decisions and detailed benefiting area calculations. The retained consultant's full methodology is provided in Appendix A to their letter report and includes a schematic of the process. Recommend that the financial impact study follow this, or a similar approach to provide each municipality with a net financial impact on their tax-supported and rate-supported budgets. Components of the Analysis Based on the information available, some initial (limited) observations can be provided, which are provided herein. Further analysis may be undertaken once additional information is provided by either the applicant or other consulting staff. Proposed Development Area and Associated Employment – The proposed development area is well defined and could be used for the financial analysis using Watson's methodology, however, as noted in previous sections, more review is required for the employment estimates. As Watson's approach utilizes the net incremental impacts, the net incremental employment would be required (i.e. additional employment from quarry, less the existing employment at the golf course and related to the farmland). Operating Revenues and Expenditures – The operating revenues and expenditures would be based on the most recent F.I.R. data for Burlington and Halton, however, as the analysis would be based on a per employee approach, the net employment would be required to conduct the operating analysis. This would identify incremental costs for other services such as							

fire, police, ambulance, etc.
Additionally, it would identify additional operating revenues such as fees, fines, etc.

Assessment, Tax Revenue, and Aggregate Licence Fees – As noted above, the information utilized for the assessment and tax revenue is based on 2008 information. Further, the aggregate licence fees are based on the 2019 rates. The following provides a summary of estimates, using 2018 tax rate information (based on the latest available F.I.R. data) and 2021 aggregate fees.

Assessment and Tax Revenue – Watson's approach to estimating the anticipated additional assessment is to calculate the existing quarry's assessed value on a per acre basis. This per acre assessed value would be the assumed value for the West and South extensions. Subsequently, the additional assessment would be multiplied by the industrial tax rates for each municipality to estimate the anticipated tax revenues.

Finally, the tax revenue from the existing properties would be netted from the calculations to arrive at a net incremental tax revenue.
These calculations are provided as follows:

Incremental Assessment
City of Burlington

Exisitng Quarry Assessed Value	$9,029,000
Existing Quarry Land Area (Acres)	546.01
Existing Assessed Value per acre	**$16,536**
Acres of Extensions	193.5
New Assessment Generated	**$3,199,779**

Note: the above assessed value per acre includes buildings. The current assessed value per acre for land only is $14,700.0. It is unclear if the extensions will include additional facilities. If they do not, the $14,700.0 per acre should be utilized to estimate new assessment generated

Existing Tax Revenue
City of Burlington

Property Type	Existing Assessment 2018$	2018 Tax Rate	Estimated Tax Revenue 2018$
Residential	$3,429,000	0.3098%	$10,624
Farmland	$1,706,000	0.0620%	$1,057
Golf Course			
Commercial	$321,000	0.4513%	$1,449
Residential	$2,046,000	0.3098%	$6,339
Managed Forest	$160,000	0.0775%	$124
Existing Tax Revenue Lost			**$19,593**

Incremental Tax Revenue
City of Burlington

Property Tax Classes		Municipal Property Tax Revenue (2018$)
1. Property Tax		
Non-residential Growth		
Industrial Assessment (IT)		*3,199,779*
Property Tax Revenue	**0.7312%**	23,396
Total Industrial Property Tax Revenue		23,396
Less Existing Property Tax Revenue		19,593
TOTAL PROPERTY TAX REVENUE		**3,803**

Note: the above tax revenue calculation assumes all new assessment will be industrial. The submission should identify the estimated portion of new assessment related to each respective tax class (e.g. industrial vs. residential, etc.).

Existing Tax Revenue
Halton Region

Property Type	Existing Assessment 2018$	2018 Tax Rate	Estimated Tax Revenue 2018$
Residential	$3,429,000	0.2676%	$9,177
Farmland	$1,706,000	0.0535%	$913
Golf Course			
Commercial	$321,000	0.3898%	$1,251
Residential	$2,046,000	0.2676%	$5,475
Managed Forest	$160,000	0.0669%	$107
Existing Tax Revenue Lost			**$16,923**

Incremental Tax Revenue
Halton Region

Property Tax Classes		Municipal Property Tax Revenue (2018$)
1. Property Tax		
Non-residential Growth		
Industrial Assessment (IT)		*3,199,779*
Property Tax Revenue	**0.6316%**	20,208
Total Industrial Property Tax Revenue		20,208
Less Existing Property Tax Revenue		16,923
TOTAL PROPERTY TAX REVENUE		**3,285**

Note: the above tax revenue calculation assumes all new assessment will be industrial. The submission should identify the estimated portion of new assessment related to each respective tax class (e.g. industrial vs. residential, etc.).

As provided above, the incremental annual tax revenue anticipated would be $3,803.0 for the City of Burlington and $3,285.0 for Halton Region.

Note: further analysis should be provided regarding MPAC assessment adjustments for residential properties within 1.0 kilometre of the proposed expansion. This may reduce the estimated tax revenue further.

Aggregate Licence Fees – As provided under the *Aggregate Resources Act* and its regulations, aggregate operators pay an annual fee based on the tonnes of aggregate extracted from the quarry. The 2021 rates for Aggregate Permits authorized to remove more than 20,000.0 tonnes annually is 20.8 cents/tonne or $724.0, whichever is greater. The fees paid are distributed as follows:

3.0 % to the Aggregate Resources Trust for rehabilitation and research;

- 61.0% to the City of Burlington;
- 15.0% to the Region of Halton; and
- 21.0% to the Crown.

As the financial impact study submitted notes that the average tonnes to be extracted from the quarry will be 1,000,000.0, the following provides a summary of the aggregate resource fees paid to each of the entities:

Allocation of Revenues	Allocation %	Allocation 2021 $
Aggregate Resources Trust	3%	$6,240
City of Burlington	61%	$126,880
Region of Halton	15%	$31,200
Crown	21%	$43,680

Capital Analysis – As noted in the previous sections, no specific capital needs were identified for this proposed development except for a crossing, to be paid for by Nelson. Further analysis needs to be conducted upon review of the submissions from the consulting team. Any capital items that may be required due to the increased truck traffic or water supply issues should be costed. If the municipalities will be ultimately responsible for any infrastructure, this amount should be analysed for ongoing lifecycle costs.

Further, broader lifecycle costs should be identified based on the City and Region's Development Charge Background Studies. As these studies identify growth-related capital needs for both the City and the Region as a whole, the incremental growth identified for this development should be apportioned their share of the growth-related lifecycle costs. This should also be included in the analysis upon further review of the consulting team submissions.

Net Financial Impact – The items noted in subsections 4.2.1 to 4.2.4 would then be summarized into a net financial impact on the tax-supported budgets and rate-supported (water and wastewater) budgets for both the City and the Region. As further information is still required, the net impact cannot be calculated at this time.

23.	Overall, the financial impact study appears to be lacking in a number of areas. The underlying information used to estimate the municipal revenues should be updated to reflect more recent information. Further, the submission focusses on the revenues and does not provide sufficient analysis on the expenditures. As a result, the net financial impact to each municipality cannot be estimated.	General	Watson & Associates Economists Ltd.	As confirmed to JART, Nelson has retained Altus to complete an updated financial impact study. This report should be completed in July and will be provided to JART upon completion.	An analysis of increased municipal expenditures was incorporated into this version of the study. The report also incorporates more recent information for revenue generation.	The financial impact study now provides a net impact to the Region and City budgets; however, revisions are suggested. See comment #8.	See response to #8 above	Comment Addressed

24.	This section summarizes the development location, existing properties in the proposed extraction areas, tonnage of aggregate anticipated to be extracted each year, plans for the rehabilitation of the extensions, and a summary of items the financial impact study will address. It is unclear if the average extraction amount of one million tonnes per year will be in addition to current extraction levels or replacing some portion of the existing extraction amounts. This should be clarified in the analysis.	Section 1. Introduction	Watson & Associates Economists Ltd.	Issued resolved. As confirmed to JART, historically the quarry has produced an average of 2 million tonnes per annum. If the Extension is approved the entire operation (existing quarry and extension) will produce approximately 1 million tonnes year. Despite this the application permits up to a maximum of 2 million tonnes per year and the impact assessments have been completed assuming this worst case scenario.	The average extraction amount of 1,000,000 tonnes per year is replacing existing extraction amounts, and effectively extending associated levies which would be exhausted if proposal was not to happen.	This information was included in the analysis, however, should not be considered as part of the net financial impact to the Region's and City's budgets, as this revenue is not additional incremental revenue.	See response to #8 above	Comment Addressed
25.	This section identifies specific financial commitments for which Nelson agrees to take responsibility. These include two main cost components: • A crossing upgrade on No. 2 Sideroad: This crossing upgrade is required for the trucks to access the Southern Extension from the main quarry. It is indicated that the cost to upgrade this crossing would be funded by Nelson along with the ongoing operating costs and maintenance of the crossing. Water Supply: It is noted that Nelson would be responsible for the cost of any replacement water supply if it has been impacted by the quarry. This section details the complaint process if there is an issue and the temporary solutions that would be employed until the local residents' well supply is restored. With respect to the upgraded crossing on No. 2 Sideroad, a description of what work is expected to be undertaken along with the estimated costs should be identified in the analysis. With respect to the water supply, it is unclear if there are potential impacts that should be considered. The retained consultant would await the peer reviews being undertaken by the consulting team to determine if there are financial impacts that need to be addressed	Section 2. Undertaking of Financial Commitments	Watson & Associates Economists Ltd.	Comment noted. Also see response to Comments 3, 4, and 9.	There will be no impact to the water supply. The financial impact from the Sideroad 2 extension will be borne by Nelson and there will be no impact or cost to the Region or City.	The Altus report notes that all expenditures related to the crossing and related to impacts of the water supply would be funded by Nelson.	Addressed.	Comment Addressed

26.	Section 3.0 of the analysis identifies various examples of road crossings for aggregate quarries. There are various crossing types identified here, so it is not clear which type will be constructed for the Nelson expansion.	Section 3. Road Crossings	Watson & Associates Economists Ltd.	The proposed road crossing as noted on the ARA Site Plans will be stop sign controlled for the truck crossing (two way stop). There will be no stop signs restricting traffic on No. 2 Sideroad.		It was noted that the detailed crossing will not be prepared until the application is approved, however, sample crossings were provided. As these crossings will be funded by the applicant, there are no further financial impact questions, although other areas of review may require further detail.	Addressed.	Comment Addressed
27.	Section 4.0 of the financial impact analysis notes that the trucks from the proposed extensions will utilize the existing entrance/exit and haul route. This section further states that no fees can be charged with respect to the additional costs due to the increased truck traffic. It is unclear as to whether the anticipated extractions (one million tonnes per year) are in addition to the current level of extraction or if these extractions are replacing the current level of extractions. If the level of extraction is higher than the current level, this would impact the road base, traffic, etc. through higher truck volumes on the haul routes. The retained consultant would await the peer reviews from the consulting team to advise on potential capital impacts.	Section 4. Maintenance of Roads	Watson & Associates Economists Ltd.	Issue resolved. As confirmed during our meeting the quarry will not result in an increase in traffic.	The average extraction amount of 1,000,000 tonnes per year is replacing existing extraction amounts, and effectively extending associated levies which would be exhausted if proposal was not to happen.	Aggregate licensing fees were included in the analysis, however, should not be considered as part of the net financial impact to the Region's and City's budgets, as this revenue is not additional incremental revenue.	See response to #8 above.	Comment Addressed
28.	This section identifies anticipated tax revenues, aggregate fees, employment estimates, and spin-offs to local businesses. Further, this section also notes that the existing quarry does not utilize most of the public services and infrastructure provided by the Region and the City. Tax revenues: The anticipated tax revenues are provided on an annual basis however; they are based on 2008 information (as identified in the Altus report). These revenues should be updated based on more recent assessment values as well as the current tax rates. Moreover, as the quarry extensions will be on existing development land, the tax revenue lost should also be identified, providing for a net annual tax revenue realized.	Section 5. Financial Considerations	Watson & Associates Economists Ltd.	As confirmed to JART, Nelson has retained Altus to complete an updated financial impact study. This report should be completed in July and will be provided to JART upon completion.	The base-year for this study is 2019, given the availability of Municipal financial data from that year.	The analysis was updated; however, the assessment and tax revenue estimates appear to be overstated. See section 2.2 of Watson's January 2022 memo.	See response to #8 above.	As stated in comment #7 above; the assessment and tax revenue estimates appear to be overstated and the item was not addressed in the latest resubmission.
29.	This section identifies anticipated tax revenues, aggregate fees, employment estimates, and spin-offs to local businesses. Further, this section also notes that the existing quarry does not utilize most of the public services and infrastructure provided by the Region and the City.	Section 5. Financial Considerations	Watson & Associates Economists Ltd.	As confirmed to JART, Nelson has retained Altus to complete an updated financial impact study.	As discussed in detail in this report, given the proximity of the existing quarry to the new quarry, it is expected that the area of impact	The analysis was updated; however, the assessment and tax revenue estimates appear to be overstated. See section 2.2 of Watson's January 2022 memo.	See response to # 7 and 8 above.	As stated in comment #7 above; the assessment and tax revenue estimates appear to be overstated and the item was not addressed in the latest resubmission.

	Assessment Adjustments: Historically, MPAC provides assessment adjustments to residential properties within 1.0 kilometre of quarries. The proposed quarry extensions may reduce assessed values of residential properties, thus reducing tax revenues. This should be included in the analysis.			This report should be completed in July and will be provided to JART upon completion.	would significantly overlap between the two extraction sites. To the extent that additional properties will be within 1km radius of the new extraction site, other properties currently within 1km of the active extraction area may see an offsetting increase to assessment values. Most properties along Cedar Springs Road and Sideroad 2 in closest proximity to the west and south quarry extensions are already well within the 1km radius of the existing site and based on MPAC's stated approach would not be affected by the extensions Based on our review of the areas being added/removed from the MPAC 1km radius, it is therefore expected that these two effects would offset each other and result in little to not net effect on surrounding properties as a whole.	In Watson's February 8, 2021 peer review report, it was noted that further analysis should be provided regarding MPAC assessment adjustments for residential properties within 1km of the proposed expansion. Further, adjustments should be made for properties that are currently within the 1km boundary that will now be considered adjacent to the quarry. The Altus report acknowledges that MPAC adjusts residential properties adjacent to an active or proposed gravel pit downward by 4% (should be 6% as provided by correspondence with MPAC) and residential properties within 1km by 2%. However, the Altus report suggests that there are an equal number of properties within 1km of the new area as are within 1km of the existing area that will no longer be adjusted. Therefore there would be no impact. Rather than a general statement, the calculations should be undertaken to ensure there is no reduction in overall assessment. With respect to the properties on Cedar Springs Road that will now be adjacent to the West Quarry Extension, no calculation adjustment has been provided. The houses that have frontage on Cedar Springs Road should have their assessment adjusted downward the additional 4%.		

30.	This section identifies anticipated tax revenues, aggregate fees, employment estimates, and spin-offs to local businesses. Further, this section also notes that the existing quarry does not utilize most of the public services and infrastructure provided by the Region and the City. Aggregate Licence Fee: This appears to be based on 2019 rates. These rates were updated for 2021 from 19.8 cents/tonne to 20.8 cents/tonne. This revenue estimate should be updated using the most recent available data.	Section 5. Financial Considerations	Watson & Associates Economists Ltd.	As confirmed to JART, Nelson has retained Altus to complete an updated financial impact study. This report should be completed in July and will be provided to JART upon completion.	The current aggregate licence fees (20.8 cents/tonne) will be incorporated into this analysis	As noted, the 1,000,000 in aggregate extraction does not represent an increase in extraction, rather the existing level will be maintained. As a result, aggregate license fees should not be considered as part of the net financial impact to the Region's and City's budgets, as this revenue is not additional incremental revenue.	See response to #8 above.	Comment addressed.
31.	This section identifies anticipated tax revenues, aggregate fees, employment estimates, and spin-offs to local businesses. Further, this section also notes that the existing quarry does not utilize most of the public services and infrastructure provided by the Region and the City. Employment Estimates: In regard to their lands, the employment estimates are based on their observed number of employees however, it is unclear if these are in addition to existing employees or just a restatement of existing (i.e. due to a shift in extraction efforts to the extension from the existing quarry). Further, as the West extension will replace the existing Burlington Springs Golf Course, there would be some loss of employment. This could include anywhere from 10 to 20 full-time equivalent employees. Further, as the South extension replaces existing farmland, potential agricultural employment may be impacted. This information should be included in the analysis.	Section 5. Financial Considerations	Watson & Associates Economists Ltd.	As confirmed to JART: The Extension results in a restatement of existing quarry employees; and Nelson has retained Altus to complete an updated financial impact study. This report should be completed in July and will be provided to JART upon completion.	This net change in employment from moving operations from the existing site to the subject site, including the loss of employment at the Burlington Springs GCC has been incorporated into this analysis	The Altus report notes a continuation of existing employment, including the loss of employment at the golf club. It should be noted that the number of jobs is not incremental to current operations but is rather a continuation of existing levels.	The study did not evaluate the losses to employment on the golf course, however did also not estimate the potential savings to the City / Region from the decreased traffic associated with daily trips to/from the golf course by both employees and guests of the facility. See memorandum included as **Tab 1** for more details.	Altus has confirmed this is the case and noted that although the employment loss from the closure of the golf course was not included in the analysis, neither was the reduction in operating costs (i.e. savings) arising from the reduced golf course customer traffic.
32.	This section identifies anticipated tax revenues, aggregate fees, employment estimates, and spin-offs to local businesses. Further, this section also notes that the existing quarry does not utilize most of the public services and infrastructure provided by the Region and the City. Spin-off Employment: This assessment appears to be based on the 2008 analysis conducted by Altus Group. As this study is 13 years old, this information should be updated.	Section 5. Financial Considerations	Watson & Associates Economists Ltd.	As confirmed to JART, Nelson has retained Altus to complete an updated financial impact study. This report should be completed in July and will be provided to JART upon completion.	This component of our analysis has been updated.	The approach to the calculation is valid (i.e. input-output multiplier method), however, it should be noted that the number of jobs is not incremental to current operations but is rather a continuation of existing levels.	As without approval of the new quarry, the existing jobs would no longer continue once the existing quarry is exhausted or production is significantly reduced, the inclusion of these jobs in the study is reasonable.	Comment addressed

33.	This section identifies anticipated tax revenues, aggregate fees, employment estimates, and spin-offs to local businesses. Further, this section also notes that the existing quarry does not utilize most of the public services and infrastructure provided by the Region and the City. Use of Services: The report states that the quarry does not utilize most municipal services. However, the quarry does receive benefit from the availability of other services such as police, fire, ambulance, etc. which, similar to many other businesses and residents, use these services as required. There would be some additional increase in operating costs that should be considered and quantified.	Section 5. Financial Considerations	Watson & Associates Economists Ltd.	Issue resolved. As confirmed in our meeting the quarry is not increasing capacity and therefore there will not be an increase in incremental operating costs. If anything once the golf course is no longer in use there would be a decrease in costs to the City and Region. Furthermore Nelson works cooperatively with the local fire department and police to provide a location for training at the Nelson Quarry.	The costs associated with these municipal services have been incorporated into our analysis	Suggested revisions to the operating cost impacts are noted in the Watson memo, dated January 2022. In estimating the impacts to the municipalities' budgets, a review of incremental operating expenditures (net of revenues) was undertaken. The basis for the operating expenditures is the Region and City's Financial Information Returns (FIRs). This is consistent with the information that Watson would utilize in this analysis. The Altus Report uses incremental property assessment to estimate the change in operating expenditures. This approach is not typically utilized by Watson; however, it was noted that this approach has been used and accepted at the LPAT (now known as the OLT). As a result, Watson would not comment on the validity of this approach. Within Altus' analysis, an assumed growth factor is used to identify how each service's expenditures would change with the addition of the development (and corresponding loss of the existing properties). As the overall assessment is decreasing, the analysis assumes a decrease in operating expenditures. There are a few services where further rationale should be provided: • Fire & Police: it is assumed that for every dollar of assessment lost,	See response to #8 above.	Comment addressed

						the operating cost of fire and police services will be reduced proportionately. How would the operations of these services decrease with the change in assessment? A more reasonable assumption may be to reduce the 100% growth factor as the reduction in assessment here may not have the same effect as adding the same dollar amount of assessment elsewhere in the City and Region. • Roads & Winter Control: it is assumed that these services will also decrease proportionately, however, there is no reduction in the City and/or Region's road network. As a result, the municipalities operating cost of maintenance, snow clearing, etc. on municipal roads would not be anticipated to change. • All Other Services: similar to fire and police, a more reasonable assumption for a reduction in operating costs would be to reduce the growth factor. This should be reviewed for each service.		

CONSERVATION HALTON COMMENTS

Proposed Burlington Quarry Expansion
Interim JART COMMENT SUMMARY TABLE – Hydrogeology

Please accept the following as interim feedback from the Burlington Quarry Joint Agency Review Team (JART). Fully addressing each comment below will help expedite the potential for resolutions of the consolidated JART objections and individual agency objections. **Additional, new comments may be provided once a response has been prepared to the comments raised below and additional information provided**.

	JART Comments (February 2021)	Applicant Response	Interim JART Response (February 2022)	Applicant Response (June 2022)	JART Response (June 2023)
1.	All studies should be coordinated and integrated. In particular, the findings of the Hydrogeologic and Hydrologic Impact Assessment, Surface Water Assessment and Level 1 and 2 Natural Environment Technical Report should inform each other and should be reviewed for consistency.	Agreed. Our integrated modelling approach was meant to help facilitate the exchange of information across disciplines. A package of interdisciplinary tables addressing both wetland and watercourse characterization and impact analysis has been prepared and provided as Schedules B and C.	Not addressed. The wetland characterization summaries only provide an annual water budget analysis, and the impact assessment and mitigation sections do not include the requested ecological interpretation for existing (as per the TOR with proposed 25-year baseline), interim (for each identified extraction phase) and both post extraction scenarios (rehabilitation scenario 1 and rehabilitation scenario 2). Please revise, present, and summarize daily water balance analyses as average monthly water volumes in tabular format, showing existing, interim and post extraction (as outlined above) with and without mitigation to establish and confirm seasonal variations and include an ecological interpretation for the results. This will set targets/thresholds required to ensure no negative impacts. The watercourse characterization summaries only provide groundwater interactions and proposed reductions, however do not include surface water flow analysis, impact assessment or mitigation sections for existing, interim and post extraction scenarios (as outlined above). Update to integrate surface water analysis, revise to present and summarize with and without mitigation to establish seasonal variations and include ecological interpretation of the results. This will set targets/thresholds required to ensure no negative impacts.	Our study, and the follow-up response to comments, has been highly integrated. . In this response, the reviewer brings up a second issue regarding monthly water budgets. The lack of monthly water budgets in the original report is not a reflection on the level of integration of this study. Hydrographs of daily flows, stage, and groundwater levels and other water budget components were provided to the other team members during the course of the project and were provided in a submission to MNDMNRF and JART. Average monthly water budgets are inferior to our submission of annual summaries and graphs of daily components. Monthly average water budgets smear the effects of wetland function because of changes in the timing of the arrival of the spring freshet and lagged changes in surface and groundwater storage. For example, the spring freshet may occur entirely in one month, or span a month boundary. Further, surface water and groundwater storage response are also lagged. The water course summaries were in response to a request by MNDMNRF to provide information on available data and model prediction on a feature- by-feature basis to ease review. The package was meant to provide the granular data (i.e., daily values) to supplement the original report which provides more general discussions of overall impact of existing, interim and post extraction conditions.	On January 1, 2023, Ontario Regulation 596/22 came into effect. As a result, technical review services for planning and development applications previously provided by Conservation Halton (CH) under Memorandums of Understanding with municipalities (e.g., technical reviews related to natural heritage and select aspects of stormwater management) can no longer be provided. As such, we defer this comment to the other JART members to confirm whether it has been addressed. Halton Region staff have reviewed Nelson's response and provided the following JART response: The original comment still stands as all studies should be coordinated and integrated and be reviewed for consistency.
2.	The proposed external catchment diversion along Colling Road should be discussed within the Impact Assessment, with modeling updated if necessary. Identify and address any uncertainty associated with completion of these works within the analysis and report.	The roadside ditch along Colling Rd. currently flows into the quarry at Blind Line. The diversion is to carry ditch further along to discharge to the unnamed tributary to Willoughby Creek. An approval for the diversion will be required. As noted by Tatham, the Colling Road diversion is not central to the management of quarry water. If the diversion is not approved, the surface runoff from north of Colling Road will continue to drain through the quarry as it currently does. Accordingly, we simulated the ditch as it is currently configured in the remedial scenarios.	Not addressed. To approve the diversion the proposed external catchment diversion along Colling Road should be discussed within the Impact Assessment, with modeling updated if necessary.	As noted, the roadside ditch along Colling Rd. was simulated as it is currently constructed. Diverting the ditch would only reduce the amount of water needed to be pumped to dewater the quarry. The water is not needed for operations and natural discharge of this water -- rather than as pumped discharge -- would not alter the water budget for the tributary to Willoughby Creek.	This comment has been addressed from a natural hazard perspective based on a supplementary submission received from the proponent. In the April 13, 2023 Tatham Engineering “Nelson Quarry, Burlington, Response to Comments” supplementary memo, the proponents 1) submitted additional analysis for the erosion hazard for the West Branch of the Mount Nemo Tributary of Grindstone Creek, and 2) have committed to removing the proposed Colling Road diversion and updating the site plan and AMP to reflect that removal. As a result, CH staff is satisfied that our outstanding natural hazard related comments have been addressed. We defer this comment to the other JART members to confirm whether it has been addressed from their perspective.
73.	It is reported 5 out of 22 wetlands receive a groundwater discharge (less than 3.0% of the total inflows). Is this based on monitoring or model results? What year does this represents? How does this relate to potentially wetlands already being impacted by existing quarry operations? High water table may not only provide minor inputs, but also prevent surface water from infiltration, and hence, extend the wetland hydroperiod. Loss of groundwater inputs can also have an impact on wetland water temperature and have impact on the amphibian breeding in the ponds. Has this been assessed?	Please see response to comment 5, and our detailed response to MNRF wetland questions. The statement was based on model results based on averaging over the simulation period for the baseline (model calibration) scenario. This statement relates to simulations of 2004 to 2015 conditions, a period which was felt to reasonably represent current conditions. The quarry extent and quarry water management were representative of that period. The position of the water table is an important factor in the wetland water balance, controlling the rate of leakage into and out of the wetlands as well as controlling runoff and interflow. Changes in groundwater discharge to the wetlands have been assessed in all the quarry development phase simulations.	It is our understanding that the impact assessment and calculation of the water balance components for wetlands was completed using the WY2010-2019 not 2004-2015 GS Flow simulation, please explain. Based on recent modelling meetings and additional discussions it is understood that the reported groundwater inflows are averages based on WY2010-2019 GS Flow model results, which represent conditions potentially impacted by existing quarry operation.	This was a typo. The text should have read WY 2010-2019.	On January 1, 2023, Ontario Regulation 596/22 came into effect. As a result, technical review services for planning and development applications previously provided by Conservation Halton (CH) under Memorandums of Understanding with municipalities (e.g., technical reviews related to natural heritage and select aspects of stormwater management) can no longer be provided. As such, we defer this comment to the other JART members to confirm whether it has been addressed. Norbert Woerns has reviewed Nelson's response and provided the following JART response: (modelling comment) CHRIS NEVILLE: UNRESOLVED. The Applicant Response of June 2022 resolves the Interim JART Response of February 2022, and addresses the first and third of the JART February 2021 comments. However, the Applicant Responses do not address the second JART February 2021 comments. Did any of the other 17

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					wetlands receive groundwater discharge before they were impacted by existing quarry operations?
4.	It is reported the West Extension is next to a locally significant groundwater discharge area, which helps to mitigate the local effects of the excavation. Although it can limit the propagation of the drawdown away from the extraction, lowering of the groundwater levels due to extraction would reduce the amount of discharge in the locally significant groundwater discharge area and hence can be deemed a negative impact. Please address these potential negative impacts in the report.	The main body of the report provides more detailed discussions of the simulations used to assess changes in groundwater levels and the changes in groundwater discharge and streamflow due to reductions in groundwater levels. The model demonstrates that the west extension will intercept a portion of recharge that currently infiltrates through the golf course before discharging into the Medad Valley. The proposed infiltration pond system will mitigate that effect, but any remaining water that is intercepted will simply be discharged through the north discharge point and into the Medad Valley to the north of the current discharge. Please refer to the MNRF Comment Response figure titled “Wetland 13204 – Graph 5” on page 161 (PDF page 292) and the associated discussion for an assessment of the change in soil moisture that will occur due to this change.	This is an assumption that the proposed infiltration pond will function as modelled. It is one thing to make it work in the model and another thing to ensure that it works as designed in reality. What would be the monitoring, mitigation and contingency mechanism to ensure that the recharge/infiltration is constant and sufficient to maintain the pre-extraction groundwater levels?	The infiltration pond was simulated in a very conservative manner as a shallow pond sitting on the Halton Till (similar to the Golf Course ponds it replaces. Simulations requested by MNDMNRF considered a deeper lake excavated to the top of the weathered bedrock which would have higher infiltration rates. Please refer to Schedule 1 and 2 for additional details about the infiltration pond and effects on the Medad Valley. Regardless, the updated Adaptive Management Plan addresses any uncertainty that may come out of the work completed by Earthfx and Tatham.	On January 1, 2023, Ontario Regulation 596/22 came into effect. As a result, technical review services for planning and development applications previously provided by Conservation Halton (CH) under Memorandums of Understanding with municipalities (e.g., technical reviews related to natural heritage and select aspects of stormwater management) can no longer be provided. As such, we defer this comment to the other JART members to confirm whether it has been addressed. Norbert Woerns has reviewed Nelson's response and provided the following JART response: UNRESOLVED – The AMP does not provide reliable alternatives to addressing well interference in the absence of the infiltration pond mitigation.
79. (A)	Although, this section states this hydrogeological assessment has been completed in accordance with Terms of Reference for the Level 1 and 2 Hydrogeological and Hydrologic Impact Assessment of the Proposed Burlington Quarry Extension (February 2020), the TOR states that a 25-year baseline period would be simulated including dry year 2007, wet year 2008 and average conditions year 2009. It seems only 10-year period was simulated as baseline, which does not include the specified period 2007-2009. Please include a 25-year baseline period as proposed in the TOR.	The selected period includes the Ontario Low Water Response Level 2 Drought condition that was posted by Conservation Halton on August 10, 2016. Monitoring data from prior to 2004 was limited, reducing the value of simulations prior to that time.	This is a major deviation from the TOR. Contrary to 2007 drought there is limited monitoring data for the Level 2 Drought condition in 2016.	The reasons for the selected time period were clearly discussed at our JART modelling meeting in November, 2021. These include an advancing quarry face and a more limited monitoring network. As we noted herein and in subsequent meetings with JART, long run times and model stability issues created practical limitations for the model run times. (The stability issues were not related to the quarry but rather to conditions at Mt. Nemo, where the Escarpment is very steep) As well, there was a benefit to running the model for a period for which some observational data were available. The model simulation started in 2009 (WY2010) and extend to 2019. As was noted, there are dry periods and wet periods within that span.	On January 1, 2023, Ontario Regulation 596/22 came into effect. As a result, technical review services for planning and development applications previously provided by Conservation Halton (CH) under Memorandums of Understanding with municipalities (e.g., technical reviews related to natural heritage and select aspects of stormwater management) can no longer be provided. As such, we defer this comment to the other JART members to confirm whether it has been addressed. Norbert Woerns has reviewed Nelson's response and provided the following JART response: (modelling comment) CHRIS NEVILLE: UNRESOLVED. The modelling period 2009-2019 was a major deviation from the 25 years indicated in the Terms of Reference. The Application has indicated that the modelling period that was selected included the Ontario Low Water Response Level 2 Drought condition posted by Conservation Halton on August 10, 2016. However, as noted in the Interim JART Response of February 2022, there is limited monitoring data for the Level 2 drought condition in 2016. In contrast, there are monitoring data from the 2007 drought, which were excluded from the analyses.
79. (B)	Hydrogeological and Hydrologic Impact Assessment of the Proposed Burlington Quarry Extension (February 2020), the TOR states that a 25-year baseline period would be simulated including dry year 2007, wet year 2008 and average conditions year 2009. It seems only 10-year period was simulated as baseline, which does not include the specified period 2007-2009. Please include a 25-year baseline period as proposed in the TOR.	Long run times and model stability issues created practical limitations for the model run times. The stability issues were not related to the quarry but rather to conditions at Mt. Nemo, where the Escarpment is very steep. One option to improve stability and reduce model run times was to remove the lower escarpment area from the simulations. This would have prevented any analysis of headwater tributaries below the escarpment. The decision was made to use a 10-year period and maintain a larger model area.	Why was this not consulted with the agencies?	This was felt to be mainly a technical issue related to model stability. Given that we were able to simulate the period with logger data, we did not feel that additional insight would be gained by simulating the full 25-years to cover periods with either no data or monthly data only. A 20-year PRMS simulation was completed. The evaluation of potential effects on headwater streams at the base of the escarpment was considered important.	On January 1, 2023, Ontario Regulation 596/22 came into effect. As a result, technical review services for planning and development applications previously provided by Conservation Halton (CH) under Memorandums of Understanding with municipalities (e.g., technical reviews related to natural heritage and select aspects of stormwater management) can no longer be provided. As such, we defer this comment to the other JART members to confirm whether it has been addressed. Norbert Woerns has reviewed Nelson's response and provided the following JART response: (modelling comment) CHRIS NEVILLE: UNRESOLVED. As indicated in the Interim JART Response of February 2022, the 25-year simulation indicated in the Terms of Reference should have been conducted. The alternative is that a detailed assessment of all of the available data should have been prepared to confirm that the 10-year period selected for the simulation period was sufficient to provide a representative coverage of baseline conditions.

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82.	To complete a surface water and groundwater impact assessment on the natural environment and private water supplies the baseline conditions scenario should represent unaltered conditions in terms of groundwater and surface water. The modelled current/ baseline scenario (2010 onwards) does not account for quarry impacts to date, i.e. what was the extent and impact of groundwater cone of depression, what were the changes to groundwater levels and vertical gradients, changes to surface water pattern and flows and surface and groundwater interactions?	Please refer to Response 15, above. Again, the study scope was directed to assessing the impact of the proposed quarry extension. There was a recognition that the expansion could impact nearby wetlands and private wells, and the study was undertaken to quantify the likely effects.	Currently, Nelson quarry operates under interim conditions. We disagree with the premise that the impacts created by the existing quarry should be overlooked and only an assessment of the additional impact of the proposed quarry extension carried out. As per the response to this comment the Nelson study team recognizes potential impact by the proposed extension. Following the same logic the existing quarry impacts should be recognized and quantified. The proposed rehabilitation of the quarry would preserve any impacts from the existing operation in perpetuity.	The model does assess the “cumulative effects” of all existing and proposed stages of quarry excavation. Results were presented in terms of absolute water levels and streamflow’s, not just in terms of change, so the cumulative impacts were fully taken into consideration. We also present incremental drawdowns from a fully transient 10-year baseline condition. It should be noted that the existing quarry is near full buildout and additional drawdowns due to ongoing operations are not expected. Similarly, our simulations of quarry rehabilitation analyzed the cumulative effects of rehabilitating both the existing and expanded site.	On January 1, 2023, Ontario Regulation 596/22 came into effect. As a result, technical review services for planning and development applications previously provided by Conservation Halton (CH) under Memorandums of Understanding with municipalities (e.g., technical reviews related to natural heritage and select aspects of stormwater management) can no longer be provided. As such, we defer this comment to the other JART members to confirm whether it has been addressed. Norbert Woerns has reviewed Nelson's response and provided the following JART response: (modelling comment) I agree with CH comment) Existing quarry impact may be included in existing conditions however they should be specifically identified CHRIS NEVILLE: UNRESOLVED. The Applicant responses are internally contradictory. In the Application Response it is indicated that the scope of the analyses was directed to assessing the impact of the quarry extension. However, in the Applicant Response of June 2022 it is indicated that potential impacts are presented with respect to a baseline condition with the existing quarry already near full buildout conditions. Contrary to what is suggested in the Application Response of June 2022, the model does **not** assess the “cumulative effects” of all existing and proposed stages of quarry excavation.
85.	It is reported in this section that data collected for previous studies (see below), have been incorporated into this assessment: Investigation by Golder in support of a previously south quarry extension (Golder, 2004) Additional hydrogeologic field studies of wetland/groundwater interaction (Golder, 2006) An assessment of water budgets for individual wetlands in south extension area (Golder, 2007) A study of the shallow overburden (Golder, 2007) However, it seems limited data from these studies have been included in this report for the reviewer to understand quarry expansion impacts on the surface water and groundwater regimes and their interactions within the natural features. Please expand and clarify how previous data have been used in the report conclusions.	The Golder data and reports were **fully** integrated into the database and analysis. The Golder data are high quality and clearly presented in the previous reports, so simply replicating the data in a new format would have limited value. Please also refer to Response 10 and 11, above. The key aspect of the Earthfx approach was to fully integrate the Golder data, plus the extended long- term measurements, into a fully transient 10-year assessment. Geologic data were used in site characterization and construction of the hydro stratigraphic model. Groundwater level data, aquifer test data, and streamflow data were used in site characterization, model construction, and model calibration. Comparative assessments of updated water budgets were compared against previous to check that model assessment was reasonable. We did not replicate the previous data reports within our reports. We believe that the data were made public through the previous application and that all parties have access to this information.	Not addressed. This is a new application, and all supporting data should be included in the reports as appendices and be appropriately referenced. Please update the reports to include this data.	Work completed by other professionals is commonly referenced in technical studies. This work has already been reviewed and we did not believe it necessary to pad out our report with previously submitted data. However, we did present all available data as hydrographs in our meeting with JART team members.	On January 1, 2023, Ontario Regulation 596/22 came into effect. As a result, technical review services for planning and development applications previously provided by Conservation Halton (CH) under Memorandums of Understanding with municipalities (e.g., technical reviews related to natural heritage and select aspects of stormwater management) can no longer be provided. As such, we defer this comment to the other JART members to confirm whether it has been addressed. Norbert Woerns has reviewed Nelson's response and provided the following JART response: UNRESOLVED - Inclusion of all relevant previous hydrogeological data would demonstrate completeness of the investigations and facilitate review of the hydrogeological investigations.
88.	It is impossible to depict some of the monitors on Figure 3.4. Please provide a larger scale map clearly showing all the monitoring location.	The map below shows the well distribution where they are tightly clustered.	Addressed	RESOLVED	RESOLVED
120	How was the subsurface conduit to model the disappearing stream segment represented in the model?	The SFR2 stream segment was assumed to interact (i.e., gain or lose flow to the weathered bedrock) with Layer 4. The stream had a relatively narrow section (same as a Strahler Class 2) and a bed hydraulic conductivity of 1x10-4 m/s compared to normal streams in Layer 1 (5x10-7 m/s).	Addressed.	RESOLVED	RESOLVED

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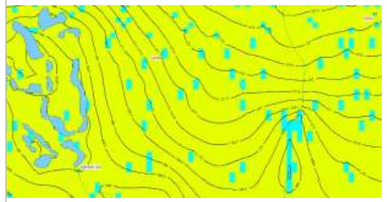
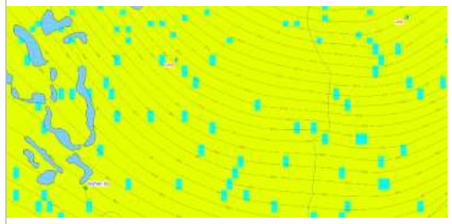
122.	It is noted that low and high limits of bulk hydraulic conductivities for Amabel Formation used in the model as presented in Table 5.1 are some of the lowest values reported by others. How do hydraulic conductivities used in the model compare to the on-site field investigation derived data? The use of a uniform hydraulic conductivity data may work well for the overall system response, but please confirm if it is suited to represent local groundwater and surface water interactions? Although a lot of field testing to obtain hydraulic conductivity data was done on and in vicinity of the site, instead of using them to refine the model and to represent local conditions, a uniform hydraulic conductivity values are used, please explain.	It should be noted that the range in values cited was relatively small, so being in the lower range is not that significant. Early in the study, we used the model to replicate the aquifer testing results and ultimately selected values that were comparable. The packer test data vary over a large range and our value is within the range of reported results. We analyzed the water level data and tested to see if there was any consistent pattern to assign spatial variability to the model parameters. In particular, early in the study we used the pilot point technique in conjunction with PEST to create an interpolated hydraulic conductivity field. In the end, we found no consistent pattern and went back to uniform property assignment.	How is this representative of the field derived data? The model starts with an assumption that all wetlands interact with groundwater irrespective of the underlying soils properties. The report should clearly recognize that using uniform hydraulic conductivity values may be detrimental to local hydrologic responses.	Assuming that the measured values vary randomly about the mean hydraulic conductivity and based on the lack of clear spatial trends in the data, the assumption of stationarity is not unreasonable. Further, the regional scale advance of the Halton ice sheet would suggest that the depositional process is similarly regional and relatively uniform. The model match to the large seasonal fluctuations in the bedrock suggests that the many surface and shallow till processes are creating an accurate system behavior. As we have noted, we also adapted a hybrid approach in which horizontal fracture zones and the random occurrence of vertical fractures were represented explicitly. This was done specifically to <u>better</u> represent local response to stress in the immediate quarry vicinity.	On January 1, 2023, Ontario Regulation 596/22 came into effect. As a result, technical review services for planning and development applications previously provided by Conservation Halton (CH) under Memorandums of Understanding with municipalities (e.g., technical reviews related to natural heritage and select aspects of stormwater management) can no longer be provided. As such, we defer this comment to the other JART members to confirm whether it has been addressed. Norbert Woerns has reviewed Nelson's response and provided the following JART response: (modelling comment) CHRIS NEVILLE: UNRESOLVED. The modelling approach ~~requires~~ that was adopted assumed the application of uniform hydraulic properties over the study area. It should be recognized and acknowledged that this approach will have limited ability to predict local hydrogeological variations and resulting impact on individual private wells.
123.	The representation of vertical fractures to connect the shallow and deeper systems by adjusting Kh/Kv anisotropy value to 1:1 of model Layer 5 and Layer 7 in 5.0% of model cells maybe a good fit for the overall regional groundwater conditions. This approach suggests that areas not underlain by the model cells where Kv/Kh anisotropy was not adjusted may be subject to reduced groundwater flux than areas where the adjustment was made. Considering the above, this approach may misrepresent groundwater and surface water interactions within streams and wetlands depending on the location of the zones with adjusted parameters. Please reconsider this approach.	Adding vertical fractures to connect the shallow and deeper systems by adjusting the Kh/Kv anisotropy values was done more to fit local response in the vicinity of the quarry face rather than improving regional groundwater heads. In general, the simulated heads (Layer 4 average heads shown with a 0.5 m contour interval overlying the Layer 5 VKA assignment) show small localized breaks in slope in the vicinity of the fracture zones (indicative of groundwater moving down to deeper zones) but much larger changes in the vicinity of surface water features. Layer 7 heads (second figure) show little change in the vicinity of the fracture zones and the only break in slope occurring near the karst stream segment. There is likely little impact in the vicinity of the streams.  	The figures provided in the response are for an area where quarry impact is most likely small (small head differences between the model layers). The north-west corner seems to capture Camile golf course ponds which are at similar distance as the tip of the proposed extension some 1 km away from the existing quarry. What are the impacts closer to the quarry face especially where wetlands are located?	As was noted, we added vertical fractures connecting the shallow and deeper systems specifically to fit local response in the vicinity of the quarry. The vertical fractures are likely randomly distributed about the study area and we attempted to represent their frequency and hydraulic effect, but there is no way to know their exact locations. In our response to MNDMNRF (Earthfx, March 2021) we provided extensive observational proof that the quarry has not impacted wetlands in close proximity to the advancing face (see Section 4, and Wetland 10/13015 and Wetland 3 discussion, among others).	On January 1, 2023, Ontario Regulation 596/22 came into effect. As a result, technical review services for planning and development applications previously provided by Conservation Halton (CH) under Memorandums of Understanding with municipalities (e.g., technical reviews related to natural heritage and select aspects of stormwater management) can no longer be provided. As such, we defer this comment to the other JART members to confirm whether it has been addressed. Norbert Woerns has reviewed Nelson's response and provided the following JART response: (modelling comment) CHRIS NEVILLE: UNRESOLVED. No data are presented to support the inclusion of the vertical fractures in the model – neither their locations nor their frequency. No evidence is presented to support the conceptualization of the fractures as vertical prisms having dimensions of the grid blocks in the model.
126.	As per Figure 18.20 it appears that the cells with increased vertical hydraulic conductivity are not present within some 100.0 meters of the edge of escarpment and within the Medad valley – please explain. Based on the retained consultant's experience the distribution of vertical fractures near the escarpment tends to be higher (halo effect).	Each cell in the model was assigned a random number from 0 to 1. Five percent of the cells (those with a random number between 0.95 and 1, for example) were assigned a different VKA value. There was no consideration of proximity to the Niagara Escarpment so some cells must have higher VKA in proximity to the Escarpment. Incorporation of an enhanced fracturing halo zone was tested early in the model development but was not found to improve results.	Neither Figure 18.20 nor 18.21 show any cells within at least 100 m along the east boundary of the escarpment. Higher hydraulic conductivities along the fringe of the escarpment may have impact on the groundwater levels, shift the groundwater divide closer to the quarry, etc. The last statement about testing the halo zone which resulted in no improvement of the results is rather subjective. To represent groundwater conditions, the model should be built using available data to a maximum extent possible.	The cells were distributed randomly. It is not subjective; we compared results to interpolated maps of water levels and did not achieve a better match with the halo, indicating that the halo effect, if present, is not as pronounced as in other study areas.	On January 1, 2023, Ontario Regulation 596/22 came into effect. As a result, technical review services for planning and development applications previously provided by Conservation Halton (CH) under Memorandums of Understanding with municipalities (e.g., technical reviews related to natural heritage and select aspects of stormwater management) can no longer be provided. As such, we defer this comment to the other JART members to confirm whether it has been addressed. Norbert Woerns has reviewed Nelson's response and provided the following JART response: (modelling

					comment) CHRIS NEVILLE: UNRESOLVED. The Applicant responses confirm that no physical consideration was given to the specification of model cells with increased vertical hydraulic conductivities. As indicated in the Applicant response, no consideration was given to the proximity to the Niagara Escarpment.
129.	It is suggested in the second paragraph of this section, based on Figure 5.12 which presents water levels in OW03-14C that quarry influence is less than 200.0 meters from the quarry face. Based on other monitoring well results it seems that this may be true for this location only suggesting that the aquifer is not uniform, and which puts in question the use of uniform hydraulic conductivity values in model layers. Please reconsider the use of uniform hydraulic conductivity values in the model.	This area is the most monitored in the study area and it seemed reasonable that, without observations to the contrary, relatively consistent aquifer properties should be adopted. As noted earlier, as part of model development we used the pilot point technique in conjunction with PEST to create an interpolated hydraulic conductivity field. In the end, we found no consistent pattern and went back to uniform property assignment.	As identified on various other figures, the quarry impacts are identified farther away from quarry face. The response in OW03-14 (Figure 5.12) suggests that the aquifer is not uniform.	The quarry impact, in that particular section of the report, was related to the dropping of heads to close to the elevation of the quarry floor. In more generalized discussions of the extent of impacts (elsewhere in the report), the effects refer to o a noticeable decline in water levels, and that occurs over larger distances (about 800 m). It is not related to local hydraulic conductivity variations.	On January 1, 2023, Ontario Regulation 596/22 came into effect. As a result, technical review services for planning and development applications previously provided by Conservation Halton (CH) under Memorandums of Understanding with municipalities (e.g., technical reviews related to natural heritage and select aspects of stormwater management) can no longer be provided. As such, we defer this comment to the other JART members to confirm whether it has been addressed. Norbert Woerns has reviewed Nelson's response and provided the following JART response: (modelling comment) CHRIS NEVILLE: UNRESOLVED. It is not clear from the Applicant responses what the extent of the quarry influence might be, and whether the extent might vary spatially. Referring to Figure 5.12, it is inferred that the influence of the quarry extends less than 200 m from the quarry face. However, it the Application Response of June 2022 it is indicated that the extent of “noticeable decline in water levels” occurs over larger distances (about 800 m).
135.	Monthly water level data were collected by Golder starting in 2003, and continuous data were collected in most wells from 2007 to 2013 and only starting again in October of 2018. Considering that the longest transient water level dataset is 2007 to 2013 why does the transient model run start at WY2010? It should be noted that the Level 1 and 2 Hydrologic and Hydrogeologic Assessment Terms of Reference proposes a 25 year simulation, and it specifically mentions years 2007, 2008 and 2009 as representative of dry, wet and average climate conditions, respectively.	The monitoring network was developing over the period of 2004 to 2008, and the most complete dataset for calibration was near the end of that period. Also please refer to Response 79 Model stability issues and long-run times forced the use of a 10-year simulation period (the stability issues were not related to the quarry but rather to conditions at Mt. Nemo, where the Escarpment is very steep). Working back from 2019 to ensure that recent data for the west was included, gave us a model start time in WY2009. There were drought periods in 2015 and 2016, so the need to simulate drought conditions was covered.	The development of the monitoring network began in 2003. There are no groundwater monitoring data available for 2015 and 2016, just model results, which reduces the confidence of relying on the model results for impact and predictive analysis during drought years.	Of the wells with continuous (logger data), only one well cluster (MW03- 04) was recording data between 2004 and 2005. These loggers were discontinued in January 2006. All other wells began recording after May 24, 2007.	On January 1, 2023, Ontario Regulation 596/22 came into effect. As a result, technical review services for planning and development applications previously provided by Conservation Halton (CH) under Memorandums of Understanding with municipalities (e.g., technical reviews related to natural heritage and select aspects of stormwater management) can no longer be provided. As such, we defer this comment to the other JART members to confirm whether it has been addressed. Norbert Woerns has reviewed Nelson's response and provided the following JART response: (modelling comment) CHRIS NEVILLE: UNRESOLVED. The Applicant Response suggests that water level data collected prior to the start of the simulation period assumed for the modelling (WY2010) were somehow not worthy of consideration in the analyses. Although it is indicated in the Applicant Response that because there were drought periods in 2015 and 2016 the need to simulate drought conditions was covered. However, as noted in the Interim JART Response of February 2022, there are no groundwater monitoring data available for 2015 and 2016.
141.	Area west of the quarry between the quarry and the Medad Valley is depicted on Figure 5.15 as having downward gradients, which suggests recharge conditions. Same figure identifies upward gradients within the Medad valley discharge conditions. If the west quarry is approved what would be the mechanism to guarantee the pre-extraction quantity of water is directed to support groundwater discharge function in Medad Valley and associated natural features?	Care should be used in interpreting the water level maps especially in areas of sparse data. In general, the map shows that there is little difference between the deep and shallow layers along the stream in the Medad (Willoughby Creek) but higher heads to either side, indicating a discharge zone. This is based on few data points, however, as access and data from within the valley is limited. Much of the area contributing to the upper reaches of Willoughby Creek (before the confluence with the tributary carrying quarry discharge) will be unaffected by the west quarry extension. The infiltration feature is intended to mitigate the drawdowns that will likely occur near the quarry footprint.	We agree that there are sparse data in the proposed west extension area, which makes it difficult to rely on model results which was built using sparse data. It has not been demonstrated that in case the proposed infiltration pond does not mitigate quarry extension impacts, the groundwater discharge within the Medad valley would be maintained. Furthermore, it was stated to JART reviewers multiple times in recent meetings and during the site visit on November 9, 2021 that the proposed infiltration pond function is not to infiltrate water and is not necessary to maintain groundwater levels. What is the mechanism to guarantee the pre-extraction quantity of water is directed to support groundwater discharge function in Medad Valley and associated natural features?	The model was built based on and to supplement the available data. Additional modelling analyses were presented to JART and MNDMNRF to demonstrate the effectiveness of the infiltration feature in replacing and exceeding the function of the Golf Course ponds (See Schedule 1 and 2). It is noted above that the infiltration pond was simulated in a very conservative manner as a shallow pond sitting on the Halton Till, similar to the Golf Course ponds it replaces. Simulations requested by MNDMNRF considered a deeper lake excavated to the top of the weathered bedrock which would have higher infiltration rates, resulting in higher heads and more groundwater discharge.	On January 1, 2023, Ontario Regulation 596/22 came into effect. As a result, technical review services for planning and development applications previously provided by Conservation Halton (CH) under Memorandums of Understanding with municipalities (e.g., technical reviews related to natural heritage and select aspects of stormwater management) can no longer be provided. As such, we defer this comment to the other JART members to confirm whether it has been addressed. Norbert Woerns has reviewed Nelson's response and provided the following JART response: (modelling comment) CHRIS NEVILLE: UNRESOLVED. The responses do

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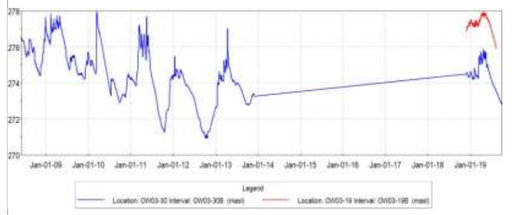
					not address the original question: If the west quarry is approved what would be the mechanism to guarantee the pre-extraction quantity of water is directed to support groundwater discharge function in Medad Valley and associated natural features? If the proposed (or not proposed?) infiltration pond is intended to mitigate the drawdowns that will likely occur near the quarry footprint, will it ensure that the pre-extraction quantity of water is directed to support groundwater discharge function in Medad Valley and associated natural features?
144.	Figure 5.16 presents a 9 month water level hydrograph for OW03-30B, which is most likely impacted by the quarry operation in 2018/2019. Discussion of a long-term natural seasonal water level fluctuations should be supported by a long- term water level monitoring dataset for wells not impacted by the quarry operation.	The figure below shows a hydrograph for OW03-19B, located 1000 m from the quarry face or 750 m further than OW03-30B. They both show a similar seasonal response patterns. 	Not addressed. As identified on the figure in the response, portion of the two hydrographs overlap but OW03-19B is cut short and deviates from OW03-30B significantly and again it is not a long-term dataset.	Perhaps this graph, showing the full period of record and at similar scales would be more informative. 	On January 1, 2023, Ontario Regulation 596/22 came into effect. As a result, technical review services for planning and development applications previously provided by Conservation Halton (CH) under Memorandums of Understanding with municipalities (e.g., technical reviews related to natural heritage and select aspects of stormwater management) can no longer be provided. As such, we defer this comment to the other JART members to confirm whether it has been addressed. Norbert Woerns has reviewed Nelson's response and provided the following JART response: (comment appears to have been addressed with longer term hydrograph)
146.	A relationship between the distance of the extraction face and groundwater levels in the shallow bedrock and deep bedrock is documented in this section. Even at 1000 meters away from the extraction face the groundwater levels are not at pre-extraction levels (“nearly identical”). This summary is based on a discussion of groundwater levels at four locations only (OW03-15, OW03-21, MW03-09 and OW03-17). All available groundwater level data should be provided for this assessment.	The point of this section is that extraction at the quarry face caused a relatively sharp drop in water levels in the deeper bedrock. The decrease in heads is maintained because local leakage from above (between 0 and 50 m) cannot match the drainage at the lower fracture zone outcrop. Further away from the quarry, the net leakage between the well and the quarry face (0 to 1000 m) balances the lateral outflow and there is no further decrease in water levels. At that point, the difference between the shallow and deeper bedrock is small, but not zero, since there is still vertical movement to the deeper system due to natural recharge from above. Water level data have been provided in two tables in Schedule E. There are 36373 manual measurements in the table and 128371 logger values. The logger data represents daily averages. We did not export the over 6.3 million sub-daily logger values.	The point of this comment was to present more data to support the discussion. It is rather a standard practice to present large datasets in graphical form. This is a new application, and all supporting data should be included in the reports as appendices and be appropriately referenced. Please update the reports to include this data.	We presented all available data as hydrographs in our meeting with JART team members.	On January 1, 2023, Ontario Regulation 596/22 came into effect. As a result, technical review services for planning and development applications previously provided by Conservation Halton (CH) under Memorandums of Understanding with municipalities (e.g., technical reviews related to natural heritage and select aspects of stormwater management) can no longer be provided. As such, we defer this comment to the other JART members to confirm whether it has been addressed. Norbert Woerns has reviewed Nelson's response and provided the following JART response: (unclear if this is resolved. Earthfx contends that all available data was presented in hydrographs presented in meeting with JART)
147.	It is clearly seen on the provided hydrographs that in the end of 2009 groundwater levels were already impacted by the quarry operation at 50, 300, 650 and 1050 meters away from the quarry face. The end of 2009 clearly cannot be used as the beginning of the transient model simulation used as a baseline scenario as it already shows impacts in groundwater conditions. Please update the baseline period.	By 2009, the quarry footprint had reached the quarry boundary and the effects of this change had been expressed in the water level data. 2009 is an intended baseline for comparison of the simulated response under a succession of quarry expansion/rehabilitation phases to the current baseline conditions. Rather than doing a series of punctuated steady-state simulations, we intended to capture the full range of daily responses under a 10-year range of daily climate inputs.	Not addressed. As stated, quarry impacts are already visible in presented hydrographs in 2009 so the model results show only additional impacts since 2009 as the quarry kept expanding in the southeast direction.	The analysis looked at the cumulative impacts of all future quarry operations and water use. As the quarry has expanded to occupy its full footprint, no significant drawdowns from current conditions are expected due to continued quarrying in the existing site. The impacts are due to the proposed expansion. The future rehabilitation looked at changes due to modification of the existing site and proposed extensions.	On January 1, 2023, Ontario Regulation 596/22 came into effect. As a result, technical review services for planning and development applications previously provided by Conservation Halton (CH) under Memorandums of Understanding with municipalities (e.g., technical reviews related to natural heritage and select aspects of stormwater management) can no longer be provided. As such, we defer this comment to the other JART members to confirm whether it has been addressed. Norbert Woerns has reviewed Nelson's response and provided the following JART response: UNRESOLVED, Impacts from the existing quarry have not been identified as discrete from those anticipated from the expanded quarry.
253.	Considering that groundwater zone of influence extends beyond 1000.0 meters away from the quarry face, if the ARA license is issued a follow up water well survey within at least 1000.0 meters of the quarry face should be carried out.	The AMP states that a follow up well survey will be completed for wells within 1km. The assumption was that most wells would be able to handle the 2-m average drawdown at 500 m. Drawdowns at 1000 m are less than 0.25 m, well below normal seasonal fluctuations.	Addressed providing well survey within 1km is completed.	RESOLVED	RESOLVED

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155.	It seems that total well depth was used to calculate available drawdown for private wells as presented in Table 5.3. At least 1.5 meters should be deducted from the well total depth to allow for pump setting and avoid pumping sediment. Also, private water well survey results are needed for this assessment as pump type (single jet, double jet vs submersible) may alter the available drawdown for a particular well.	Many of the cross sections (including that shown in Response 117) indicate that some private wells are completed through the aquifer, possibly to provide the extra depth for pump installation. Given this possible solution, reporting the available aquifer drawdown is clear and sufficient for contingency planning.	Partially addressed. Have all private wells in the predicted impact zone been assessed to see if they were constructed below the bottom of the aquifer?	The wells were assessed with respect to their available drawdown as well as the available drawdown in the aquifer. For example Figure 8.76 shows the Layer 4 and Layer 6 wells with <5 m of available drawdown. More important was the total available drawdown in the aquifer, as individual well construction issues are addressed in the AMP.	On January 1, 2023, Ontario Regulation 596/22 came into effect. As a result, technical review services for planning and development applications previously provided by Conservation Halton (CH) under Memorandums of Understanding with municipalities (e.g., technical reviews related to natural heritage and select aspects of stormwater management) can no longer be provided. As such, we defer this comment to the other JART members to confirm whether it has been addressed. Norbert Woerns has reviewed Nelson's response and provided the following JART response: PARTIALLY RESOLVED - Those wells completed entirely through the aquifer have not been differentiated from wells partially penetrating the aquifer. A correction to the available drawdown should be made to accommodate the pump interval at the bottom of all wells where the bottom of the well was used to calculate the available drawdown..
162	Topography-related Properties – The accuracy and extent of the drone survey data in the vicinity of the Quarry and expansion lands should be included within the document. LiDAR data with a +/- 0.1 meter accuracy is available for purchase from Conservation Halton to improve the accuracy of the results, if necessary.	It would have been useful to have this at the outset of the study. We had to develop our own coverages. LIDAR data is increasingly available and we are using it where available	Addressed. Accuracy of drone survey data stated in surface water comment table and is considered acceptable.	RESOLVED	RESOLVED
168.	Paragraph five of this section explains that white areas on Figure 6.17 represent areas where groundwater discharge exceeds groundwater recharge. It should be noted that these areas coincide with wetland locations surrounding the proposed southern extension and south of the western extension area (wetland 13201), and about the West Branch of Mount Nemo the tributary to Grindstone Creek. Considering that the baseline scenario represents partially impacted groundwater conditions the amount of groundwater discharge in these areas was potentially higher. How would groundwater discharge function be restored and maintained during extraction face moving closer to those features resulting in additional groundwater lowering?	Areas of groundwater discharge typically occur in the vicinity of the groundwater-fed wetlands and in riparian areas of streams. This is shown more clearly in Figure 7.20	Not addressed. The second part of the comment is totally disregarded, specifically: How would groundwater discharge function be restored and maintained during extraction face moving closer to those features resulting in additional groundwater lowering?	Groundwater upwelling contributes to base flow in the GSFLOW model. We reported on expected changes in streamflow based on simulations of theP12, P3456, and rehabilitation scenarios. In general, streamflow changes were small for P12. The changes under P3456 and RHB1 were minimized due to the infiltration feature. Additional simulations with a modified infiltration feature were conducted at the request of MNDMNRF to further reduce the impact on groundwater discharge to the soil zone. Please refer to Schedule 1 and 2 for more details.	On January 1, 2023, Ontario Regulation 596/22 came into effect. As a result, technical review services for planning and development applications previously provided by Conservation Halton (CH) under Memorandums of Understanding with municipalities (e.g., technical reviews related to natural heritage and select aspects of stormwater management) can no longer be provided. As such, we defer this comment to the other JART members to confirm whether it has been addressed. Norbert Woerns has reviewed Nelson's response and provided the following JART response: The simulations are based upon assumptions of average hydraulic conductivity of the materials underlying the proposed infiltration ponds. The simulations have not been able to account for local variations . It has not been demonstrated how groundwater discharge conditions will be restored consistent with the approved rehabilitation plan of the existing quarry.
170.	Based on the recharge map, the area which is proposed for west quarry extension provides recharge which supports a number of downstream private water supplies and discharge within Medad Valley. This is also supported by provided cross sections on Figures 5.3 and 5.4. How would these conditions be maintained during and after extraction?	Recharge would still occur in the area between the quarry face and Cedar Springs Road. This would be augmented by the infiltration feature which would accept part of the quarry discharge.	The response provided relies on the assumption that the proposed infiltration pond will work as in the model. Similarly, to previous comments (74, 141), this has not been demonstrated and there are no monitoring and mitigation measures proposed to ensure its functionality.	Additional modelling analyses were presented to JART and MNDMNRF to demonstrate the effectiveness of the infiltration feature in replacing and exceeding the function of the Golf Course ponds. It was noted above that the infiltration pond was simulated in a very conservative manner as a shallow pond sitting on the Halton Till, similar to the Golf Course ponds it replaces. Simulations requested by MNDMNRF considered a deeper lake excavated to the top of the weathered bedrock which would have higher infiltration rates, resulting in higher heads and more groundwater discharge. Please refer to Schedule 1 and 2 for more details.	On January 1, 2023, Ontario Regulation 596/22 came into effect. As a result, technical review services for planning and development applications previously provided by Conservation Halton (CH) under Memorandums of Understanding with municipalities (e.g., technical reviews related to natural heritage and select aspects of stormwater management) can no longer be provided. As such, we defer this comment to the other JART members to confirm whether it has been addressed. Norbert Woerns has reviewed Nelson's response and provided the following JART response: (modelling comment) UNRESOLVED The simulations are based upon general assumptions regarding hydraulic conductivities. The simulations do not constitute proof of the functionality or effectiveness of the proposed infiltration ponds in addressing potential site-specific well interference issues. The simulations should be considered as providing a generalized estimate of anticipated infiltration pond functionality. Due to the prevalence of fracture flow within the bedrock as evidenced by the presence of numerous seepages and springs, significant variations in actual groundwater conditions should be anticipated on a site-specific

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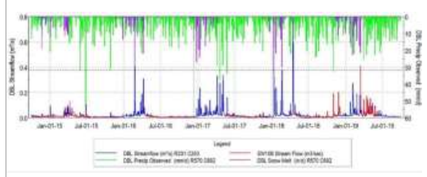
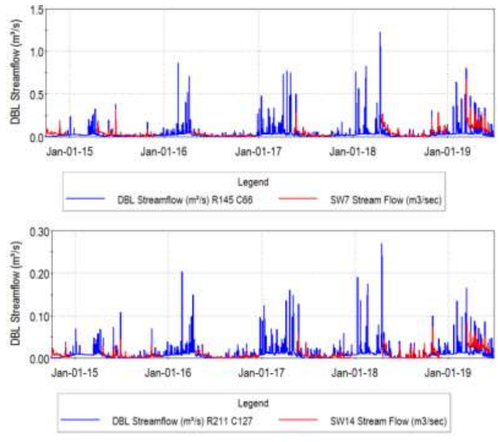
					basis. CHRIS NEVILLE: I concur with this comment and suggest on that UNRESOLVED be added.
172.	The report should document which and how parameters in the PRMS sub-model were adjusted to calibrate the GSFLOW model.	There are numerous parameters in the PRMS model, most of which can be varied on a HRU, monthly, or HRU and monthly basis. We have presented the parameter values that we used and highlighted the key ones in the property tables. Calibration entailed a combination of automated (Monte Carlo) parameter estimation and manual adjustment processes in which the soil property and land use property values were refined. Visual inspection of hydrographs at gauge locations was the primary tool for evaluating the goodness of fit during the manual calibration process, adjusting parameters as needed to better match peaks and base flow recession.	Not addressed. CH has concerns with adjusting land use property values as part of the calibration as those values can be directly measured.	The land use classification was not adjusted during calibration, but the associated hydrologic properties associated with each class were adjusted. The PRMS inputs were assigned by soil, land use, and vegetation class recognizing that there will be local variation in the properties within each class. The calibration adjusted the assigned property values within reasonable ranges to improve the match to the observed flows at all gauges.	On January 1, 2023, Ontario Regulation 596/22 came into effect. As a result, technical review services for planning and development applications previously provided by Conservation Halton (CH) under Memorandums of Understanding with municipalities (e.g., technical reviews related to natural heritage and select aspects of stormwater management) can no longer be provided. As such, we defer this comment to the other JART members to confirm whether it has been addressed. Norbert Woerns has reviewed Nelson's response and provided the following JART response: (modelling comment) CHRIS NEVILLE: RESOLVED
173.	Figure 6.19, Simulated and observed flow at SW10B for WY2019 - While the match of observed streamflow to the GSFLOW simulated flows is very good for 2019, the match for Fall 2018 is weak. Further discussion is required and refinements to the calibration may be required.	Over the longer period of record, the model performs well, although there is not much winter/early spring data for comparison other than 2019. We have noticed a bit of a lag in the fall recovery. This is likely due to the need to bring soils up to field capacity before groundwater discharge or Dunnian flow occurs. In the field, the values of soil storage capacity will likely vary, with some areas contributing flow earlier than others. Randomizing the storage capacity values within each class might help but was not implemented in this model. The quality of the data also appears to get better with time. 	Not addressed It appears that the soil layer in the model does not best fit the natural data and that field capacity and soil capacity should be revisited.	We believe that we have achieved a good match except to mechanisms that allow for contribution to groundwater recharge and overland flow before the entire soil reservoir has reached field capacity. In our response to MNDMNRF (Earthfx, March 2021) we provided extensive comparison between observed and simulated shallow model response. Overall, the calibration to the minipiezometers was excellent, in both response timing and to monitors across the wide study area.	On January 1, 2023, Ontario Regulation 596/22 came into effect. As a result, technical review services for planning and development applications previously provided by Conservation Halton (CH) under Memorandums of Understanding with municipalities (e.g., technical reviews related to natural heritage and select aspects of stormwater management) can no longer be provided. As such, we defer this comment to the other JART members to confirm whether it has been addressed. Norbert Woerns has reviewed Nelson's response and provided the following JART response: (modelling comment) CHRIS NEVILLE: UNRESOLVED. The Applicant Response, “We believe that we have achieved a good match except to mechanisms that allow for contribution to groundwater recharge and overland flow before the entire soil reservoir has reached field capacity” implies that the “except” is not important. Referring to the original comment, the match to Fall 2018 condition is relatively poor. Contrary to what is suggested in the Applicant Response of June 2022, many of the plots included in the responses to the MNDMNRF comments do not include comparisons between observed and shallow model responses. Instead, observed water levels are shown along with simulated soil moisture fractions (see for example Figure 3 and 16 subsequent figures).
174.	To validate the GSFLOW model, hydrographs illustrating simulated and observed flows should be presented at a surface water monitoring location on each tributary.	Of the 20 surface water gauges available for GSFLOW calibration, 10 were located more than 3.5 km from the site, had data only for 2018 and 2019, and, of these, seven were outside the model boundary. We found that no change in simulated flow occurs at or close to these locations. SW15 is on the opposite (north) side of the quarry and far from the expansion areas. SW7 and SW14 were discussed in great detail, so it was only SW2 which was omitted and the effects of the quarry extension were better seen in the upstream gauges.	Not addressed, comment stands. SW7 and SW14 are not discussed in this section, only SW9 and SW10 are. Further, graphs are not provided in Appendix E for SW7 or SW14. Graphs are provided for SW9, SW10B, SW29, and SW2. SW2 was not omitted, but shows poor correlation and must be included as the only gauge downstream of the karst feature on Willoughby Tributary. Please provide hydrographs for all flow monitoring stations shown on Figure 19.4 in Appendix E.	We presented all available data as hydrographs in our meeting with JART team members. The two hydrographs below were part of the presentation. 	On January 1, 2023, Ontario Regulation 596/22 came into effect. As a result, technical review services for planning and development applications previously provided by Conservation Halton (CH) under Memorandums of Understanding with municipalities (e.g., technical reviews related to natural heritage and select aspects of stormwater management) can no longer be provided. As such, we defer this comment to the other JART members to confirm whether it has been addressed. Norbert Woerns has reviewed Nelson's response and provided the following JART response: (modelling comment) CHRIS NEVILLE: PARTIALLY ADDRESSED. The Applicant Response of June 2022 includes hydrographs for SW7 and SW14. Hydrographs have not been included for SW9, SW10B and SW29. Further discussion of the implications of the poor match to the data from SW2 is required, as this is the only gauge downstream of the karst feature on Willoughby Tributary.

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				SW7 and SW14 are in the Medad Valley and separate sections were devoted to illustrating change from baseline conditions. SW2 is affected by numerous in-line ponds along Cedar Spring Road downstream of the karst feature on Willoughby Tributary.	
176.	Please include OW03-15B observed and simulated water levels on Figure 6.24. The model overestimates deep groundwater conditions by some 1.0-2.0 meters and at the same time underestimates the shallow groundwater levels by some 0.5-2.0 meters without an explanation why and what it means in terms of surface and groundwater interactions. Please provide an explanation of surface and groundwater interactions at this location and any other location where the model does not simulate the observed data.	OW03-15 is adjacent to the south quarry discharge location, and water levels in the area are affected by leakage from the stream. While this is represented in the integrated model, the pumping records from the south quarry are limited during this period.  The model is high in the deep bedrock, low in the middle zone, and low in the upper zone. As noted, the discrepancies here are smallest for the upper flow zone which is more closely linked to GW/SW interaction.	Not addressed. We agree that leakage from the stream is most likely responsible for the higher water levels in overburden (OW03-15C) and shallow bedrock (OW03-15B) than simulated data. The model results do not replicate this and suggest that the hydraulic conductivity of the till layer is too low in that location.	As noted earlier, we adopted a hydraulic conductivity for the unweathered till that was on the high side.	On January 1, 2023, Ontario Regulation 596/22 came into effect. As a result, technical review services for planning and development applications previously provided by Conservation Halton (CH) under Memorandums of Understanding with municipalities (e.g., technical reviews related to natural heritage and select aspects of stormwater management) can no longer be provided. As such, we defer this comment to the other JART members to confirm whether it has been addressed. Norbert Woerns has reviewed Nelson's response and provided the following JART response: (modelling comment) CHRIS NEVILLE: UNRESOLVED. The comments and responses appear to be at cross-purposes. It is suggested in the Interim JART response of February 2022 that the hydraulic conductivity of the till layer is too low in that location. In direct contrast, it is indicated in the Application Response of June 2022 that "we adopted a hydraulic conductivity for the unweathered till that was on the high side".
177.	Please provide a borehole logs for well nests OW03- 21 and OW03-31. If well nest OW03-31 has a shallow installation, please provide the data. Please include OW03-21C simulated water levels on Figure 6.25. As presented on Figure 6.26, while the observed data in OW03- 31A (deep bedrock) is consistently higher than OW03-31B (shallow bedrock), suggesting upward gradients, while the simulated water levels show consistently downward gradients. Considering OW03-31 is located next to a wetland and the model does not represent local conditions it poses a question if the model can be used to predict impacts on the wetland.	Borehole logs are included in Schedule E. Monitor OW03-31 does not have a shallow C monitor. Simulated water levels at OW03-21 for Layer 1 and 2 were very similar to those for Layer 4. There are a number of possible reasons for this local anomaly, including well construction, survey error, local shallow topographic/drainage effects and others.	Partially addressed. The simplest explanation would be that the measured data represents local conditions, which the model does not replicate and as originally stated it poses a question if the model can be used to predict wetland impacts in that location.	Local variability does exist, but more important, the model matches the bedrock response patterns in the near (dewatered deep system), intermediate (seasonal variability up to 10 m) and far (no significant vertical gradient) distance from the quarry face. This was discussed in detail in our report and in our Nov. 2021 JART Modelling meetings. As far as we are aware, this is the first model in Ontario that replicates both this transient bedrock response pattern, and the shallow wetland soil moisture hydroperiod and leakage that drives this dramatic seasonal variability.	On January 1, 2023, Ontario Regulation 596/22 came into effect. As a result, technical review services for planning and development applications previously provided by Conservation Halton (CH) under Memorandums of Understanding with municipalities (e.g., technical reviews related to natural heritage and select aspects of stormwater management) can no longer be provided. As such, we defer this comment to the other JART members to confirm whether it has been addressed. Norbert Woerns has reviewed Nelson's response and provided the following JART response: PARTIALLY ADDRESSED (modelling comment) The question of the model's ability to provide reliable and accurate site specific predictions of impact from the proposed quarry remains unresolved. CHRIS NEVILLE: I concur and have nothing to add.
178.	Please include OW03-29C observed and simulated water levels on Figure 6.27. Based on observed water level data in Figure 6.27 there is a reversal of vertical gradients to upwards in the fall, this is not represented in the model as the simulated water levels are consistently 0.5 to 1.0 meter higher in the shallow bedrock – please explain.	Comparing monthly water levels to logger data is a bit iffy, but there does seem to be a reversal with water levels slightly higher in the deep system for a short period in the fall. A possible explanation is the deeper system, with low storage, responds quicker to increased recharge even if it occurs outside the immediate area. The local recovery of heads may be lagged. Also see Response 177.	Not addressed. Model does not replicate the measured data very well. There is a similar lag in water level as in the shallow installations. OW03-29C data are outstanding.	An extensive discussion of the shallow system match and lag is included in our response to MNDMNRF dated March, 2021. Most important, the model also matches the dramatic seasonal change in the bedrock head as discussed in detail at our Nov. 2021 modelling meetings.	On January 1, 2023, Ontario Regulation 596/22 came into effect. As a result, technical review services for planning and development applications previously provided by Conservation Halton (CH) under Memorandums of Understanding with municipalities (e.g., technical reviews related to natural heritage and select aspects of stormwater management) can no longer be provided. As such, we defer this comment to the other JART members to confirm whether it has been addressed. Norbert Woerns has reviewed Nelson's response and provided the following JART response: (modelling comment) CHRIS NEVILLE: PARTIALLY ADDRESSED. As far as we are aware, Figure 6.27 was never supplemented with the OW03-29C observed and simulated water levels.
179.	It appears that there is a two to three-month lag between the observed and simulated data as presented on Figures 6.29 and 6.30 – please explain. It appears that MP16 is constructed in MNRF wetland 13037. As per Provincially Significant Grindstone Creek Headwaters Wetland Complex assessment, February 2007, Ontario	The issue of response lag is discussed in great detail in our response to MNRF comments included in Schedule D. The heads in the unweathered Halton Till (Layer 2) take longer to respond than the soil zone. This can be seen in plots of soil moisture included in Schedule D. As noted in an earlier response, the soil moisture capacity and other factors may not be uniform but be	Not addressed. There is a difference between physical measured data and the model results. If the model does not replicate the measured data it does not replicate local conditions and cannot be used for impact assessment or predictive analyses. If the heads in Layer 2 take longer to respond potentially the hydraulic conductivity of this layer are too low. It should be added that the lag between measured and simulated groundwater levels is also present in the bedrock wells e.g.: Fig. 6.26 and 6.27 of the Level 1 and 2 Hydrogeological Assessment report. Also, groundwater levels in these wells do not replicate short term responses (spikes in water levels) as presented in	An extensive discussion of the shallow system match and lag is included in our response to MNDMNRF dated March, 2021. Most important, the model also matches the dramatic seasonal change in the bedrock head as discussed in detail at our Nov. 2021 modelling meetings.	On January 1, 2023, Ontario Regulation 596/22 came into effect. As a result, technical review services for planning and development applications previously provided by Conservation Halton (CH) under Memorandums of Understanding with municipalities (e.g., technical reviews related to natural heritage and select aspects of stormwater management) can no longer be provided. As such, we defer this comment to the other JART members to confirm whether it has

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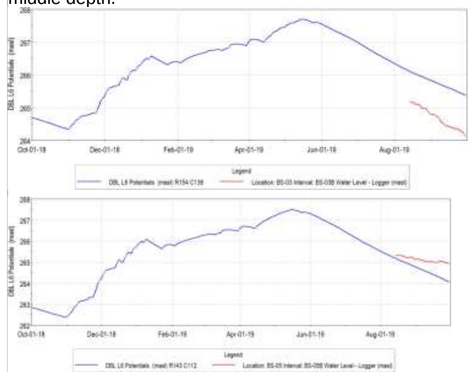
	Ministry of Natural Resources Aurora District this wetland also known as No. 12 was identified to be seepage-fed and contributing base flows to Grindstone Creek.	distributed in a more random way within the range of values. That would allow some parts of the system to respond more rapidly than others. The figure shows that at times simulated heads are above the base of the monitor parts of the year.	logger data (Figure 6.26 and 6.27) which suggest that the model underestimates surface and groundwater interactions. Second part of the comment (re wetland 123) is completely disregarded.		been addressed. Norbert Woerns has reviewed Nelson's response and provided the following JART response: (modelling comment) - This is an important point; it reinforces the impression that the model does not, and/or is not capable of accurately replicating local, site specific conditions casting doubt on the reliability of impact predictions on a site specific basis. CHRIS NEVILLE: I would add only "UNRESOLVED".
182.	Please explain a two to four-month lag between observed and simulated water level results for MP5 and what it means in terms of using the model for predictive analysis.	See Response 179	Not addressed. See response to Comment No. 179.	MP5 is a 1 m deep minipiezometer with a 10 cm screen and as such is responding to the soil zone. Please see response 179	On January 1, 2023, Ontario Regulation 596/22 came into effect. As a result, technical review services for planning and development applications previously provided by Conservation Halton (CH) under Memorandums of Understanding with municipalities (e.g., technical reviews related to natural heritage and select aspects of stormwater management) can no longer be provided. As such, we defer this comment to the other JART members to confirm whether it has been addressed. Norbert Woerns has reviewed Nelson's response and provided the following JART response: (modelling comment) CHRIS NEVILLE: UNRESOLVED. The response to Comment 179 does not address the JART Comment 182.
186.	The GSFLOW calibration section is lacking calibration to transient groundwater level data outside of the existing quarry zone of influence, especially to the west of the quarry. Please update the calibration accordingly.	Long term monitoring wells with data loggers are not routinely found in the MECP water well record database. The PGMN network is growing slowly. We focused our calibration efforts on matching data wells in the vicinity of the quarry as they had an extended period of record. These well were installed for earlier south quarry studies. There are a several wells on the west side with short periods of record. The data from these sites were mainly used for comparing with the calibrated model predictions.	Not addressed. The observed and simulated data for the wells installed on the west side of the quarry should be provided in graphical form.	We presented all available data as hydrographs in our meeting with JART team members. The two hydrographs, for wells closest to the quarry, are typical of the west calibration at the middle depth. 	On January 1, 2023, Ontario Regulation 596/22 came into effect. As a result, technical review services for planning and development applications previously provided by Conservation Halton (CH) under Memorandums of Understanding with municipalities (e.g., technical reviews related to natural heritage and select aspects of stormwater management) can no longer be provided. As such, we defer this comment to the other JART members to confirm whether it has been addressed. Norbert Woerns has reviewed Nelson's response and provided the following JART response: (modelling comment) CHRIS NEVILLE: UNRESOLVED. The response here should include all of the hydrographs for wells on the west side of the quarry showing both the observations and the model results.
188.	Figure 6.39 is confusing. It shows a loss of groundwater on annual basis at a rate of some 1000-2000 m^3/d, and groundwater ET losses in winter months at rates which are comparable to summer months – please clarify.	Yes, there is a bit of background needed to better understand the figure. In a typical MODFLOW model, ET losses from groundwater are simulated by specifying a value for ETmax, the maximum ET loss rate which occurs when the water table is at or above land surface and Ext Depth, the extinction depth below which no ET occurs. ET losses linearly decrease with depth to the water table. In GSFLOW, ETmax is not specified. Rather, the PRMS model calculates the daily potential ET and then attempts to satisfy this demand first through evaporation from canopy storage and then through evaporation and ET from the soil zone. Any leftover ET demand is passed on to MODFLOW as the daily value for ETmax. In the spring, PET is usually met by available water in the soil zone. As PET demand increases in the summer months, upland areas (which receive limited run-on from upslope cells) dry out and cannot meet the ET demand and the rate of potential GWET increases. Because the upland areas have greater depth to water, some of this GWET demand will not be met and AET will be less than PET. Ironically, GWET will not be that high in the lowland areas, despite the shallow water table, because	Partially addressed. Thanks for the ET clarification. What about the 1000-2000 m^3/d loss of groundwater as visible on Figure 6.39?	The value (2000 m^3/d) translates to about 0.8 mm in a month averaged over the 83 km^2 study area, which is a very small number. January recharge, by comparison, is about 19 mm.	On January 1, 2023, Ontario Regulation 596/22 came into effect. As a result, technical review services for planning and development applications previously provided by Conservation Halton (CH) under Memorandums of Understanding with municipalities (e.g., technical reviews related to natural heritage and select aspects of stormwater management) can no longer be provided. As such, we defer this comment to the other JART members to confirm whether it has been addressed. Norbert Woerns has reviewed Nelson's response and provided the following JART response: (modelling comment) CHRIS NEVILLE: PARTIALLY ADDRESSED. The Applicant Response of June 2022 places the 2000 m^3/d loss of groundwater on Figure 6.39 in context, but never provides an explanation of what it physically represents. What happens to the groundwater discharge to the soil zone. Does it get routed to surface water features in the model?

		the soil zone, which is replenished from below, will be able to meet the ET demand through soil zone ET. As a consequence, even though technically it the ET is ET from groundwater, it is included with GW discharge to the soil zone (surface leakage) rather than GWET in the MODFLOW GW balance). In the winter months, there is still some PET calculated on warm days. Because the canopy coverage is reduced and because transpiration processes are shut down, a bigger percentage of this winter PET is passed to the MODFLOW model and is labelled as GWET.			
192.	The proposed set of groundwater assessment points for “the Baseline and Scenario comparative analyses” at locations without observed data seems questionable. Please provide a justification of why these assessment points are representative of baseline conditions and why would it be appropriate to use them for comparative analyses.	GW-8 is located near OW03-17. The assessment points were selected not for model calibration, but to provide coverage of a wide area away from the wetlands which were addressed separately. GW6 and GW8 are near P12 on inter-stream divides which would be more sensitive to change than points adjacent to wetlands or streams. GW1, GW2, GW3, and GW4 are along the west side along roads with private wells that could be affected by P3456. Similarly, GW5 and GW 7 cover roads with housing on the east that might be affected by P12	Not addressed. Please present data collected to date at the proposed set of groundwater assessment points for “the Baseline and Scenario comparative analyses”.	The model provides results at each of over 1.24 million cells. As we noted, we wanted to present results that portrayed the groundwater system response at locations other than just in the wetlands to provide a measure of the possible impact to private wells and other features.	On January 1, 2023, Ontario Regulation 596/22 came into effect. As a result, technical review services for planning and development applications previously provided by Conservation Halton (CH) under Memorandums of Understanding with municipalities (e.g., technical reviews related to natural heritage and select aspects of stormwater management) can no longer be provided. As such, we defer this comment to the other JART members to confirm whether it has been addressed. Norbert Woerns has reviewed Nelson's response and provided the following JART response: (modelling comment) CHRIS NEVILLE: UNRESOLVED. The request in the Interim JART Response of February 2022 is appropriate and reasonable.
196.	Please provide digital, daily water levels, presented graphically (to depict the wetland hydroperiod) and summarize daily water balance analyses as average monthly water volumes presented in tabular format integrated in the report. Compare driest year, average and wettest year monthly water volumes to assess potential impact.	Extensive additional information related to the wetlands was provided in response to MNRF for more information regarding the wetlands. This has been provided in Schedules B and C.	Not addressed. Monthly wetland water balance summaries are still outstanding. Please also refer to response to Comment No. 1 above.	Please refer to response to Comment 1, above.	On January 1, 2023, Ontario Regulation 596/22 came into effect. As a result, technical review services for planning and development applications previously provided by Conservation Halton (CH) under Memorandums of Understanding with municipalities (e.g., technical reviews related to natural heritage and select aspects of stormwater management) can no longer be provided. As such, we defer this comment to the other JART members to confirm whether it has been addressed.
198.	Figures 7.20 and 7.21 show groundwater discharge to the soil zone under wetlands and streams and discharge to streams, respectively. Some of these areas are within less than 200.0 meters of the proposed south extraction. How would these functions be maintained during and after extraction?	The model was used to evaluate the magnitude of likely change in groundwater/surface water interaction as a result of quarry expansion by comparing baseline conditions and conditions under the various scenarios. Because of the drawdown created by dewatering P12, there are small changes in groundwater discharge to streams and streamflow, generally restricted to within the 2 m drawdown zone. The magnitude of the changes are reduced significantly when levels in P! 2 recover and a lake is formed.	Not addressed. What are the mitigation measures to maintain groundwater discharge function to the soil zone under wetlands and streams?	As discussed in the report, the nearby wetlands are mostly perched and not significantly affected under P12. Changes in streamflow, as noted, are small.	On January 1, 2023, Ontario Regulation 596/22 came into effect. As a result, technical review services for planning and development applications previously provided by Conservation Halton (CH) under Memorandums of Understanding with municipalities (e.g., technical reviews related to natural heritage and select aspects of stormwater management) can no longer be provided. As such, we defer this comment to the other JART members to confirm whether it has been addressed. Norbert Woerns has reviewed Nelson's response and provided the following JART response: UNRESOLVED Ignoring results of Tatham shallow groundwater monitors showing groundwater level seasonally above ground level resulting in groundwater discharge conditions, not perched conditions
200.	Wetland 9 (13014) water balance summary shows no groundwater discharge, however based on Figure 6.26, at OW03-21 there are documented upward gradients between the deep and shallow bedrock. Please provide hydrograph of all available monitoring data for OW03-30, OW03-31, MW03-08, MW03-10 and MW03-11 located in and around Wetland 9.	A hydrograph for MW03-10 is presented below as it is closer to the wetland than OW03- 21 and also has a shallow (C) well. There is some crossover between the B and A wells, but the shallow well consistently shows downward gradients between the overburden and the deep bedrock. Similar conditions exist in all nearby wells It is important to note that simulated heads in Layer 1 were below land surface while stage was close to land surface the entire simulation period. The water budget shown summed up the stream leakage for all cells within the wetland polygon as discharge to groundwater.	Partially addressed. There was a typo in our comment, Figure 6.26 shows the observed and simulated results for well OW03-31, which is located in proximity to Wetland (13014). Hydrographs for OW03-30, OW03-31, MW03-08 and MW03-11 outstanding.	We presented all available data as hydrographs in our meeting with JART team members.	On January 1, 2023, Ontario Regulation 596/22 came into effect. As a result, technical review services for planning and development applications previously provided by Conservation Halton (CH) under Memorandums of Understanding with municipalities (e.g., technical reviews related to natural heritage and select aspects of stormwater management) can no longer be provided. As such, we defer this comment to the other JART members to confirm whether it has been addressed. Norbert Woerns has reviewed Nelson's response and provided the following JART response: APPEARS UNRESOLVED – not sure which meeting is being referred to where all available data was provided. It is assumed that the requested hydrograph information was not presented.

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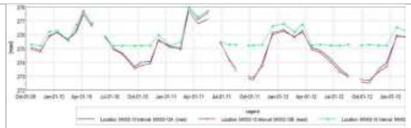
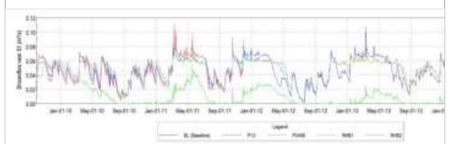
					
209.	It is stated that from a hydrogeological perspective the proposed west quarry extension is located in a favorable area due to the Medad Valley which is “a locally significant groundwater discharge area” which reduces the amount of inter-seasonal water level fluctuations. The Medad Valley is downstream of the proposed extension and although it is a hydraulic boundary which reduces the amount of water level fluctuations, a reduction of flow towards it would be considered a direct negative impact on this feature. Furthermore, most of the proposed west quarry extension is up gradient of numerous private water supplies, an area which provides recharge to the underlying aquifer. Since most of this area would be extracted causing groundwater lowering due to quarry cone of influence and reducing the up gradient area providing recharge for the private water supplies, an infiltration pond had to be proposed to mitigate the impacts, feasibility of which is uncertain (please see comments below, re: Page 226, Section 8.6.1 Infiltration Pond).	The baseline simulation indicates that heads would be elevated in the vicinity of the golf course ponds, Under Scenario P3456, the mound would be shifted to underneath the infiltration pond (see figures in response 207).	Not addressed. The feasibility of the infiltration pond has not been demonstrated. Also, there is conflicting messaging about the infiltration pond based on recent discussions. Is it required as a mitigation measure or is it not? If it is not, demonstration of no impact must be provided. It should also be noted that there are no monitoring, mitigation and contingency measures proposed in relation to the infiltration pond.	Additional modelling analyses were presented to JART and MNDMNRF to demonstrate the effectiveness of the infiltration feature in replacing and exceeding the function of the Golf Course ponds. (Please see Schedule 1 and 2). It was noted above that the infiltration pond was simulated in a very conservative manner as a shallow pond sitting on the Halton Till, similar to the Golf Course ponds it replaces. Simulations requested by MNDMNRF considered a deeper lake excavated to the top of the weathered bedrock which would have higher infiltration rates, resulting in higher heads and more groundwater discharge.	On January 1, 2023, Ontario Regulation 596/22 came into effect. As a result, technical review services for planning and development applications previously provided by Conservation Halton (CH) under Memorandums of Understanding with municipalities (e.g., technical reviews related to natural heritage and select aspects of stormwater management) can no longer be provided. As such, we defer this comment to the other JART members to confirm whether it has been addressed. Norbert Woerns has reviewed Nelson's response and provided the following JART response: UNRESOLVED –(modelling comment) - model simulations do not provide proof of functionality. Generalized hydraulic conductivity parameters employed in the simulations do not allow for local variations in groundwater flow patterns such as is expected in fractured bedrock environment CHRIS NEVILLE: I agree completely.
213.	A more robust discussion of the anticipated changes in stream flows should be provided. At a minimum, the analysis should include: Maximum changes in stream flow rates for each tributary/flow node (in addition to the change in average stream flow rates provided). Percentage change in average and maximum stream flow rates. Any change in the duration of no flow or base flow periods. Simulated stream hydrographs and analysis for Willoughby Tributary immediately downstream of Collings Road.	The hydrograph below compares flows for Willoughby Tributary immediately downstream of Collings Road for the baseline and four scenarios. Flow statistics are provided in the accompanying table. In general, flows under P12 are generally similar to the baseline. Flows under P3456 and RHB1 are similar to each other but are generally lower in the winter and early spring compared to baseline but higher in the late spring. Flows do not differ much in the summer and fall. Flows under RHB2 are significantly lower due to cessation of pumping to dewater the quarry.  **Station Near S1** | Baseline | P12 | P3456 | RHB1 | RHB2 Average Flow | 0.044 | 0.042 | 0.046 | 0.045 | 0.008 Maximum Flow | 0.122 | 0.120 | 0.091 | 0.088 | 0.055 Minimum Flow | 0.005 | 0.002 | 0.000 | 0.003 | 0.000 Q50 | 0.043 | 0.040 | 0.053 | 0.048 | 0.004 Q95 | 0.015 | 0.012 | 0.015 | 0.013 | 0.000 **Change in Flow by Volume** Average Decrease (m³/s) | | 0.003 | -0.001 | 0.000 | 0.038 Maximum Decrease (m³/s) | | 0.016 | 0.085 | 0.030 | 0.082 Maximum Increase (m³/s) | | -0.034 | -0.032 | -0.028 | 0.002 **Change in Flow by PerCent** Average Decrease (%) | | 7.504 | -7.862 | -2.113 | 85.132 Maximum Decrease (%) | | 55.919 | 99.954 | 43.332 | 100.000 Maximum Increase (%) | | -119.872 | -220.597 | -105.933 | 37.005 % of Days below Q50BL | 50.019 | 55.105 | 42.745 | 50.000 | 99.888 % of Days below Q95BL | 5.010 | 7.419 | 5.233 | 6.119 | 78.795	Partially addressed. Only addressed for Willoughby Tributary and not for other tributaries / nodes.	Please refer to the watercourse characterization tables.	This comment has been addressed from a natural hazard perspective based on a supplementary submission received from the proponent. In the April 13, 2023, Tatham Engineering “Nelson Quarry, Burlington, Response to Comments” supplementary memo, the proponents 1) submitted additional analysis for the erosion hazard for the West Branch of the Mount Nemo Tributary of Grindstone Creek, and 2) have committed to removing the proposed Colling Road diversion and updating the site plan and AMP to reflect that removal. As a result, CH staff is satisfied that our outstanding natural hazard-related comments have been addressed. We defer this comment to the other JART members to confirm whether it has been addressed from their perspective.

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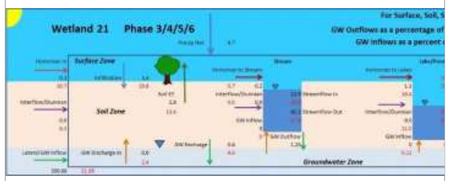
214.	Detailed water budget for wetland figures should include baseline and proposed values to facilitate reviews.	Baseline water budgets were provided in figures 7.23 to Figure 7.30 for 8 key wetlands. Wetland water budgets for the four scenarios are provided in subsequent sections of the report. If you are asking for the baseline values to be posted on the scenario results figures, it can be done but would take some effort and would not provide any new information. An example for Wetland 21 is shown below with baseline values posted in red. 	Not addressed. Please provide baseline values based on the TOR with proposed 25-year baseline.	The 25-year question has been addressed earlier.	On January 1, 2023, Ontario Regulation 596/22 came into effect. As a result, technical review services for planning and development applications previously provided by Conservation Halton (CH) under Memorandums of Understanding with municipalities (e.g., technical reviews related to natural heritage and select aspects of stormwater management) can no longer be provided. As such, we defer this comment to the other JART members to confirm whether it has been addressed. PARTIALLY ADDRESSED. While the indication that the “25-year question” has been raised previously, it has never been resolved to the satisfaction of the JART. Baseline values based on the TOR with proposed 25-year baseline have never been provided.
215.	Table 8.3, Scenario Summary – The climate data periods used to analyze extraction scenarios are not consistent. Explanation and justification for the start and end dates should be provided.	As noted earlier, there were model stability issues related to modelling the Niagara Escarpment near Mt. Nemo. The periods posted in the table denote the successful run times. For key scenarios, we were able to cover most or all of the 10-year period; sometimes requiring a separate drought period restart. The rehabilitation scenarios were run long enough to derive key information, such as lake stage and quarry discharge under the each rehabilitation scenarios. This information provided useful feedback and was incorporated into design modifications.	Not addressed. This response does not explain why there is a variation in the length of model period (ranging from a total of 2 to 10 years for various scenarios). Stability alone would not account for missing run time. We note that not all the scenarios were run for a full 10 years and none were run for the length of time proposed within the TOR.	The model crashed at random points in the run. If a sufficiently long run was obtained, we analyzed the model results. Long-term conditions were assessed with the 20-year PRMS simulation and the corresponding steady state model simulation. The stability and time frame were discussed in our Nov. 2021 Modelling meetings. Please let us know what other factors we should investigate to account for the stability issues. We have only been using GSFLOW extensively for 14 years and welcome any suggestions.	This comment has been addressed from a natural hazard perspective based on a supplementary submission received from the proponent. In the April 13, 2023, Tatham Engineering “Nelson Quarry, Burlington, Response to Comments” supplementary memo, the proponents 1) submitted additional analysis for the erosion hazard for the West Branch of the Mount Nemo Tributary of Grindstone Creek, and 2) have committed to removing the proposed Colling Road diversion and updating the site plan and AMP to reflect that removal. As a result, CH staff is satisfied that our outstanding natural hazard-related comments have been addressed. We defer this comment to the other JART members to confirm whether it has been addressed from their perspective.
222.	Wetland 21 (13201) is considered compromised due to the road and culvert, and its water budget is not considered representative of future conditions. There is also minor groundwater discharge to the wetland. Please confirm how changes to this wetland will be assessed and mitigated. The NETR identifies this wetland as adjacent to a rare vegetation community and this should be considered when assessing impacts.	An extensive package of **interdisciplinary** tables integrating wetland and watercourse characterization and analysis has been prepared and provided in Schedules B and C. Wetland 1 As noted, there are small changes in groundwater inflows to Wetland 21. Also noted is that further review of the wetland is planned and inflows may be supplemented. The model did not consider possible flow augmentation, so the effects of the water budget, if any, will likely be smaller than predicted. 3201 is discussed in detail.	Not addressed. Please refer to response to Comment No. 1 above.	This wetland will be supported via flow from the infiltration ponds, as outlined in the AMP. Please refer to our updated response to Comment 1.	On January 1, 2023, Ontario Regulation 596/22 came into effect. As a result, technical review services for planning and development applications previously provided by Conservation Halton (CH) under Memorandums of Understanding with municipalities (e.g., technical reviews related to natural heritage and select aspects of stormwater management) can no longer be provided. O. Reg. 596/22 does not affect CH’s mandatory programs or services. CH has only reviewed this comment based on natural hazard, and wetland matters, per Ontario Regulation 686/21 and Ontario Regulation 162/06. The proposed discharge pipe for mitigation is within the CH Regulated area and is outside the proposed Licence boundary, therefore a CH Permit will be required. Given the above, CH has no further comment from a regulatory perspective. We defer any remaining natural heritage related comments to the other JART members to confirm whether it has been addressed.
225	Phases P34, P3456, RHB1 - The report suggests that water is not discharged to the tributary of Mt. Nemo Creek during these phases, while other reports indicate the discharge from Quarry Sump Q200 will continue through these phases and will potentially increase. Analysis should be consistent with proposed mitigation plan and the modeling updated as necessary.	Discharge from Quarry Sump Q200 to dewater the existing quarry would continue through phases P34, P3456, and RHB1. The increased discharge from the sump during Phase 12 would be discontinued and the South Quarry Extension would be allowed to fill.	Addressed.	RESOLVED	RESOLVED

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226	Scenario P34 assumes that extraction in Phase 1 and 2 is complete and the water levels filled to the natural conditions. How long will it take for P12 to fill to the natural conditions? Unless P12 is filled before extraction commences in P34 the proposed approach does not represent cumulative impacts.	The simulations of P34 assumed that the P12 quarry would fill in a relatively short amount of time (assumed to be several years) with a high rate initially and tapering off over time. It was also assumed that P34 would be fully excavated at the start of the simulation, so that a conservative analysis of impacts could be conducted. There will likely be a period where some of the P34 area has been partly excavated and the P12 not fully recovered, but we do not believe that this will represent a worst condition than the two end- members.	Addressed.	RESOLVED	RESOLVED
228.	The proposed infiltration pond (as shown on Figure 8.38) does not match the pond shape on the submitted site plans. The pond on the site plans does not have a spur parallel to Cedar Springs Road in the northwest corner of the site. The grades on the site plans suggest that the spur cannot be constructed as shown on Figure 8.38. Please clarify.	The graphical presentation may be slightly different, but the function is consistent.	Not addressed. Has the “spur” been incorporated in the model? This is a location where the proposed extraction is the closest to Medad Valley and there are downstream private water supplies and potential groundwater discharge areas within the Medad valley. Groundwater monitoring and mitigation must be proposed.	It was assumed that the diversion pipe would provide perforated for this segment.	On January 1, 2023, Ontario Regulation 596/22 came into effect. As a result, technical review services for planning and development applications previously provided by Conservation Halton (CH) under Memorandums of Understanding with municipalities (e.g., technical reviews related to natural heritage and select aspects of stormwater management) can no longer be provided. As such, we defer this comment to the other JART members to confirm whether it has been addressed. Norbert Woerns has reviewed Nelson's response and provided the following JART response: (modelling comment) CHRIS NEVILLE: UNRESOLVED. The Applicant Response of June 2022 is neither complete nor does it address the question asked in the Interim JART Response of February 2022.
229.	Is the proposed infiltration pond an appropriate measure to mitigate impacts on private water supplies? The proposed infiltration pond would make most, if not all downstream wells, categorized as groundwater under direct influence of surface water (GUDI wells). Although, the proposed infiltration pond could be used as a measure to mitigate impacts on the NHS (Medad Valley), assuming that the pre-extraction groundwater heads could be maintained, considering private water supplies exist downstream of the proposed pond, how would the construction of the ponds be carried out to ensure ample and good quality of water is available for down gradient groundwater users? What measures would be implemented to ensure that water quality meets ODWQS? How would the pond be constructed to ensure continued infiltration: it is stated in the report that wetlands are perched, what would be done to ensure that the infiltration pond does not lose its intended functionality with time? How would water be prevented to flow back into the extraction zone? Monitoring, mitigation and contingency details should be provided to ensure that there is no water quantity and quality impacts on the downstream groundwater users in this area.	Wells were already affected by the golf course irrigation ponds Many private wells are already close to ditches and streams The water quality is monitored and fit for discharge to surface water (i.e. to the unnamed tributary to Willoughby Creek. A discussion of surface water quality is presented in Response 7 and 8 The pond is to be excavated to the top of the weathered bedrock. Significantly higher infiltration rates (than from the golf course irrigation ponds) would be expected. Some infiltrated water is likely to discharge to the quarry and be recirculated.	Not addressed. The proposed infiltration pond would be significantly closer to most private wells than the existing golf course ponds, the existing golf course ponds were most likely built to retain water rather than infiltrate it, which provides for time and extra filtration of infiltrated surface water. Discharge monitoring to surface water is to ensure protection of down gradient private water supplies in terms of water quality.	The water quality data for the quarry discharge and for wells near the Golf Course ponds did not have any water quality issues. Water quality is monitored routinely at the discharge point. Additional monitoring is planned as per the AMP.	On January 1, 2023, Ontario Regulation 596/22 came into effect. As a result, technical review services for planning and development applications previously provided by Conservation Halton (CH) under Memorandums of Understanding with municipalities (e.g., technical reviews related to natural heritage and select aspects of stormwater management) can no longer be provided. As such, we defer this comment to the other JART members to confirm whether it has been addressed. Norbert Woerns has reviewed Nelson's response and provided the following JART response: UNRESOLVED – proposed water quality monitoring in AMP does not address Ontario Drinking Water Standards. A GUDI water quality assessment and testing would be required if the purpose of the infiltration pond is to provide augmentation of groundwater supplies to down-gradient private wells as a communal water source.
232.	Scenario P3456 assumes that extraction in Phase 1 and 2 is complete and the water levels filled to the natural conditions. How long will it take for P12 to fill to the natural conditions? Unless P12 is filled before extraction commences in P3456 the proposed approached does not represent cumulative impacts	See response 226	Addressed.	RESOLVED	RESOLVED

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234.	No changes to the water budget for Wetland 22 (13200) are suggested, as the wetland is perched and there is no change to its contributing area, however as noted in the Surface Water Assessment drawings DP-1 and DP-2, it appears that there will be changes to the catchment area of the wetland. Please discuss if these changes will impact the water budget for this wetland.	Our assessment did not find significant changes to the area directly contributing to the wetlands and, therefore, no significant change to the water budget.	Not addressed. This is inconsistent with information provided during the November 9th, 2021 site visit, when mitigation measures were mentioned for this wetland. Please explain.	The model did not show significant impact. Regardless, provisions will be made to augment flows if needed.	On January 1, 2023, Ontario Regulation 596/22 came into effect. As a result, technical review services for planning and development applications previously provided by Conservation Halton (CH) under Memorandums of Understanding with municipalities (e.g., technical reviews related to natural heritage and select aspects of stormwater management) can no longer be provided. As such, we defer this comment to the other JART members to confirm whether it has been addressed. Norbert Woerns has reviewed Nelson's response and provided the following JART response: UNRESOLVED – surface water input required regarding anticipated change to surface water catchment for wetland 130200. Details regarding flow augmentation are required.
260.	The impact assessment was done using a background scenario which represents altered conditions. As summarized in section 8.10.2, there is 2.0 meters of drawdown predicted up to 1000.0 meters from the excavation, which suggest that the baseline conditions scenario does not document natural functions within surrounding wetlands and watercourses - please clarify.	This has been previously addressed.	Not addressed. See response to Comment Nos. 15, 73, 79, 82, and 147.	See earlier responses. As was noted, the model considered the cumulative effects of all future development and water use. The quarry currently is at its limits and no further change due to the existing operations is expected until the rehabilitation phase.	On January 1, 2023, Ontario Regulation 596/22 came into effect. As a result, technical review services for planning and development applications previously provided by Conservation Halton (CH) under Memorandums of Understanding with municipalities (e.g., technical reviews related to natural heritage and select aspects of stormwater management) can no longer be provided. As such, we defer this comment to the other JART members to confirm whether it has been addressed. Norbert Woerns has reviewed Nelson's response and provided the following JART response: UNRESOLVED- existing quarry impacts have not been specifically identified and are included as part of baseline conditions.
267.	The groundwater monitoring program must include shallow monitoring wells including wells completed in overburden to understand full impact of the proposed extraction.	A detailed discussion of the monitoring program and AMP is presented in our response to comments from the MECP (Schedule A). We will take this comment under consideration as the monitoring program and AMP are finalized.	Not addressed. Subject to AMP review when available.	The AMP has been provided to JART.	On January 1, 2023, Ontario Regulation 596/22 came into effect. As a result, technical review services for planning and development applications previously provided by Conservation Halton (CH) under Memorandums of Understanding with municipalities (e.g., technical reviews related to natural heritage and select aspects of stormwater management) can no longer be provided. As such, we defer this comment to the other JART members to confirm whether it has been addressed. Norbert Woerns has reviewed Nelson's response and provided the following JART response: PARTIALLY ADDRESSED – some overburden monitors are included in the AMP however no water level thresholds are included. These are to be determined; no water quality monitoring proposed for shallow groundwater monitors.
268.	Staff support using private water wells to supplement monitoring and impact assessment, however, the efficacy of this monitoring "to act as an early warning system" as said in the first paragraph on page 304 is questionable. Especially, for the south extension area, where most of the proposed private wells for monitoring are more than 1.0 kilometer from the extraction zone (Figure 9.1). Monitoring wells between the extraction zone and groundwater receptors should be proposed to proactively assess impacts.	A detailed discussion of the monitoring program and AMP is presented in our response to comments from MECP (A copy is provided in Schedule A). We will take this comment under consideration as the monitoring program and AMP are finalized.	Not addressed. Subject to AMP review when available.	The AMP has been provided to JART.	On January 1, 2023, Ontario Regulation 596/22 came into effect. As a result, technical review services for planning and development applications previously provided by Conservation Halton (CH) under Memorandums of Understanding with municipalities (e.g., technical reviews related to natural heritage and select aspects of stormwater management) can no longer be provided. As such, we defer this comment to the other JART members to confirm whether it has been addressed. Norbert Woerns has reviewed Nelson's response and provided the following JART response: PARTIALLY RESOLVED – background monitors are proposed separate form private wells. Some are yet to be installed.

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273.	It is reported that the south extension area has been monitored extensively for 7 years. Considering most of the monitors were most likely impacted by present quarry operation during that time, how reliable is the data to establish baseline conditions?	Please refer to Response 3, 15 and 78 for a discussion of cumulative impact and what is considered baseline	Not addressed, the question is not about cumulative impacts, but rather if monitoring data which documented most likely impacted conditions can be used as baseline to complete impact assessment.	As discussed in our report, the past monitoring data were analyzed extensively to determine what the likely range of groundwater level change and the lateral extents of zone of impact would be. This informed our modelling effort to further quantify the likely impacts.	On January 1, 2023, Ontario Regulation 596/22 came into effect. As a result, technical review services for planning and development applications previously provided by Conservation Halton (CH) under Memorandums of Understanding with municipalities (e.g., technical reviews related to natural heritage and select aspects of stormwater management) can no longer be provided. As such, we defer this comment to the other JART members to confirm whether it has been addressed. Norbert Woerns has reviewed Nelson's response and provided the following JART response: UNRESOLVED - Impacts from the existing quarry operations have not been specifically identified.
278.	Considering that private well referred to as DW2 is located within the present quarry zone of influence, it may not represent the natural variability of the groundwater elevation fluctuations as stated. How many years of DW2 monitoring data is available to date?	Well DW2 has been continuously monitored since August 2019. Also refer to Response 280, below.	Not addressed. We disagree that a private water supply well, with a very limited baseline data, can be used to show natural variability of the groundwater elevation fluctuations and trends under various future pumping and climatic conditions.	Given that there are no other up gradient wells with data; an up gradient well with 2 years of record is extremely useful.	On January 1, 2023, Ontario Regulation 596/22 came into effect. As a result, technical review services for planning and development applications previously provided by Conservation Halton (CH) under Memorandums of Understanding with municipalities (e.g., technical reviews related to natural heritage and select aspects of stormwater management) can no longer be provided. As such, we defer this comment to the other JART members to confirm whether it has been addressed. Norbert Woerns has reviewed Nelson's response and provided the following JART response: PARTIALLY RESOLVED -Efforts to locate and install background monitors separate from existing private wells have been initiated but some are yet to be installed.
279	Please provide an example of the trend analysis. How often would this analysis be repeated based on actual measurements rather than simulated levels?	Please see: https://www.nvca.on.ca/Shared%20Documents/NVCA%20Groundwater%20Trend%20Analysis%20Using%20the%20PGMN%20May%202013.pdf For a discussion of seasonal trend analysis.	Addressed.	RESOLVED	RESOLVED
282.	What groundwater mitigation measures would be implemented to mitigate impacts (if identified through monitoring) on the natural environment features? E.g. groundwater discharge to Medad Valley, wetlands and streams.	The change in soil moisture conditions in the Medad Valley is discussed in our Wetland characterization table included in the MNRF comment response. These changes are small and are broadly distributed along the valley wall. The water intercepted by the western extension (and not infiltrated through the infiltration pond) will be ultimately be discharged to the Medad Valley slightly to the north, so no downstream impacts are likely.	Not addressed. If the groundwater levels cannot be maintained as suggested based on the model results, mitigation measures might be needed.	MNDMNRF expressed similar concerns regarding the Medad Valley. As per the updated AMP, additional monitoring is planned as well as changes to the operation of the infiltration feature to raise heads and increase infiltration.	On January 1, 2023, Ontario Regulation 596/22 came into effect. As a result, technical review services for planning and development applications previously provided by Conservation Halton (CH) under Memorandums of Understanding with municipalities (e.g., technical reviews related to natural heritage and select aspects of stormwater management) can no longer be provided. As such, we defer this comment to the other JART members to confirm whether it has been addressed. Norbert Woerns has reviewed Nelson's response and provided the following JART response: UNRESOLVED – The proposed infiltration pond has been simulated. Questions remain regarding the effectiveness of the infiltration pond given the generalized model assumptions. No alternatives have been proposed to the infiltration pond for protection of springs, seeps and wetlands down-gradient of the pond,
286.	A number of important monitors are not included in the monitoring program, e.g.: MW03-02, OW03-16 and MW next to it (based on Figure 3.4 cannot decipher what the MW number is), OW03-32, MW03- 03, OW03-31, MW03-08, MW03-10. All monitoring well intervals should be monitored (including shallow either bedrock or overburden installations, which are usually designated C).	A key component of the monitoring for the AMP is to assess the extent of possible impacts in areas more distant from the quarry. A number of the wells suggested by the reviewer are located in closer proximity to the proposed quarry extension. Others are near already proposed monitoring nests. The AMP, however, is currently under review and finalization.	Not addressed. Subject to AMP review when available.	The AMP has been provided to JART.	On January 1, 2023, Ontario Regulation 596/22 came into effect. As a result, technical review services for planning and development applications previously provided by Conservation Halton (CH) under Memorandums of Understanding with municipalities (e.g., technical reviews related to natural heritage and select aspects of stormwater management) can no longer be provided. As such, we defer this comment to the other JART members to confirm whether it has been addressed. Norbert Woerns has reviewed Nelson's response and provided the following JART response: UNRESOLVED -None of the recommended monitoring location have been included in the AMP.

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294.	Provided thresholds in Table 9.2 assume that there are no impacts to the shallow zone. It seems, if the Level 1 and 2 Threshold conditions are met, a very similar response is proposed and there is no action proposed after reaching Threshold 1 to avoid Threshold 2. There is no action proposed to avoid reaching a minimum water level nor any action if it is reached or exceeded. Please revise to propose appropriate actions.	The shallow bedrock is not used as a water supply aquifer, and shallow seasonal variability is larger (some shallow monitors go dry). The deeper monitors provide a more representative measurement that is less susceptible to false alarms.	Not addressed. It is agreed that the deeper monitors may be less susceptible to false alarms; however, considering there are potentially shallow private wells and natural environment which rely on shallow groundwater zone, threshold values for shallow wells should be also developed. Considering, the response to comment 20 mentions mitigation to potential impact to shallow wells (deepening) threshold values for shallow wells are needed.	The AMP has been provided to JART.	On January 1, 2023, Ontario Regulation 596/22 came into effect. As a result, technical review services for planning and development applications previously provided by Conservation Halton (CH) under Memorandums of Understanding with municipalities (e.g., technical reviews related to natural heritage and select aspects of stormwater management) can no longer be provided. As such, we defer this comment to the other JART members to confirm whether it has been addressed. Norbert Woerns has reviewed Nelson's response and Provided the following JART response: UNRESOLVED – It remains unclear how shallow wells will be protected without shallow groundwater monitoring.
297.	Please provide groundwater quality and quantity monitoring details. What would be the frequency of the trend analysis? Shallow monitoring wells and a number of wells listed in comment re Section 9.5.1 should be added to the monitoring program. Nitrite and nitrate should be added to water quality monitoring.	Further information about the quantity and quality monitoring program and AMP is presented in our response to comments from MECP (see Schedule A). The issues with shallow monitors are discussed in Response 294.	Not addressed. Subject to AMP review when available. No response to nitrite and nitrate monitoring request provided.	The AMP has been provided to JART.	On January 1, 2023, Ontario Regulation 596/22 came into effect. As a result, technical review services for planning and development applications previously provided by Conservation Halton (CH) under Memorandums of Understanding with municipalities (e.g., technical reviews related to natural heritage and select aspects of stormwater management) can no longer be provided. As such, we defer this comment to the other JART members to confirm whether it has been addressed. Norbert Woerns has reviewed Nelson's response and provided the following JART response: PARTIALLY ADDRESSED – Nitrate and nitrite added to water quality monitoring however no threshold for groundwater quality parameters were identified. No mechanism identified for mitigation measures for water quality.
306.	Include a summary of effects on watercourses in these sections.	An extensive summary of the effects on wetlands and streams has been compiled for MNRF and has been provided in Schedules B and C.	Not addressed. Please provide written analysis of the effects on the watercourses within the Watercourse Characterization Summaries. The effects on flow are not summarized in the tables in the summaries and the provided charts are difficult to read as several charts are labeled the same and the legends are not clear as to what each line is. It is also confusing that the summaries appear to be talking about groundwater as opposed to surface water (groundwater, water budget) please clarify that surface flows are being compared.	Hydrographs comparing flows at all significant gauges were presented for each scenario. The overall impacts on streamflow's were summarized in a summary section at the end of each scenario (e.g., Section 8.5.5 for P12). These summaries could have been brought forward to Chapter 11, but the focus at the time of reporting seemed to be on wetlands and domestic water supply. A summary of watercourse data was compiled for MNDMNRF to consolidate the monitoring data and model assessments for each watercourse into a single section, rather than across the various scenarios, specifically to ease the review of effects.	On January 1, 2023, Ontario Regulation 596/22 came into effect. As a result, technical review services for planning and development applications previously provided by Conservation Halton (CH) under Memorandums of Understanding with municipalities (e.g., technical reviews related to natural heritage and select aspects of stormwater management) can no longer be provided. As such, we defer this comment to the other JART members to confirm whether it has been addressed. Norbert Woerns has reviewed Nelson's response and provided the following JART response: UNRESOLVED – requires surface water input
307	Outline proposed pumping/discharge points for Rehabilitation Scenario 1.	These will remain as before at Sump 001 and Sump 002	Addressed.	RESOLVED	Norbert Woerns has reviewed Nelson's response and provided the following JART response: RESOLVED
314.	Please submit all borehole logs used for the assessment (Only 50 out of 100 reported borehole logs were provided). 2 wells "Pump well 1" and PW-2; 6 on-site quarry wells; 35 minipiezometers of the "MP" series; and 1 staff gauge, SG-4.	An extensive suite of logs and monitoring details has been provided in our response the MNRF (see Schedule D). Available borehole logs have been provided, as per the request, in schedules B and C and additional information is also provided in Schedule E.	Partially addressed. Only three extra borehole logs were provided in Schedule D and two in Schedule E.	Specific requests were made by other reviewers for logs of wells drilled for this study. The wells referred to in this comment were installed by Golder and the logs are in the previous Golder submissions.	On January 1, 2023, Ontario Regulation 596/22 came into effect. As a result, technical review services for planning and development applications previously provided by Conservation Halton (CH) under Memorandums of Understanding with municipalities (e.g., technical reviews related to natural heritage and select aspects of stormwater management) can no longer be provided. As such, we defer this comment to the other JART members to confirm whether it has been addressed. Norbert Woerns has reviewed Nelson's response and provided the following JART response: PARTIALLY ADDRESSED- some additional logs provided

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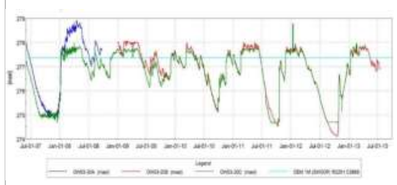
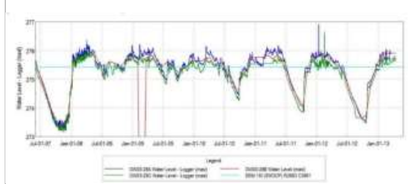
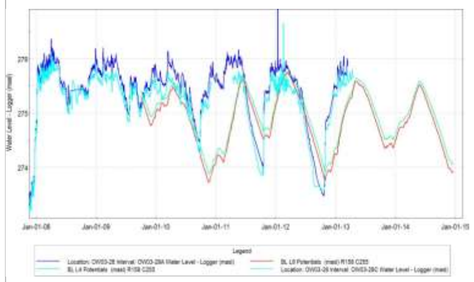
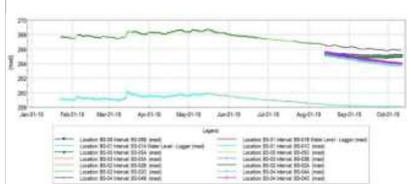
318	Monitoring well packer test and slug test results for all tested wells should be provided (please provide location of MW18-1 and MW18-2 monitoring wells). On page 367, last paragraph of section 15.2.1 it is reported that the packer testing results are in section 11.1, but section 11.1 is an introduction to Summary and Conclusions. Borehole logs in section 15.1 for reported in section 15.2 packer tested wells do not show the information either.	A spreadsheet with packer test data has been provided in Schedule E. The information has also been presented in a table in a MS-Word document. Figures showing the packer test locations are also provided.	Addressed.	RESOLVED	RESOLVED
328.	OW03-20 documented groundwater levels suggest upward gradients at this location suggesting groundwater discharge conditions. Please provide simulated data for all OW03-20 (A, B and C) intervals.	The wells are located next to a ditch and therefore may intermittently receive groundwater discharge. The remainder of the wetland may be perched. A spreadsheet with the observed and simulated groundwater levels has been provided in Schedule E. 	Not addressed. We cannot locate the simulated water level data in Appendix E. Groundwater levels in the deep bedrock aquifer are constantly higher than the middle and shallow aquifer, which does not support provided response.	The well is on the side of a sloping area, and local conditions and vertical interconnection may account for the generally small gradient. Nearby location MW03-08 exhibits downward gradients from the shallow to deep system.	On January 1, 2023, Ontario Regulation 596/22 came into effect. As a result, technical review services for planning and development applications previously provided by Conservation Halton (CH) under Memorandums of Understanding with municipalities (e.g., technical reviews related to natural heritage and select aspects of stormwater management) can no longer be provided. As such, we defer this comment to the other JART members to confirm whether it has been addressed. Norbert Woerns has reviewed Nelson's response and provided the following JART response: UNRESOLVED-(Modelling Comment) CHRIS NEVILLE: The hydrograph provided in the Applicant response includes only the observations for OW03-20 A/B/C. The corresponding simulation results requested in the JART February 2012 comments have not been provided here.
329.	OW03-28 documented groundwater levels suggest upward gradients at this location suggesting groundwater discharge conditions. Please provide simulated data for all OW03-28 (A, B and C) intervals.	The wells are located in a low-lying area and therefore may intermittently receive groundwater discharge. The remainder of the wetland is likely perched. A spreadsheet with the observed and simulated groundwater levels has been provided in Schedule E. 	Not addressed. We cannot locate the spreadsheet with simulated data. An OW03-28 hydrograph should be presented showing simulated and observed data.	The requested hydrograph is attached. 	On January 1, 2023, Ontario Regulation 596/22 came into effect. As a result, technical review services for planning and development applications previously provided by Conservation Halton (CH) under Memorandums of Understanding with municipalities (e.g., technical reviews related to natural heritage and select aspects of stormwater management) can no longer be provided. As such, we defer this comment to the other JART members to confirm whether it has been addressed. Norbert Woerns has reviewed Nelson's response and provided the following JART response: (Modelling Comment) CHRIS NEVILLE: RESOLVED
330.	BS-01 through BS-05 reported groundwater level monitoring period is less than 1 year. Please extend the monitoring period to include the most recent data. Please include BS-06 and BS7 groundwater level data, borehole logs and location of these two wells.	The analyses were completed using the available data. Data for the BS series wells starts in January 2019 for some of the wells and in August 2019 for the remainder. Observations were provided until mid-October 2019. Monitoring has continued since that time to assist with the development of the AMP. We did not have water levels for BS-06 or BS-07. Well locations are shown below. 	Not addressed. Recent monitoring data still outstanding.	No data were provided past the study cutoff time of October 2019.	On January 1, 2023, Ontario Regulation 596/22 came into effect. As a result, technical review services for planning and development applications previously provided by Conservation Halton (CH) under Memorandums of Understanding with municipalities (e.g., technical reviews related to natural heritage and select aspects of stormwater management) can no longer be provided. As such, we defer this comment to the other JART members to confirm whether it has been addressed. Norbert Woerns has reviewed Nelson's response and provided the following JART response: UNRESOLVED

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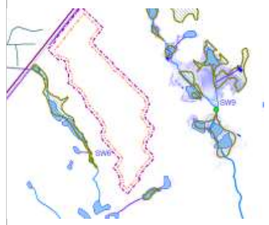
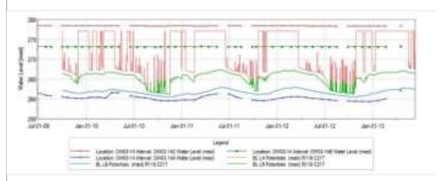
335	Please clarify for which wetlands field surveyed bathymetry data was used	Bathymetry data were available for the golf course ponds and wetlands to the south and east of P12. 	Addressed.	RESOLVED	RESOLVED
337.	Please explain why specific yield values for weathered and fractured zone hydro stratigraphic layers are so low (Weathered Amabel, Middle Amabel bedding plane fracture zone and Lower fracture zone)? They are an order of magnitude smaller than respective competent bedrock layers. As per section 5.2.4 Layer 4 may act as unconfined aquifer when specific yield rather than storage is used. It should be noted that this is also possible in lower layers closer to the extraction where water table drops significantly.	In general, the pump test and responses to recharge all indicated that storage is very low in the bedrock system. The assumption was that if the bulk layers were dewatered, they would exhibit a higher storage than the fracture zones, so a higher value was assigned.	Not addressed. The question was about the specific yield rather than storage. It seems questionable to assign a lower specific yield value (drainable porosity) to weathered Amabel, and middle and lower fracture zones, which can be drained close to the extraction zone.	The original response is correct. A low value was assigned to layers specifically representing fracture zones. Higher values were assigned to the bulk rock zones assuming they had drainable primary porosity.	On January 1, 2023, Ontario Regulation 596/22 came into effect. As a result, technical review services for planning and development applications previously provided by Conservation Halton (CH) under Memorandums of Understanding with municipalities (e.g., technical reviews related to natural heritage and select aspects of stormwater management) can no longer be provided. As such, we defer this comment to the other JART members to confirm whether it has been addressed. Norbert Woerns has reviewed Nelson's response and provided the following JART response: UNRESOLVED – The response to the question of specific yield is counter to common knowledge that fractured bedrock would have higher specific yield than that of unweathered bedrock due to abundance of fractures due to weathering.
343.	Please include simulated and observed water levels for OW03- 14B. It should be noted OW03-14A water levels are also constantly overestimated by some 1-2 m.	OW03-14C and OW14B are nonresponsive and are either plugged or dry. The simulated water levels for all well are shown on the figure below for the overlapping observation/simulation period. 	Addressed.	RESOLVED	RESOLVED
344.	Contrary to wells within 100.0 meters of the extraction the model underestimates deep system groundwater levels by some 1.0-2.5 meters, moreover, simulated water levels from model layer 7 or 8 should be presented and compared to MW03-09A. Shallow zone observed and simulated groundwater levels should be also included on this figure.	It is difficult to match water levels exactly, given that we are trying to simulate heads close to a quarry face with a large-scale model where the local quarry geometry 10 years ago is not the same as now (further, some main quarry rehab has already taken place along the south wall). The figure shows simulated water levels in Layer 8 and observations in MW03-09A in blue. 	Addressed.	RESOLVED	RESOLVED

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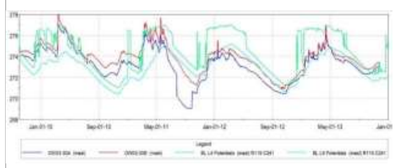
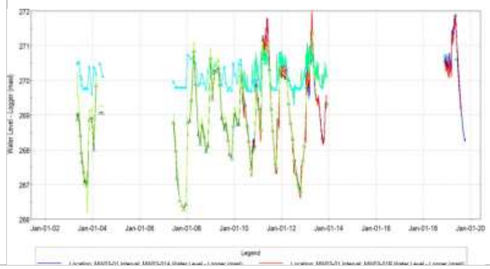
345.	OW03-30 – observed groundwater levels in the deep and middle zones seem to be higher than simulated water levels. Simulated water levels from model layer 7 should be presented and compared to OW03-30A. Shallow zone groundwater OW03-30C observed and simulated water level data should be included.	Hydrographs for OW03-30 A and B are provided. There is no shallow well OW03-30C. Groundwater level data and the hydrograph have been provided in Schedule E. Simulated water levels at OW03-21 for Layer 1 and 2 were very similar to those for Layer 4. There are a number of possible reasons for this anomaly, including well construction, survey error, local shallow topographic/drainage effects and others.	Upward gradients are reported in numerous monitoring wells east of the southern extension (OW03-31, OW03-20, and OW03-28). Does the model replicate these conditions?	Similarly, downward gradients are observed at OW03-29 and MW03-09. Overall, the vertical gradients are typically small (10's of cm) compared to the seasonal fluctuations of several meters that are observed. The small vertical gradients reflect local surface topographic variation, while the larger seasonal fluctuations are consistent with our overall conclusions describing the near, intermediate and far scale water level response to leakage from above. The minor gradients are not significant relative to the seasonal fluctuations	On January 1, 2023, Ontario Regulation 596/22 came into effect. As a result, technical review services for planning and development applications previously provided by Conservation Halton (CH) under Memorandums of Understanding with municipalities (e.g., technical reviews related to natural heritage and select aspects of stormwater management) can no longer be provided. As such, we defer this comment to the other JART members to confirm whether it has been addressed. Norbert Woerns has reviewed Nelson's response and provided the following JART response: UNRESOLVED – (modelling comment) CHRIS NEVILLE: The Applicant Response of June 2022 does not address the question whether the model replicates upward gradients are reported in numerous monitoring wells east of the southern extension.
347.	The large difference between simulated and observed water levels in MW03-02 as presented on Figure 19.28 puts in question using the model to predict local conditions. Perhaps the difference between the observed and simulated water levels can be explained by heterogeneity of the bedrock aquifer. Has there been any hydraulic testing done on MW03- 02 to identify local hydraulic properties of the aquifer? Please provide a borehole log for MW03-02. Please include MW03-02B observed and simulated data.	See response 346 	Not addressed. The response to comment 346 suggests that the model cannot be used for local impact and predictive analysis. In addition, in response to comment 123 the argument is quite opposite to response to comment 346. The response to 123 states: "Layer 7 heads (second figure) show little change in the vicinity of the fracture zones and the only break in slope occurring near the karst stream segment. There is likely little impact in the vicinity of the streams". Please explain the inconsistency.	[Comment 346: As noted above, this monitor is adjacent to the stream carrying the south quarry discharge. The monitor is also immediately beside a randomly placed vertical fracture; that is also under a wetland cell fed by the south quarry discharge. In summary, this cell probably receives too much leakage from above, explaining the high simulated water level. This is expected given the placement of the random vertical features and does not raise any alarms about the model] There is a subtle difference between being able to predict local affects and the ability to predict the effects at a particular observation point. Observed response is affected by the presence and absence of fractures, where the presence and absence and properties of these features are unknowable. The model uses randomly placed fractures to mimic the aggregate response of the local system in the vicinity of the quarry. Thus, the placement of a fracture may degrade the ability to match the response at an observation point where no fracture exists, but without the placement of the random fractures, the model would not be able to match the general pattern of drawdowns (as seen by examining the response of multiple wells).	On January 1, 2023, Ontario Regulation 596/22 came into effect. As a result, technical review services for planning and development applications previously provided by Conservation Halton (CH) under Memorandums of Understanding with municipalities (e.g., technical reviews related to natural heritage and select aspects of stormwater management) can no longer be provided. As such, we defer this comment to the other JART members to confirm whether it has been addressed. Norbert Woerns has reviewed Nelson's response and provided the following JART response: UNRESOLVED – Comment 346 referred to, is missing from this table. This issue points to the inability of the model to provide accurate predictions of impact on site specific locations.
348.	Considering MW03-01C is a shallow well (about 2.0 meter deep), simulated water levels from an appropriate layer should be presented on Figure 19.28. Please include MW03-01B observed and simulated data.	MW03-01C data does not appear on Figure 19.28.	Not addressed. Considering MW03-01C is a shallow well (about 2.0 meter deep), simulated water levels from an appropriate layer should be presented on Figure 19.29, which is on the same page as Figure 19.28. Please include MW03-01B observed and simulated data.	MW03-01 is directly influenced by the intermittent south quarry discharge, which has not been closely monitored, so simulations and conclusions are difficult. MW03-01A and B have nearly identical response, while the shallow C monitor seasonally dries out. 	On January 1, 2023, Ontario Regulation 596/22 came into effect. As a result, technical review services for planning and development applications previously provided by Conservation Halton (CH) under Memorandums of Understanding with municipalities (e.g., technical reviews related to natural heritage and select aspects of stormwater management) can no longer be provided. As such, we defer this comment to the other JART members to confirm whether it has been addressed. Norbert Woerns has reviewed Nelson's response and provided the following JART response: UNRESOLVED-unable to see all of information provided in response by Earthfx as the hydrograph is cutoff in this table

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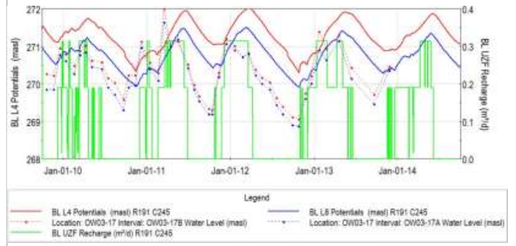
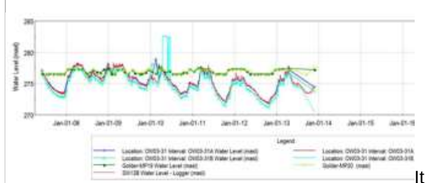
349.	Please explain a 2-3-month lag between the observed and simulated water levels at monitor OW03-17.	See Comment 173. As we noted, there is a bit of a lag in the fall recovery. This is likely due to the need to bring soils up to field capacity before groundwater discharge or Dunnian flow occurs. In the field, the values of soil storage capacity will likely vary, with some areas contributing flow earlier than others. Randomizing the storage capacity values within each class might help but was not implemented in this model.	Not addressed. Figure 19.30 shows deep and middle bedrock aquifer water levels. The provided response is inadequate to explain the lag.	 The figure, similar to Figure 19. 30 (the focus of the comment) now shows the simulated recharge. The shallow and deep bedrock both respond to the presence/absence of recharge. That is why our original response relates the lag in groundwater levels to the lag in recharge. As can be seen, our match to the timing of recharge events is good but not perfect. The events should start a bit earlier and be should be peakier (higher maximum but shorter duration) to match the peakiness of the response. Aquifer storage may also be too high, but we are already at the lower end of reasonable values. The local variation in vertical fracturing within the Halton Till is a more likely suspect for the peaky response.	On January 1, 2023, Ontario Regulation 596/22 came into effect. As a result, technical review services for planning and development applications previously provided by Conservation Halton (CH) under Memorandums of Understanding with municipalities (e.g., technical reviews related to natural heritage and select aspects of stormwater management) can no longer be provided. As such, we defer this comment to the other JART members to confirm whether it has been addressed. UNRESOLVED. The response should include a discussion of the implications on model predictions of the “local variation in vertical fracturing within the Halton Till” that is not incorporated in the analyses.
350.	Please explain a couple month lag between observed and simulated water levels as visible on Figures 19.35, 19.38, 19.39, 19.40 and implications of using the model for predictive analysis. Please provide construction details of the mini- piezometers used in the assessment.	See Comment 173. As we noted, there is a bit of a lag in the fall recovery. This is likely due to the need to bring soils up to field capacity before groundwater discharge or Dunnian flow occurs. In the field, the values of soil storage capacity will likely vary, with some areas contributing flow earlier than others. Randomizing the storage capacity values within each class might help but was not implemented in this model. Minipiezometer data have been provided.	Not addressed. Simulated vs. observed lag commented in Comment No. 179. There are three locations where the minipiezometer data is presented: Wetland Characterization Summaries tables, MNRF Response Table 2, and MNRF Response Appendix B: Borehole Logs. The data reported in all three locations are different. Either ground surface elevations or depths are different for most of the installations, which makes the report difficult to understand and undermines the confidence of the model results.	See above.	On January 1, 2023, Ontario Regulation 596/22 came into effect. As a result, technical review services for planning and development applications previously provided by Conservation Halton (CH) under Memorandums of Understanding with municipalities (e.g., technical reviews related to natural heritage and select aspects of stormwater management) can no longer be provided. As such, we defer this comment to the other JART members to confirm whether it has been addressed. NOT RESOLVED. The Applicant response of June 2022 does not address the interim JART response of February 2022.
357			Groundwater interaction table shows average WLs based on manual measurements below the bottom of both instruments (see below). Also, ground elevation at MP19 and MP20 is at 278.56 and 278.36, respectively, meanwhile Wetland 13016 – Figure 1 - Bathymetry shows that elevation should be below 278. Please explain. 	No response provided by proponent.	On January 1, 2023, Ontario Regulation 596/22 came into effect. As a result, technical review services for planning and development applications previously provided by Conservation Halton (CH) under Memorandums of Understanding with municipalities (e.g., technical reviews related to natural heritage and select aspects of stormwater management) can no longer be provided. As such, we defer this comment to the other JART members to confirm whether it has been addressed. Norbert Woerns has reviewed Nelson's response and provided the following JART response: NO COMMENT
358.			OW03-31 show groundwater levels are constantly above MP19 and MP20 water levels in spring/early summer of 2008 and 2009 upon which they decline below them, which potentially is due to extraction face nearing closer to the well.  It should be noted that the model does not simulate groundwater levels well in this area as visible on Figure 6.26:	No response provided by proponent.	On January 1, 2023, Ontario Regulation 596/22 came into effect. As a result, technical review services for planning and development applications previously provided by Conservation Halton (CH) under Memorandums of Understanding with municipalities (e.g., technical reviews related to natural heritage and select aspects of stormwater management) can no longer be provided. As such, we defer this comment to the other JART members to confirm whether it has been addressed. Norbert Woerns has reviewed Nelson's response and provided the following JART response: NO COMMENT

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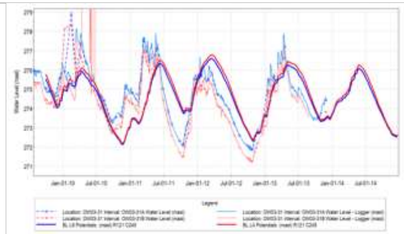
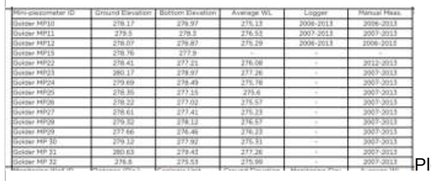
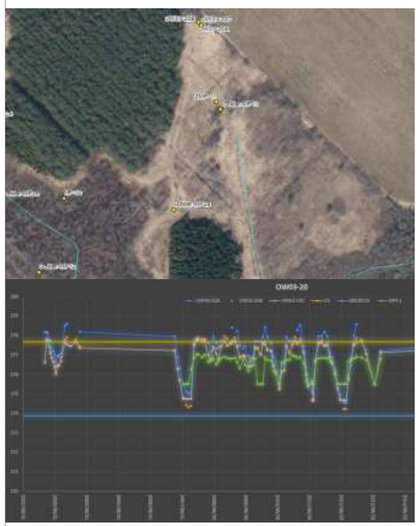
			 Figure 6.26: Comparison of observed and simulated water levels at monitor OW03-31 (Note: deep There is a lag between the observed and simulated groundwater water levels. The observed high groundwater levels, which potentially contribute to groundwater seepage within the wetland are not simulated in the model. Considering the lag between simulated and measured water levels and that the modelled peak groundwater levels do not match the observed data (groundwater levels are used in the model to calculate seepage into the wetland), the model cannot be used to predict impacts on the wetland.		
359.			Groundwater interaction summary shows average WLs based on manual measurements below the bottom of all instruments but MP32. Also, by comparing the ground elevation to the provided bathymetry map, the ground elevation of several instruments seems to be incorrect.  Please explain.	No response provided by proponent.	On January 1, 2023, Ontario Regulation 596/22 came into effect. As a result, technical review services for planning and development applications previously provided by Conservation Halton (CH) under Memorandums of Understanding with municipalities (e.g., technical reviews related to natural heritage and select aspects of stormwater management) can no longer be provided. As such, we defer this comment to the other JART members to confirm whether it has been addressed. Norbert Woerns has reviewed Nelson's response and provided the following JART response: NO COMMENT
360.			Monitoring well OW03-20 is some 60 metres north of MP11 (see below), it shows measured groundwater levels almost constantly above MP11 levels (see below), suggesting groundwater seepage into this part of the wetland. Please provide simulated groundwater levels for OW03-20.  	No response provided by proponent.	On January 1, 2023, Ontario Regulation 596/22 came into effect. As a result, technical review services for planning and development applications previously provided by Conservation Halton (CH) under Memorandums of Understanding with municipalities (e.g., technical reviews related to natural heritage and select aspects of stormwater management) can no longer be provided. As such, we defer this comment to the other JART members to confirm whether it has been addressed. Norbert Woerns has reviewed Nelson's response and provided the following JART response: NO COMMENT

HYDROLOGIC/HYDROGEOLOGIC MODELLING COMMENTS

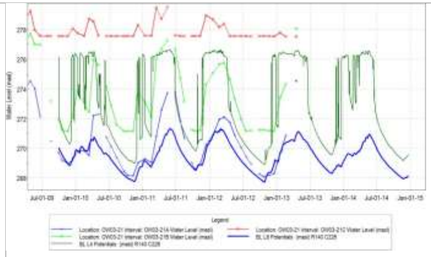
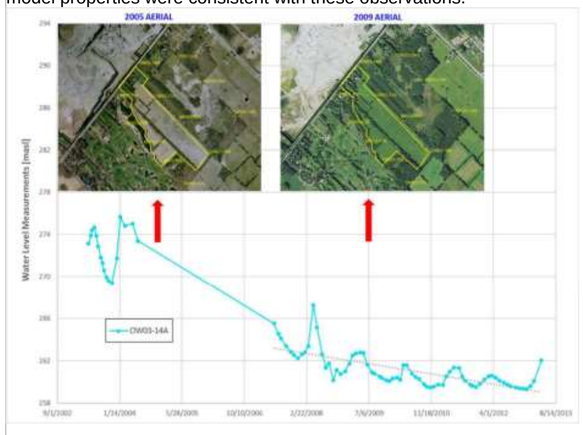
	JART Comments (February 2021)	Applicant Response	Interim JART Response (February 2022)	Applicant Response (June 2022)	JART Response (June 2023)
61.	The retained consultant has not commented on the predictions of the potential effects of the proposed extension. It has not been demonstrated that the modelling that has been conducted provides an adequate basis for making such predictions	The **reviewer** states in his comment overview: ***Our review of the GSFLOW results suggests that, in general, the calibrated model is capable of matching variations in water levels arising from seasonal climate fluctuations.*** **If the model can replicate the transient response in shallow and deep monitors both near and far from the existing quarry, it is, by logical extension, capable of predicting the effects of an extension to the quarry.** In Chapter 7 of this report we present a detailed modeling analysis of the baseline conditions regarding groundwater levels and streamflow and wetland conditions with comparisons to observations. In Chapter 8, we present a highly detailed analysis of likely changes to these conditions for a range of stages in the quarry extension and under a range of climate conditions (as represented using historic climate data). We know of no other quarry impact assessment with this level of detail and comprehensive analysis of groundwater, streamflow, and wetland response These two chapters are a critical part of Level 1 and 2 Hydrogeologic and Hydrologic Impact Assessment. We strongly feel the reviewer has shirked his responsibility by not reviewing the predictions of the potential effects of the proposed extension. The statement that "It has not been demonstrated that the modelling that has been conducted provides an adequate basis for making such predictions" is a disingenuous comment as it is impossible to determine that the model does not provide an adequate basis for predicting impacts without considering how the model was applied to compare the scenario predications and the type of results produced The reviewer later acknowledges that there is an entire section (Section 19 – Appendix E) discussing the calibration of the GSFLOW model, with 46 pages including sections on calibration strategy, region calibration to streamflow and regional groundwater levels, local-scale calibration to 8 streamflow gauges, calibration to quarry discharge, calibration to groundwater levels at the quarry face and the need to adjust hydraulic conductivities to match the observations along with discussions, tables, maps, and hydrographs of model results. This follows Section 17 and 18 of the report which provide another 93 pages of text, maps, and hydrographs describing the development and preliminary calibration of the hydrologic and groundwater sub models. The model was developed specifically to cover the large study area extending to below the Niagara Escarpment while still providing the high level of detail needed to assess the likely effect of the proposed quarry extension on groundwater levels, streamflow, and the water balance in nearby wetlands. The calibration was done over a two-year period with multiple revisions, innovations, and improvements to derive a good match to the observations (particularly in the shallow subsurface), and reasonably constrained parameter values. The model was calibrated by comparison to regional groundwater flow patterns and streamflow as well as local behavior of water levels at the quarry face and during aquifer testing. The model response was checked over a wide range of climate conditions that occurred over a 10-year period which included wet and dry years. Post-analysis checks, such as that provided in Response 41, further verify that the calibrated model captured key features of the hydrologic and hydrogeologic conditions in the study area. This was all accomplished using a highly advanced integrated model, despite long run times and instabilities related to the Niagara Escarpment, in a fractured rock/till environment, and with highly complex GW/SW interaction between headwater streams and shallow wetlands. We do not believe that there has ever been such a complex integrated transient analysis ever done in Ontario to analyze a proposed quarry extension. We believe that we accomplished the goal of producing a model that can successfully predict the likely changes in streamflow, groundwater levels, and wetland stage under the quarry extension scenarios considered. Results from this model provided useful input to other team members evaluating the impact to hydrologic and natural heritage features.	The response does not address our central concern. The model appears to be capable of simulating variations in water levels due to fluctuation climatic conditions. However, no results are presented to confirm that the model is there is capable of matching changes in water levels caused by an advancing quarry face. No results are presented that confirm the predictive capabilities of the model for the proposed quarry extensions.	A great deal of effort was expended in analyzing the historic behavior of groundwater levels in the vicinity of the quarry as the quarry face advanced, as discussed in the report. After a general calibration to regional water levels, the model calibration was re-analyzed specifically to match the unique patterns of response observed: specifically, drawdowns that extended out to about 800-1000 m from the face, a perched upper bedrock with a well-drained lower bedrock, and a highly responsive zone that seasonally dewatered. Matching this response also took a great deal of effort, and we believe it provides great confidence in the model's ability to predict response due to quarry expansion. Matching an advancing quarry face is not significantly different than matching an existing quarry face at different distances from that face. We are unaware of any quarry application model that simulated a dynamically advancing face in a fully integrated transient model. To date, the majority of approved applications have used steady state groundwater-only simulations with no dynamically advancing quarry face. This was discussed at length in our Nov. 2021 JART meetings.	NOT RESOLVED. This issue was discussed during the November 2021 JART meetings but was not resolved. The hydrogeology peer reviewers have never requested the simulation of an advancing quarry face with a coupled model. However, it is still considered essential that a model developed to support the assessment of the potential effects of a quarry expansion be demonstrated to be capable of reliable predictions of the long-term declines in groundwater levels due to an advancing quarry face. As indicated in the response, analyses with a steady-state model of two positions of the quarry would suffice for such a demonstration.

HYDROLOGIC/HYDROGEOLOGIC MODELLING COMMENTS

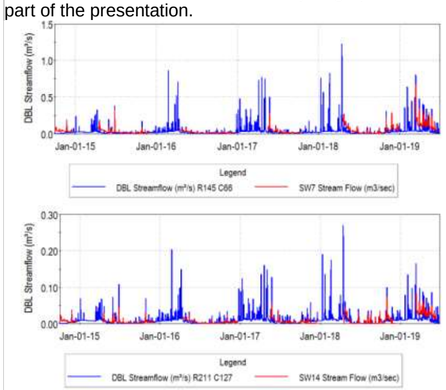
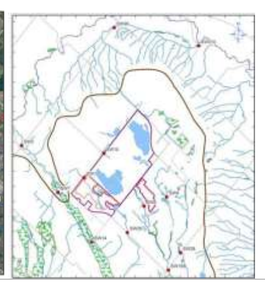
62	The Terms of Reference for the Level 1 and 2 Hydrogeologic and Hydrologic Impact Assessment of the Proposed Burlington Quarry Extension are dated February 2020 (Earthfx, Inc., Azimuth Environmental Consulting, Inc., Tatham Engineering, and Worthington Groundwater, February 2020). The field investigations and modelling analyses must have been largely completed by the date of the Terms of Reference.	Comment noted.	No further comments.	RESOLVED	
63.	The modelling described in the Level 1/2 report does not achieve the objective of providing defensible predictions of the potential impacts of the proposed development. The analyses described in the Level 1/2 report are extraordinarily complex from a process perspective, but highly simplified with respect to the assignment of material properties. It is not clear what parameters have the greatest influence of the predictions, whether there are sufficient data to constrain the assignment of parameter values, and whether the parameter values inferred through calibration are consistent with the available data.	No basis for this comment is presented by the reviewer. See the opening statement in Response 61. **<u>General comments:</u>** **"Everything should be made as simple as possible, but no simpler."** Attributed to Albert Einstein **"It seems that perfection is reached not when there is nothing more to add, but when nothing more can be removed."** Terre des Hommes [Land of People] by Antoine de Saint Exupéry, 1939 **Simplicity is the final achievement. After one has played a vast quantity of notes and more notes, it is simplicity that emerges as the crowning reward of art.** (Frédéric Chopin, a musician and composer, quoted in If Not God, Then What? by Fost, 2007) **<u>Specific comments about simplicity and complexity in groundwater models:</u>** ***Guideline 1: Apply the principle of parsimony*** *Using the principle of parsimony, the model is kept as simple as possible while still accounting for the system processes and characteristics evident in the observations and while respecting other information about the system.* From: Hill, M.C., 1998, Methods and Guidelines for Effective Model Calibration: USGS Open File Report 98-4005, Reston, VA.	While we appreciate the quotes on simplicity and the principle of parsimony, the response does not address our general concern. We recognize that "process complexity" must be addressed, at least with respect to simulating the effects of climate variations on shallow water levels. Our motivation has not been to encourage "parameterization complexity". Rather, it has been to seek understanding. To be clear, we repeat our fundamental concern. It is not clear what parameters have the greatest influence on the predictions, whether there are sufficient data to constrain the assignment of parameter values, and whether the parameter values inferred through calibration are consistent with the available data. The response does not address the questions in our review comments. • Which parameters make a real difference in the calibration?	We found the model response, specifically in the quarry vicinity, sensitive to the property values (hydraulic conductivity, anisotropy, and specific yield/specific storage) assigned to the fracture zones, the properties assigned to the intervening bulk bedrock units, the vertical fracture properties, and their density (in the order listed). It was relatively straight-forward to do the regional calibration to MECP observations. The values selected are constrained within tight ranges of the selected values, and are consistent with the available data. By using measured precipitation and calibrating to observed total streamflow and water levels, with a fully transient approach across a range of climate stress conditions (seasonal and inter-annual variability, including a Level 2 drought) the model has been tested across a wide range of conditions. In addition, the complex transient surface water and groundwater storage effects have been fully evaluated. This demonstrates that there is no single parameter that controls the system behavior. Hydraulic conductivity is important, but so is recharge variation. Topography and layer geometry are also important. Overall, our findings are that full transient process representation is key.	The modelling reported in the Burlington Quarry Extension Level 1/2 Assessment Report (Earthfx, 2020) is an essential component of the application and serves an important purpose. The modelling identifies the natural and manmade features that may be affected by the extension. These features include streams, wetlands and private wells. The coupled analyses that have been developed and applied are comprehensive and have been conducted to a high technical standard. The modelling is essential; however, it is important to note that it involves deliberate simplifications of a complex natural system. Viewed from this perspective, an impact assessment that is model driven is problematic. Rather than replacing data collection and synthesis, the modelling should be complementary. Models provide insights into what is likely to happen when a proposed development proceeds and are important for the ongoing interpretation of changes. However, it must be stressed that models do not "prove" anything. The emphasis of the assessment should be directed to analysis of all site data, and to the development of a comprehensive and robust Adaptive Management Plan. During the peer review of the modelling SSP&A has identified important limitations and uncertainties in the analyses of the proposed South and West Extensions. The uncertainties highlight the importance of including the conception and evaluation of mitigation measures and contingencies in the assessment. With respect to the Proposed South Extension, on the basis of the model results it is concluded that "the wetlands will leak a small amount more to the groundwater system when Phases 1 and 2 are complete, but the effect of this change will be so small that it cannot be measured in the field and will not change the overall water budget of each wetland". It is not clear how impacts to wetlands will be mitigated if there are areas where the vertical hydraulic conductivity of the Halton Till is higher than assumed in the analyses. With respect to the proposed West Extension, it is not clear how will impacts to private wells be mitigated if declines in groundwater levels lead to reductions in well capacities. It is not clear that well capacities can be maintained by drilling the wells deeper; restoring well capacities by extending wells may not be feasible if the deeper rock is not sufficiently transmissive, or the ambient water quality deteriorates with depth. NOT RESOLVED. Comparisons between simulation results and observed streamflows are presented for 6 locations in Figures 19.5, 19.7, 19.9, 19.10, 19.11 and 19.13. For 3 of the 6 locations, results are presented for WY2-17-WY2019. For the other 3 locations, results are presented for WY2015-WY2019. As indicated elsewhere in the responses, the quarry face had not advanced substantially over those time intervals. It should also be noted that precipitation has not been measured in the vicinity of the quarry. There is no climate station on Mount Nemo.

		*An important contribution of Freyberg (1988) was **identifying and highlighting that a model that fits the observations best may not forecast best**. This **concern is of primary importance when calibrating highly parameterized models (especially those using pilot points).** The highly parameterized approach often achieves an excellent fit but can also "over fit," where the parameter estimation chases noise in the observations and yields unrealistic parameter values and distributions (e.g., parameter "bullseyes," or hotspots).* From: Revisiting "An Exercise in Groundwater Model Calibration and Prediction" After 30 Years: Insights and New Directions" Randall J. Hunt, Michael N. Fienen, and Jeremy T. White The reviewer has touched an important part of our approach to modelling. Earthfx has completed more than 25 Source Water Protection, land development, watershed management, and quarry/mining studies using an integrated modelling approach. The experience has shown us that it is extremely important to account for the physical processes that control runoff and groundwater recharge. That is not to say that spatial variability in material properties is not important, but, in many cases, these variations are unknown except at a few points and the extrapolation of these data to the rest of the model comes with a high level of uncertainty. Our experience has been that the use of simpler models with average material properties can provide all the information needed to assess the likely magnitude of changes to the system due to imposed stresses even though it may not be possible to accurately predict the exact response at a particular point in space. We have spent a great deal of effort to determine regional values for material properties that best match regional groundwater flow patterns and streamflow as well as local behavior of water levels at the quarry face. The model response was checked over a wide range of climate conditions that occurred over a 10- year period which included wet and dry years. The ability to match observations over this extended period means that the values selected are consistent with the available data.	• Are there data to constrain the most important parameters? • How were the ranges established over which the parameter values would be adjusted to match the calibration targets?		
64.	Review of the GSFLOW results suggests that, in general, the calibrated model is capable of matching variations in water levels arising from seasonal Climate fluctuations. However, there are fundamental concerns regarding the treatment of the available data and the approaches that have been adopted for simulating groundwater flow in the bedrock. Evidence could not be found in the report that confirmed the GSFLOW model was capable of yielding acceptable matches to observed declines in groundwater levels arising from ongoing quarry operations.	The first statement confirms that the model is capable of matching the fluctuations in the data. **The reviewer has, however, failed to understand that the complex seasonal fluctuations in water levels are amplified in areas of quarry influence, and that our successful simulation of the full range of observed fluctuations is proof that the model is able to predict the influence of the quarry.** The following is a brief description of how seasonal processes interact with the quarry drainage in the range of 100 m to 800 m from the face (See Section 19.5.4): During wet seasons, the rate of vertical replenishment (recharge to the shallow bedrock) exceeds the rate of lateral seepage (under drainage) into the quarry. The fractures rapidly fill, and water levels rise significantly (**nearly 7 m** as observed in Figure 19.24, below) In late spring, recharge to the bedrock dramatically falls, and aquifer levels rapidly drop via leakage (drainage) into the quarry. As one moves beyond 800 m from the face, the effect of drainage into the quarry is negligible, water levels in the shallow and deep system broadly equilibrate, and seasonal fluctuations of 1-2 m are observed in all monitors. In summary, **large** seasonal fluctuations in monitoring levels are a key indicator of quarry influence. The reviewer, in stating *"the calibrated model is capable of matching variations in water levels arising from seasonal climate fluctuations"* has thus confirmed that the model is effectively simulating the interaction of natural processes and quarry influence. It is clear that the failure of the reviewer to understand these complex integrated model processes has resulted in his inability to complete the review as stated in Comment 61. Further, it is also apparent that the reviewer does not appreciate that representing the complex interaction of integrated model processes ("Process complexity" mentioned in Comment 63) is more important than an approach "*where the parameter estimation chases noise in the observations*" ("Parameterization complexity") (Hunt et al., as above). There is likely no amount of model K field parameterization and parameter estimation that will recreate the interaction of climate, soil zone processes, Halton till leakage and quarry drainage processes. Processes matter. The first statement supports our approach to transient integrated modelling.	<u>Part 1</u> The response is correct to note that the reviewer has failed to understand how the simulation of the full range of observed fluctuations is proof that the model is able to predict the influence of the quarry. It is not clear how the ability to match seasonal fluctuations caused by climate fluctuations constitutes "proof' that the model is capable of simulation conditions for which it was not calibrated, in particular, for expansion of the quarry. <u>Part 2</u> The response refers to seasonal processes interacting with the quarry drainage in the range of 100 m to 800 m from the face. Has a comparison been made between conditions observed in the shallow and deep groundwater systems between 2004 and 2021 to assess whether the effects of drainage into the quarry are negligible beyond a distance of 800 m from the quarry face?	As noted above, the model calibration was re-analyzed specifically to match the unique patterns of response observed at the quarry face: specifically, drawdowns that extended out to about 800-1000 m from the face, a perched upper bedrock with a well-drained lower bedrock, and a highly responsive zone that seasonally dewatered. The ability to match this behavior is the same needed to predict the groundwater response to the expansion of the quarry. That said, the model does much more in terms of closely matching observed streamflow, the seasonal behavior of groundwater levels, the general timing of runoff and recharge events, etc. Yes, there was a significant discussion in the report regarding our analysis of historic quarry response. It should be noted that this and the previous questions related to the analysis of historical quarry response and baseline model results in the quarry vicinity were the subject of a detailed technical meeting with Dr. Neville and the Conservation Halton reviewer in Nov. 2021.	NOT RESOLVED. The reference to "our analysis of historic quarry response" is not a reference to additional analyses conducted to confirm that the model is capable of reproducing the effects of an advancing quarry face.

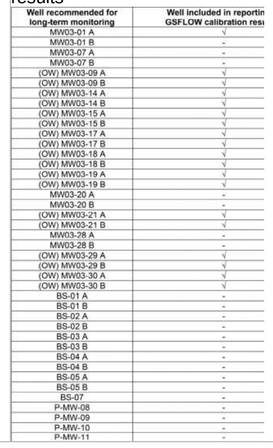
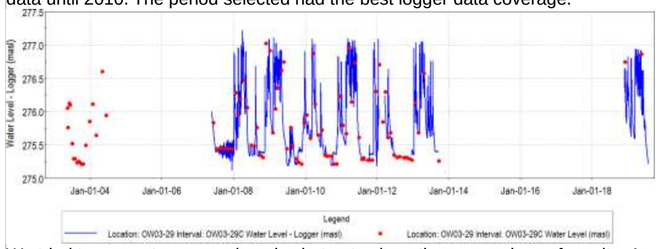
HYDROLOGIC/HYDROGEOLOGIC MODELLING COMMENTS

		 There is no basis for the second statement. The report (see Section 19.5) describes the efforts made to matching the water levels at the quarry face and incorporate information obtained from a set of historic observations of drawdowns as mining within the existing footprint approached the observation wells. Significant revisions were made to the model after a good regional calibration was achieved, to better match the unique conditions that occur in the vicinity of the quarry face. Additional comments made by the reviewer question the methods used, but a good local calibration could not be achieved without the approach taken. This is discussed further on.			
65.	Although the model has been developed to predict the potential impacts of the quarry expansion, the predictive capacity of the model has not been demonstrated. In general, the hydrographs presented in the report demonstrate that the model is capable of reproducing changes in water levels that are driven by seasonal variations in climate. However, no comparison is presented between observed and simulated average declines in water levels caused by the quarry operations. The quarry has been operating sufficiently long that it should be possible to identify the declines for at least some key monitoring locations. An appropriate application of the MODFLOW model would be to simulate time-averaged water levels for different positions of the quarry face. Did the position of the quarry face change 2003/2004 and 2007/2010? Has the position of the quarry face changed between 2010 and 2020? The results of time-averaged simulations of the different time periods would be important for confirming that the predicted effects of the quarry expansion on bedrock groundwater levels are within the realm of possibility. Referring the hydrographs in Golder (2010), it is estimated that for OW03-14A, the average level between April 2003 and July 2004 was about 272.0 meters amsl, and between July 2007 and July 2010 the average level was about 261.0 meter amsl. For monitoring well OW03-15A, the average level between April 2003 and July 2004 was about 260.0 meters amsl, while the average level between July 2007 and July 2010 was about 259.0 meters amsl. Substantial drawdowns were also observed at OW03-21. Golder (2010) present hydrographs for three other wells that show clear long-term declining trends and that might be used for this demonstration: Onsite quarry well 5 (Golder, 2010; Figure D.1.77); Onsite quarry well Goodchild (Golder, 2010; Figure D.1.78); and Onsite quarry well Sterrett (Golder, 2010; Figure D.1.79).	See above. It appears the reviewer did not read the section of the report describing local calibration. Section 5.3.3.2, 6.11, and 19.5 of the report specifically address the effects of the quarry that have been observed in the South Quarry Extension area monitoring network for many years. Although limited due to gaps in the monitoring data, this particular set of observation data, related to the movement of the quarry face and changes in water levels, was analyzed early on in the study to determine the effect of quarry development on water levels and to ensure that model properties were consistent with these observations. 	The hydrograph presented in the response to Comment 65 provides an excellent illustration of both the long-term and short-term changes in groundwater levels observed at OW03-14A. Please indicate the corresponding figure that shows the results from the groundwater model over the same time interval. Please also indicate where similar figures are presented for OW03-15A and the onsite quarry wells 5, Goodchild and Starrett	We did not simulate the movement of the quarry face. Our simulation of baseline conditions starts after the quarry had fully expanded to its limits. However, the model calibration was refined to match the unique patterns of response observed: specifically, drawdowns that extended out to about 800-1000 m from the face, a perched upper bedrock with a well-drained lower bedrock, and a highly responsive zone that seasonally dewatered.	RESOLVED. The movement of the quarry face was not simulated.

HYDROLOGIC/HYDROGEOLOGIC MODELLING COMMENTS

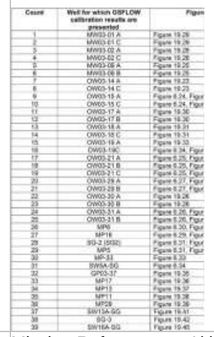
66.	No mention is made in the report of the two well- instrumented constant-rate pumping tests that have been conducted near the quarry. These tests provide useful opportunities to test the predictive capabilities of the calibrated groundwater flow model. The pumping test conducted in March 2004 is reported in Golder (2004; Appendix B). The pumping test conducted in February 2006 is reported in Golder (2006).	Much time and effort was spent early in the study digitize the Golder test data, verify the transmissivity estimates Golder obtained from the tests, and then set up transient model runs (MODFLOW only) to replicate test results. This was done with early versions of the model to aid in the pre-calibration, but is not discussed in great detail within the report. Model values for hydraulic properties did vary during the course of the GSFLOW calibration. Generally, K values for the lower Amabel increased from the early values assumed and are much closer to the Golder pump test derived K's.	The response indicates that a substantial effort was made to "replicate" the results of the pumping tests conducted previously at the site. It is precisely the documentation of the results of these efforts that is required to assess the model.	The pump test results provided initial estimates and practical constraints for the bedrock properties. The analyses were done with a temporary transient version of the MODFLOW-NWT model and the current GSFLOW model superseded this version.	NOT RESOLVED. Is it not feasible to apply the "temporary" version of the MODFLOW-NWT model in steady-state to simulate water levels for different stable positions of the quarry face?
67.	Streamflow Monitoring – A relatively small subset of the existing streamflow monitoring locations has been considered in the modelling analyses. Furthermore, inconsistent sets of streamflow monitoring stations have been considered for the GSFLOW calibration and the representation of baseline conditions. It was left with the impression that selective use has been made of the available data in the GSFLOW calibration and the representation of baseline conditions. At a minimum, all stations considered for the representation of baseline conditions should have calibration records that extend across the 10-year period WY2010 to WY2019. In addition, if it is not feasible to include all the existing streamflow monitoring locations in the calibration analyses/baseline conditions simulations, the documentation should include explanations regarding why some stations are included and others are not	All streamflow monitoring locations within the model boundaries were considered in the modelling analyses to see if the model produced reasonable matches to observed flows. Figure 19.4 shows the location of stations discussed in the report. As you note, not every flow monitoring station is discussed, but the locations discussed provide a good sampling of close and far stations, of stations affected/not affected by quarry discharge, and cover the reaches of streams likely to be affected by quarry expansion. It should be noted that data for all stream reaches were produced and saved for all simulations. We have post-processed these data to produce detailed water budgets for a set water courses to address a request by MNRF in their review. These have been provided in Schedules B and C.	The response to Comment 342 refers to simulation results for SW14 and SW7 are shown in Figures 8.72 and 8.73. These figures are reproduced below. Are any observations available for these stations, which would allow us to assess the match of the model to the observations?	We presented all available data as hydrographs in our meeting with JART team members. The two hydrographs below were part of the presentation.  SW7 and SW14 are in the Medad Valley and separate sections were devoted to illustrating change from baseline conditions. SW2 is affected by numerous in-line ponds along Cedar Spring Road downstream of the karst feature on Willoughby Tributary.	RESOLVED.
68.	Existing Streamflow Monitoring Locations – Referring to Tatham Engineering (2020; Table 2), there are 20 existing streamflow monitoring locations. SW01, SW02, SW06, SW07, SW09, SW10, SW14, SW15, SW21, SW22, SW23, SW24, SW25, SW26, SW28, SW29, SW30, SW31, SW34, SW35	The first figure shows the location of the 20 Tatham stations, while the second is from Figure 19.4 showing stations used for comparisons. The stations not shown in the second figure are all below the Escarpment and outside the model boundary. Simulated flows near the model boundary were compared against the closest gauge for consistency during model development.  	The response to Comment 342 refers to simulation results for SW14 and SW7 are shown in Figures 8.72 and 8.73. These figures are reproduced below. Are any observations available for these stations, which would allow us to assess the match of the model to the observations?	See above	RESOLVED.

HYDROLOGIC/HYDROGEOLOGIC MODELLING COMMENTS

69.	Monitoring locations for which results from the GSFLOW model calibration are reported – The Level 1/2 Hydrogeological and Hydrological Impact Assessment has been reviewed and it is noted that: The GSFLOW model has been calibrated for the five (5) year period, WY2010-WY2014 (October 2009 to September 2014); and The summary of the number of wells for which GSFLOW simulation results are reported in the Level 1/2 report is presented on Table 1. Comparisons between observations and simulation results are presented for 39 locations. No explanation is provided for restricting the GSFLOW calibration to the five-year period 2009-2014. Excellent data are available since 2003, and at a minimum it would be expected there to be some discussion of the consistency between the model results and earlier data. This is particularly important for assessing the ability of the GSFLOW model to match long-term changes in groundwater conditions caused by the evolution of the existing quarry, in particular the 2005-2019 advancement of the south extraction face). Table 1. Reported comparisons between observations and GSFLOW simulation results 	The model was calibrated over a 10-year period, WY2010-WY2019. Unfortunately, the “excellent” data from 2003 for model calibration that the reviewer refers to mostly falls within WY2008 to WY2013 as shown by the data for OW03-29. The 2003 data are mostly manual monthly measurements with a large gap between May 2004 and August 2007. There is another large gap from WY2014 to August 2018. Most wells show similar data distributions but there is variation. OW03-15 and OW03-30, for example, are part of a group of wells that did not have logger data until 2010. The period selected had the best logger data coverage.  We tried to present a comprehensive but not exhaustive comparison of results. As with the streamflow stations, the locations selected provided a good sampling of close and far stations and covers the area where groundwater is likely to be affected by the quarry expansion.	We acknowledge the correction in the duration of the model calibration. As indicated in the presentation materials accompanying a meeting held on November 11, 2021, the quarry face did not advance substantially over the period of the model calibration. Referring to Comment #61, we still contend that by limiting the calibration to this period, data are excluded that could have been matched to demonstrate the capability of the calibrated model to match observations of the effects of an advancing quarry face.	For the purposes of the cumulative impact analysis, the modelling focused on the relatively stable period from 2009 onward. While it might have been interesting to create a model that simulated the development of the quarry between 2003 and 2009, the effort to obtain monthly air photos (if available), map the incremental changes, modify the model surfaces on a monthly basis, incorporate all other changes such as construction/movement of ponds and sumps, would have been enormous. We know of no other modelling study that has incorporated a moving quarry face. As noted, instead we analyzed the observed historic response and used the insights gained to inform the model calibration to better represent local response in the quarry vicinity.	NOT RESOLVED. As indicated in Comment 61, at no point was a full transient analysis requested with the coupled GSFLOW model of the effects of the advancing quarry face.

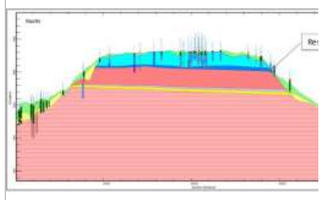
Well recommended for long-term monitoring	Well included in reportin GSFLOW calibration resu
MW03-01 A	√
MW03-01 B	-
MW03-07 A	-
MW03-07 B	-
(OW) MW03-09 A	√
(OW) MW03-09 B	√
(OW) MW03-14 A	√
(OW) MW03-14 B	√
(OW) MW03-15 A	√
(OW) MW03-15 B	√
(OW) MW03-17 A	√
(OW) MW03-17 B	√
(OW) MW03-18 A	√
(OW) MW03-18 B	√
(OW) MW03-19 A	√
(OW) MW03-19 B	√
MW03-20 A	-
MW03-20 B	-
(OW) MW03-21 A	√
(OW) MW03-21 B	√
MW03-28 A	-
MW03-28 B	-
(OW) MW03-29 A	√
(OW) MW03-29 B	√
(OW) MW03-30 A	√
(OW) MW03-30 B	√
BS-01 A	-
BS-01 B	-
BS-02 A	-
BS-02 B	-
BS-03 A	-
BS-03 B	-
BS-04 A	-
BS-04 B	-
BS-05 A	-
BS-05 B	-
BS-07	-
P-MW-08	-
P-MW-09	-
P-MW-10	-
P-MW-11	-

HYDROLOGIC/HYDROGEOLOGIC MODELLING COMMENTS

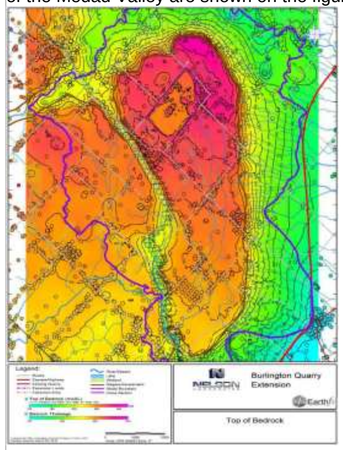
70.	Monitoring locations recommended for long-term monitoring – The wells recommended for inclusion in the long-term monitoring network are listed on Table 10.1 of the Level 1/2 report. The check marks on Table 2 denote those wells for which GSFLOW calibration results are reported. The results for the GSFLOW calibration are reported for only about half of these wells. The GSFLOW calibration should have included all of the wells recommended for inclusion in the long-term monitoring program. The GSFLOW results represent a prediction of what is likely to occur in the future, and the data from the long-term monitoring program will serve in an ongoing assessment of the realism of that prediction. As a minimum condition for reliability, it should be confirmed that the GSFLOW results provide a reasonable match to data that are already available. Table 2. Wells recommended for long-term monitoring 	As above, we tried to present a comprehensive but not exhaustive comparison of results. As with the streamflow stations, the locations selected provided a good sampling of close and far stations and covers the area where groundwater is likely to be affected by the quarry expansion.	We still maintain that a complete set of results be provided.	Hydrographs for all wells and stream stations were presented in a meeting with the JART team.	NOT RESOLVED. Is the response referring to the meeting held on November 11, 2021 (Sideways Nov 11, 2021 V3a.pdf)?
71.	Missing References – Although the Level 1 and Level 2 report is extensive, it is not complete. Complete references for many of the documents cited in the report are missing. Missing references are listed below. Page 52: Brunton, 2008 Page 52: Brunton, 2009 Page 52: Johnson et al., 1991 Page 54: Liberty et al., 1976 Page 54: Brett et al., 1990 Page 54: Bond et al., 1976 Page 54, 67: Johnson et al., 1992 Page 57: Brett et al., 1995 Page 57: Voss, 1969 Page 57, 103: Golder, 2004 (also Figure 5.9) Karrow, 1987. In addition to including the complete citation in the list of references, the specific map sheet should be indicated, Map 2508. Page 71: OGS, 2010 [and Figure 3.26] Page 71: White, 1975 Page 71: Karrow, 2005 Page 71: Chapman and Putnam, 1984 Page 71: Barnett, 1992 Page 82, 132: Earthfx, 2010 Page 82, 132: Hargreaves and Samani, 1982 Page 82: MNRF, 2013(also Figure4.9) Page 86: Worthington Water, 2020 Page 86: Worthington, 2020 Page 86: Worthington Groundwater, 2020 Page 104: Golder, 2005 Page 104: Jagger Himms [sic] (2003)	Comment noted. This does not change the conclusions of the report. Key missing references are provided below. Barnett, P.J., 1992, Quaternary geology of Ontario; in Geology of Ontario, Ontario Geological Survey, Special Volume 4, p.1011-1088. Brunton, F.R., Belanger, D., DiBiase, S., and Yungwirth, G., 2007, Caprock Carbonate Stratigraphy and edrock Aquifer Character of the Niagara Escarpment – City of Guelph Region, Southern Ontario, and paper presented at the 60th Canadian Geotechnical Conference/8th Joint CGS/IAH- CNC Groundwater Conf., Oct. 2007, Ottawa, Ontario. runton, F. R., 2008, Preliminary revisions to the Early Silurian stratigraphy of Niagara Escarpment - Integration of sequence stratigraphy, sedimentology and hydrogeology to delineate hydrogeologic units: in Summary of Field Work and Other Activities, 2008, Ontario Geological Survey, Open File Report 6226, p.31-1 to 31-18. runton, F. R., 2009, Update of revisions to the Early Silurian stratigraphy of the Niagara Escarpment - Integration of Sequence Stratigraphy, Sedimentology and Hydrogeology to delineate Hydrogeologic Units: in Summary of Field Work and Other Activities 2009, Ontario Geological Survey, Open File Report 6240, p.25-1 to 25-20. Chapman, L.J. and Putnam, D.F., 1984, The physiography of southern Ontario: Ontario Geologic Survey, Special Volume 2, 270p. NC-Lavalin Engineers and Constructors Inc. and Charlesworth and Associates, 2006, Hamilton groundwater resources characterization and wellhead protection partnership study: report to the City of Hamilton, February, 2006 Chiew, F.H.S. and McMahon,T.A., 1993 Assessing the Adequacy of Catchment Streamflow Yield Estimates, Australian Journal of Soil Research, v.31, p.665-680. illon (2008) Dillon Consulting, 2008, Hydrogeological Study of the New Freelton Well: March 2008. Earthfx, 2010, Tier 1 water budget and water quantity stress assessment of the Black-Severn River watershed: 124 pp. Earthfx (2020) – This *report* ly, D.M., and Kahle, S.C., 2012, Simulation of groundwater and surface-water resources and evaluation of water-management alternatives for the Chamokane	The response does not include an answer to our question on page 142. Is the reference to Golder Associates (2007) a reference to Golder Associates (2007a) or Golder Associates (2007b) in the list of references?	Golder Associates (2007b)	RESOLVED.

	[should read “Hims”] Page 104: Charlesworth & Associates (2006) Page 104: Dillon (2008) Page 104: Gartner Lee (2005) Page 104: AECOM (2009) Page 104: OGS (2010) Page 104: Wood (2018a) Page 104: Earthfx (2020) Page 105: Brunton, 2007 Page 109: Kassenaar and Wexler, 2006 Page 121: Huntington and Niswonger, 2014 Page 121: Hunt et al., 2013 Page 121: Ely and Kahle, 2012 Page 121: Tanvir Hassan et al., 2014 Page 121: Niswonger et al., 2014 Page 121: Leavesly et al., 2011 [should be Leavesley] The reference in the text of the report is to Golder Associates (2007). Is that to Golder Associates (2007a) or Golder Associates (2007b) in the list of references? Page 143, 512: Chiew and McMahon, 1993 Page 460: [Figure 17.10] MNR, 2013	Creek basin, Stevens County, Washington: U.S. Geological Survey Scientific Investigations Report 2012–5224, 74 p. Gartner Lee (2005) Gartner Lee Limited, 2005, Proposed Dolostone Quarry, Hamilton Volume 1: Hydrogeological Level 2 Report: June 2005. Hargreaves, G.H. and Samani, Z.A. (1982) Estimating potential evapotranspiration: Journal of Irrigation and Drainage Engineering, v.108, 223-230. unt, R.J., Walker, J.F., Selbig, W.R., Westenbroek, S.M., and Regan, R.S., 2013, Simulation of climate-change effects on streamflow, lake water budgets, and stream temperature using GSFLOW and SNTEMP, Trout Lake Watershed, Wisconsin: U.S. Geological Survey Scientific Investigations Report 2013–5159, 118 p., http://pubs.usgs.gov/sir/2013/5159/. Huntington, J.L. and Niswonger R.G., 2012, ole of surface-water and groundwater interactions on projected summertime streamflow in snow dominated regions - An integrated modeling approach: Water Resources Research, v.48, .11 Johnson M.D., Armstrong, D.K., Sanford, B.V., Telford P.G., and Rutka, M.A., 1992, Paleozoic and Mesozoic Geology of Ontario: in Geology of Ontario, Ontario Geological Survey, Special Volume 4, Part 2, p.907-1010.Page 57: Brett et al., 1995 Karrow, P.F., 1987, Quaternary geology of the Hamilton-Cambridge area, southern Ontario: Ontario Geological Survey Geoscience Report 255, 94p (accompanies Map 2508). Karrow, P.F., 2005, Quaternary geology of the Brampton area, southern Ontario: Ontario Geological Survey Geoscience Report 257, 59p. assenaar, J.D.C. and E.J. Wexler, 2006, Groundwater modelling of the Oak Ridges Moraine area: YPDT-CAMC Technical Report #01-06: Available at http://www.ypdt- camc.ca. Page 121: Liberty, B.A., Bond, I.J., and Telford, P.G., 1976, Paleozoic geology of the Hamilton area, southern Ontario: Ontario Geological Survey. Map 2336, scale 1:50 000. iswonger R.G., Allander K.K., and Jeton A.E., 2014, Collaborative modelling and integrated decision support system analysis of a developed terminal lake basin Journal of Hydrology. 517: 521-537. DOI: 10.1016/J.Jhydrol.2014.05.043 Page 71: Ontario Geological Survey, 2010, Surficial geology of southern Ontario; Ontario Geological Survey, Miscellaneous Release— Data 128 – Revised. anvir Hassan, S.M., M, Niswonger, R.G., and Zhongbo Su, 2014 Role of surface-water and groundwater interactions on projected summertime streamflow in snow dominated regions - An integrated modeling approach: paper presented at the 41st IAH International Congress, September 2014, Marrakech, Morocco Vos, M.A., 1969, Stone resources of the Niagara Escarpment: Ontario Dept. Mines, IMR31, 68p, accompanied by 6 maps. White, O.L., 1975, Quaternary Geology of the Bolton Area, Southern Ontario; Ontario Division of Mines, Geological Report 117, 119p, with Map 2275 and Map 2276, scale 1:63.360. Wood Environment & Infrastructure Solutions, 2018, Freelton Well FDF01 Increased Water Taking Assessment – Phase 3 Community of Freelton, Ontario: September 2018 Worthington Groundwater, 2020, Appendix B – Karst Investigation: in Level 1 and Level 2 Hydrogeological Assessment Proposed Burlington Quarry Extension – Appendix A and B, report prepared by Earthfx Inc. for the Nelson Aggregates Co., November 2019, 41 p.			
72.	Referring to page 92, the analyses are referred to as an “integrated model-driven, quarry assessment approach”. The objectives are summarized on page 22: The objective of this Level 2 ARA investigation is to characterize the existing conditions at the Burlington quarry site, describe the development of an integrated groundwater/surface water assessment model, and predict any likely changes to the hydrologic and hydrogeologic conditions at different phases of extraction and final rehabilitation.	Comment noted.	No further comments.	RESOLVED	RESOLVED.

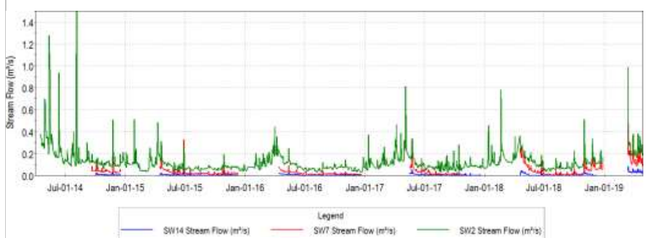
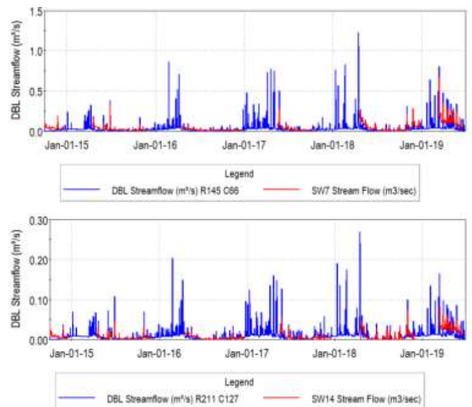
HYDROLOGIC/HYDROGEOLOGIC MODELLING COMMENTS

91.	The control points for mapping the elevations of the top of the Cabot Head Formation are shown in Figure 3.13. What control points were used to map the thickness of the Cabot Head Formation shown in Figure 3.14?	The thickness of the Cabot Head was calculated using the top of Queenston, thickness of the Manitoulin and Queenston, and then checking the surface against the top of bedrock, which captures the incision of the Medad Valley.	The response does not address our question. We did not ask how the thickness of the Cabot Head Formation was estimated. Rather, we asked what control points were used to map its thickness shown in Figure 3.14.	There was a typo, the response should have stated "…the thickness of the Manitoulin and Whirlpool. The top of the Cabot Head was mapped by interpolating the data points indicated. Similarly, the top of the Queenston was mapped by interpolating the data points for the top of the Queenston Fm (including MECP water wells, Oil and Gas wells and outcrops at Kerncliff Park and Smokey Hollow Waterfall). The thickness of the Whirlpool and Manitoulin were mapped by interpolating the data points for thickness of each respective unit. The interpolated thicknesses were added using grid arithmetic to the interpolated top of Queenston to get the top of Manitoulin. The resultant surfaces were checked for consistency then checking against the top of bedrock, which captures the incision of the Medad Valley. Finally, the thickness of the Cabot Head was computed by subtracting the Top of Manitoulin from the Top of Cabot Head. All the log analysis, formation picking, variance analysis, interpolation of surfaces using kriging, application of rules for surface checking, grid arithmetic to derive secondary surfaces, posting of data, and preparation of maps and cross-sections was done within the VIEWLOG environment.	RESOLVED.
92.	It is indicated in the text that "while Brunton (2008) was able to subdivide the Reynales, these units are hydro geologically similar (dolostone with shale partings) and are un-subdivided in the Golder and MECP logs; for simplicity, the Rockway and Merritton unit is referred to herein as the Reynales Formation." The retained consultant has checked with Mr. Brunton, and he writes, "There is no Reynales at this quarry. In fact the greenish unit below Merritton or upper Fossil Hill Fm may in fact be a thin Grimsby Formation unit" (written communication, October 15, 2020). 	The purpose of this statement is unclear. Brunton did not identify the Grimsby formation in any of borehole data that we provided to him for review. Are you implying that Brunton is inconsistent or unreliable by noting that there ***may*** be a thin Grimsby unit at the site? The significance of subdividing a thin unit formerly referred to as the Reynales Formation into 2 or possibly three units is unclear. Golder could not justify subdividing the unit despite mentioning the work by Brett. The 2004 Golder core is no longer available. Finally, the unit cannot be subdivided based on MECP wells.	No, we are not implying that Brunton is either inconsistent or unreliable. Rather, we are indicating for the record that Brunton did not identify the Reynales Formation at this site. No further comments.	RESOLVED	RESOLVED.
93.	The control points for mapping the elevations of the top of the Reynales Formation are shown in Figure 3.15. What control points were used to map the thickness of the Reynales Formation shown in Figure 3.16?	The thickness of the Reynales is created by subtracting interpolated top of Reynales from the interpolated Top of Cabot Head. This is the preferred approach as not all wells penetrate the formation	The response does not address our question. We did not ask how the thickness of the Reynales Formation was estimated. Rather, we asked what control points were used to map its thickness shown in Figure 3.16. As with Comments 97, 101 and 102, our question is directed at assessing the distribution of high-reliability points for gridding the surfaces. By "high-reliability" we mean from "a surveyed borehole logged by a professional geoscientist".	As the response explained, the thickness of the Reynales is created by subtracting (using grid arithmetic) the interpolated top of Reynales (interpolated using the top of Reynales data points) from the interpolated Top of Cabot Head (interpolated using the picks for the top of Cabot Head).	RESOLVED.
95.	What is the basis for the indication that the Irondequoit, Gasport and Goat Island formations are hydro geologically similar? The retained consultant's experience elsewhere in southern Ontario suggests that their hydrogeologic characteristics are distinct. Has any attempt been made at the site to conduct hydraulic tests on the separate units? Referring to Figure 3.25, no packer test results are shown for the Goat Island Formation, and substantially lower values of hydraulic conductivity are estimated for the rocks between the Gasport Formation and the Cabot Head Formation.	The extensive bedrock packer testing undertaken by both Golder and our field project partner Azimuth Environmental at this site did not identify distinct hydrogeologic formation properties for these units. Other Source Water Protection conducted in the area for Hamilton and Halton also failed to significantly differentiate the units. The lack of aquifer confinement in the study area may also be a factor. The static water level in BS01 was at a depth of 10 m when the packer testing was undertaken, limiting the ability to packer test the upper portion of the borehole.	No further comments.	RESOLVED	RESOLVED.

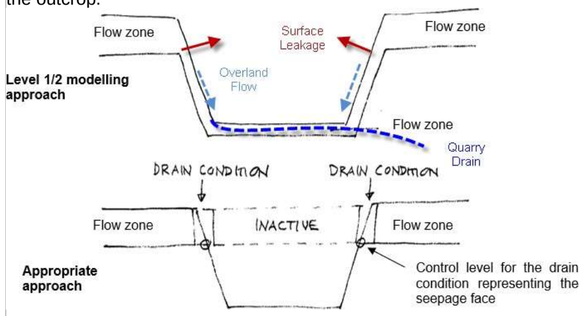
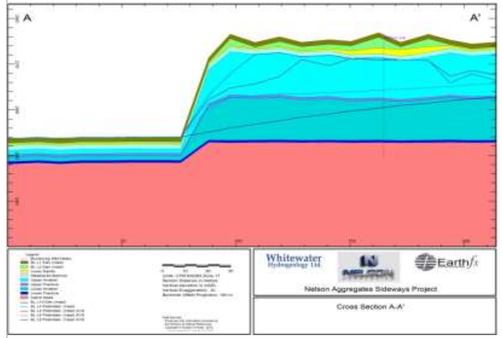
HYDROLOGIC/HYDROGEOLOGIC MODELLING COMMENTS

96.	What control points were specified to support the mapping of the elevations of the top of bedrock? Does the mapping shown in Figure 3.23 lump high-quality data from site monitoring wells and the information from the MECP water well record database?	The bedrock pick locations and the constraint point used to delineate the bottom of the Medad Valley are shown on the figure below.  Picking of geologic units is a labor-intensive process in which a geologist/hydrogeologist posts the boreholes on section and then “picks” the contact elevation at each selected borehole. The contact data is posted to the database. The picking typically begins with the higher quality boreholes and MECP boreholes added where ground elevation and bedrock elevation seem to be consistent with other information (i.e., on other parallel and perpendicular sections). The bedrock picks are then kriged and the surface is examined for outliers and inconsistencies.	Clarification provided and acknowledged. The map does clarify the locations of the control points. However, no distinction is made in the map between high-quality data from site monitoring wells and information from the MECP water well record database. We are left to conclude that the answer of our second question is that the two sources of picks are lumped.	RESOLVED	RESOLVED.
97.	What control points were specified to support the mapping of the thickness of the Amabel Formation in Figure 3.24 [Goat Island Formation + Gasport Formation + Irondequoit/Merritton/Rockway]?	The thicknesses of all the units are calculated by subtracting the gridded surfaces (generated by interpolation of the borehole picks) as not all wells penetrate the entire formation.	See response to comment 90. The response does not address our question. We did not ask how the thicknesses of the units were estimated. Rather, we asked what control points were used to map the thicknesses shown in Figure 3.24.	Maybe we do not understand the question as this is the same generic question as above. The responses have spelled out the process.	RESOLVED.
101.	What control points were specified to support the mapping of the thickness of the Halton Till in Figure 3.27?	The thicknesses of all the units are calculated by subtracting the gridded surfaces (generated by interpolation of the borehole picks) as not all wells penetrate the entire formation.	The response does not address our question. We did not ask how the thicknesses of the Halton Till were estimated. Rather, we asked what control points were used to map the thicknesses shown in Figure 3.27.	Same as above	RESOLVED.
102.	What control points were specified to support the mapping of the thickness of the MIS sands and ORAC in Figure 3.28?	The thicknesses of all the units are calculated by subtracting the gridded surfaces (generated by interpolation of the borehole picks) as not all wells penetrate the entire formation.	The response does not address our question. We did not ask how the thicknesses of the HMIS sands and ORAC were estimated. Rather, we asked what control points were used to map the thicknesses shown in Figure 3.28.	Same as above	RESOLVED.
104.	No indication is provided in the report that a distinction has been made between data from climate stations above and below the Niagara Escarpment. The retained consultant’s experience suggests that this distinction is important, affecting whether a station provides data that is or is not representative of conditions on Mount Nemo. The expectation is that the climate data from Millgrove and Mountsberg are likely to be most representative. However, referring to Figure 4.2, there are no recent data from either station. The Millgrove station is about 9.3 kilometres from the quarry.	We noted that the interpolated precipitation data showed a decreasing trend from west to east and speculated that this might be related to the presence of the Niagara Escarpment. It could also be related to proximity to Lake Ontario, degree of urbanization, or other factors. We therefore did not split the data into two populations above and below the Escarpment and interpolate the data separately.	No further comments.	RESOLVED	RESOLVED.

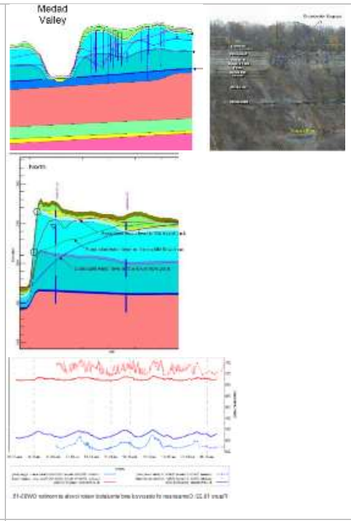
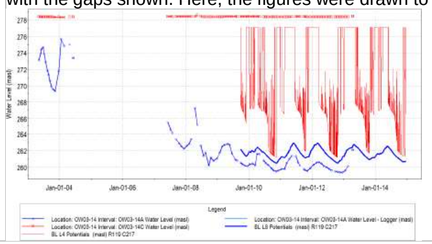
HYDROLOGIC/HYDROGEOLOGIC MODELLING COMMENTS

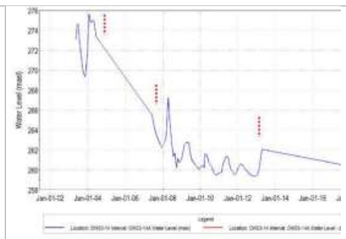
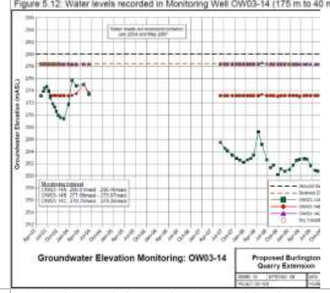
105.	The references for the SOLRIS land use mapping are not consistent. In the text, reference is made to SOLRIS v.3 (2019) (pages 82, 132, 446, Figures 4.8, 6.11, 17.12). However, the citation in the list of references is to MNRF (2014), accessed August 2015.	Comment noted. Correct reference is: Ontario Ministry of Natural Resources and Forestry (MNRF), 2019, Southern Ontario Land Resource Information System (SOLRIS) Version 3.0 [Computer File], Peterborough, ON (Accessed August 2019).	No further comments.	RESOLVED	RESOLVED.
106.	Are the lime coloured areas on this figure clay loam? It is not clear from the legend that these colours are the same?	A figure with improved colour scale is provided below.	Enhanced Figure noted. It appears that the lime coloured areas represent clay loam. The colour figures provide striking visualizations but may be difficult to interpret for individuals who may have difficulty in distinguishing colours of similar shades.	RESOLVED	RESOLVED.
107.	Referring to Figure 4.10, there are only three WSC stream gauges in the model area, with two of the stations close to each other on Grindstone Creek (above Highway 403 and near Aldershot). None of the three WSC stations are located on Mount Nemo.	We did not select the locations for the WSC stations. The gauge data were useful for the PRMS model pre-calibration because of the long- term record available. There were many additional gauges placed on streams above and below the Escarpment but the period of record is shorter and the data have gaps.	No further comments.	RESOLVED	RESOLVED.
108.	Referring to Figure 4.10, is it correct in understanding that Willoughby Creek is almost perpendicular to Bronte Creek where it discharges to Bronte Creek? 	The map appears accurate and the angle may be closer to 80°. 	No further comments.	RESOLVED	RESOLVED.
109.	Is there a record of flows in Willoughby Creek?	There were three stations established on Willoughby Creek (Figure 4.14). Flow was measured from 2014 to 2019, with gaps in the record for SW7 and SW14 during the winter of each year. These flows were discussed in the chapters of the report the reviewer declined to review. 	Is the plot of the flow records included in the response presented elsewhere in the report? Referring to Comment 67 and 68, as far as we could tell there are no comparisons between observed and simulated flows at stations SW7 and SW14. In what sections of the report that we declined to review are the observed flows discussed?	We presented all available data as hydrographs in our meeting with JART team members. The two hydrographs below were part of the presentation.  SW7 and SW14 are in the Medad Valley and separate sections were devoted to illustrating change from baseline conditions. SW2 is affected by numerous in-line ponds along Cedar Spring Road downstream of the karst feature on Willoughby Tributary.	RESOLVED.

HYDROLOGIC/HYDROGEOLOGIC MODELLING COMMENTS

111.	It is indicated that the discrepancy between the Ontario Hydro Network (OHN) mapping and the observed golf course and quarry pond is due to the time period during which the OHN mapping was conducted. Documentation of the OHN mapping is not cited in the list of references. What was time period for the OHN mapping?	We obtained the stream coverage early in the study. Most of the files were dated 4/2018 or 6/2018. https://geohub.lio.gov.on.ca/datasets/mnrf::ontario-hydro-network-ohn-watercourse\	No further comments.	RESOLVED	RESOLVED.
113.	Precipitation data is the key driver for the PRMS analyses. It is indicated on page 92 that measured precipitation is added to the top of the model. It is important to note from the outset that no measurements of precipitation are available within the study area. Referring to Figure 4.1, there are no climate stations close to Mount Nemo.	This is a general problem in southern Ontario as the number of active stations continues to drop. Our best option was to interpolate the available data for the study period.	No further comments.	RESOLVED	RESOLVED.
114.	It is indicated on page 92 that the layers of the MODFLOW and GSFLOW models must be continuous across the model domain. This requirement has been interpreted in a way that is considered to be non-physical. The results close to the deep cutting features, including the Medad Valley and the existing quarry are not realistic. An excerpt from a cross-section through the model along 2nd Side Road is reproduced below (Figure 5.2), As shown in the figure, the model layers are “pushed down” below the base of the Medad Valley. This is not a realistic representation of the bedrock flow zones in the rocks of the Niagara Escarpment. For example, a view across the gorge of the Niagara River downstream from Niagara Falls is shown on the next page. Rather than diving down below the Niagara River, the bedrock flow zones daylight at the gorge. Groundwater exits at the base of each flow zone, forming stacked seepage faces. The results shown in Figures 5.2-5.4 and 19.18-19.20 of the report illustrate why the representation of conditions along the Medad Valley and Niagara Escarpment and around the existing quarry is important. A portion of Figure 19.18 is reproduced below. There is no evidence to suggest that the water levels in the weathered top-of-rock and in the middle flow zone decline steeply as predicted with the model Hydrographs for observation well OW03-15 between April 2003 and July 2010 and between July 2009 and January 2015 are reproduced here on page 9. The long-term average water levels in the shallow “C” and deeper “B” and “A” monitoring intervals are about 273.0 meters, 269.0 meters and 259.0 meters amsl, respectively. Since 2003, the water levels have varied by only about ± 1.0 meter with respect to the average levels. The water levels are controlled by the elevations at which the flow zones daylight at the quarry, indicated by the circles added to the excerpt from Figure 19.18.The non- physical simulation approach that has been adopted compromises severely the reliability of predictions of potential impacts of the quarry extension.	We agree that representing groundwater discharge at the quarry face is important. We have used the method suggested by the reviewer in numerous older quarry and Escarpment area studies that we conducted. Draping the layers into the valley allows groundwater discharge to land surface (surface leakage) to occur at or near the multiple seepage faces. This flow is conveyed overland to the nearest quarry drain or stream reach. This alternative approach is needed because of the requirement that the layers remain continuous. Its effect on the flow system is similar and easier to implement than the older one of truncating layers and assigning a drain conductance and control elevation (usually calibrated values) in the last active cell next to the outcrop. 	We appreciate the constraints of the model being required to have continuous layers. Does the approach of replacing the explicit representation of a seepage face with MODFLOW Drains with surface leakage and overland flow yield similar results? In the response it is indicated that the water levels shown in Figure 19.18 are in fact controlled by the elevations at which the flow zones would daylight at the quarry. It appears we may be missing something. Our expectations are that at the escarpment: • The groundwater level in the top of rock is likely close to the base of this unit, an elevation of 273 m, rather than diving down to an elevation of about 254 m; and • The groundwater level in the middle flow zone to be about 263 m, not 254 m. Referring to the hydrographs for OW03-15, it appears that the simulated water levels are about 2 m below the average observed levels in the C and A monitoring intervals. Do the simulated water levels at the face of the escarpment not influence the calculated discharges from the units? Page 6	We believe that the methodology produces similar results and allows better routing of flow from the sides of the excavation to the floor drains and to the sump for discharge. The figure shows a section through the quarry face near OW03-15. As can be seen, the average heads in Layer 8 are controlled by leakage at the base of the quarry (254 masl). The heads in Layer 6 are controlled by the base of the middle fracture zone (once you get a cell or two into the wall) at 264 masl. The heads in these layers due not change dramatically due to seasonal recharge. The heads in Layer 4 are much more variable, as the layer is partially saturated most of the time. The fourth line shows the heads in Layer 4 on October 31, 2012 and they are near the top of the layer (273 m) but above the average heads in the layer**. It should be noted that the response at the monitoring wells may have been affected by placement of fill against the slope and other operational factors.** 	NOT RESOLVED. As indicated in the marked-up version of the figure above, in our experience it is more likely that groundwater in the upper flow zones will exit at a seepage face rather than diving down to the quarry floor. It is not clear what is the basis for the belief that the methodology that has been adopted produces similar results.

HYDROLOGIC/HYDROGEOLOGIC MODELLING COMMENTS

					
118.	Is this bedding plane fracture shown in Figure 5.9 at an elevation close to the elevations assigned for the middle flow zone in the model (model layer 6)?	Yes, the bedding plane fracture is near that elevation. Also see response 117, above. We expect that the elevation of the middle flow zone will vary from place to place but generally following the regional dip of the unit.	No further comments.	RESOLVED	RESOLVED.
121.	It is indicated that Layer 4 has a minimum thickness of 1.0 meter. However, on page 103 it is indicated that an assumed depth of weathering equal to 0.3 meter was applied across the model, extending down from the top of bedrock. What is the correct thickness of model layer 4?	The upper weathered fracture zone had a minimum thickness of 1 m. The 0.3 is a typo. Packer testing by Golder and Azimuth was generally done more than 2 m below the bedrock contact (likely because the zone was sealed off by the surface casing). Packer test data are provided in Schedule E.	No further comments.	RESOLVED	RESOLVED.
127.	It is indicated that downward leakage tends to minimize the differences in the head between the shallow and deeper bedrock layers. This seems to be in direct conflict with the water level data shown in Figure 5.11. There is a substantial difference in the water levels between the “A” and “B” intervals (~10.0 meters), and it may only be possible to sustain this head difference if the intervening rock has relatively low vertical hydraulic conductivity at this location.	The point of this whole discussion was that the differences in head between shallow and deep bedrock layers decrease with distance from the quarry face. This is essentially the “quarry face paradox”. As the reviewer noted, it is only possible to sustain this head difference if the intervening rock has relatively low vertical hydraulic conductivity. However, the hydrograph also shows that there is response in the deep system that is not lagged or attenuated, which is only possible if there is a relatively high vertical hydraulic conductivity. The random placement of vertical fracture zones offered a reasonable solution to the paradox.	Our only additional comment is that it is possible to have a response in the deep system that is neither lagged nor attenuated without there being a relatively high vertical hydraulic conductivity. The observations may reflect a geomechanical response to surface loading.	RESOLVED	RESOLVED.
128.	It is indicated that municipal supply wells FDF01 and FDF03 “have been interpreted to intersect the highly permeable fractured zone in the middle of the Gasport Formation.” Who has made this interpretation?	Earthfx hydrogeologists.	No further comments.	RESOLVED	RESOLVED.
133.	The connecting of the hydrographs across time long gaps provides a misleading impression. The lines connecting the gaps are in effect speculations regarding what might have happened during the gaps. Alternate hydrographs have been reproduced for OW-3-14 to illustrate objections to the presentation and to illustrate an appropriate approach.	There are many ways to present the data. In Figure 19.23, the same data are presented with the gaps shown. Here, the figures were drawn to highlight the decrease in head. 	No further comments.	RESOLVED	RESOLVED.

	 Figure 5.12: Water levels recorded in Monitoring Well OW03-14 (175 m to 40 m fro 				
134.	It is indicated that a horizontal hydraulic conductivity of 1.0×10.0^{-7} meters/second (1.0×10.0^{-8} meters/second, vertical) was selected for the Lower Aquitard (collectively the Lower Gasport through Manitoulin formations). What is the basis for this selection? Are the model results sensitive to the value of the hydraulic conductivity assigned to Layer 9?	Typo: Sentence should read; For the simulations in this study, a collective transmissivity of $1x10^{-7}$ m^2/s was selected. For model stability, Layer 9 was treated as a constant transmissivity layer. Assuming that flow mostly takes place in the upper 5 m, that given a Kh of about $2x10^{-8}$ m/s. Relatively little flow occurs in this zone and model results should not be overly sensitive to the K of this zone within reasonable upper bounds.	No further comments.	RESOLVED	RESOLVED.
136.	Are the water level maps developed exclusively from levels reported in the MECP WWIS database? If yes, how do maps compare with the high-reliability data from dedicated Site monitoring wells? If no, how were the data of very different reliability synthesized?	Developing water level maps was a multi-step process. We started with a database query to get average water levels for all wells within the study area. The query automatically averaged the observations for wells with multiple measurements and retrieved the single static water level measurements for the MECP wells. Wells were posted in VIEWLOG with gradient colours so that likely outliers could be easily spotted. Follow-up investigations (looking at paper records, comparison of reported ground elevations with the DEM) were done to see if the errors were positional, due to errors in the units, or ground elevation). It should be noted that many of the potential outliers could not be discarded as the data seemed reasonably accurate and the differences could be more likely attributed to the fractured nature of the bedrock. The remaining wells were flagged as outliers and removed from subsequent queries. Wells were partitioned into shallow and deep subsets and further partitioned into above and below the Escarpment subsets. Variography was completed on each subset to determine the best variogram shape and estimate of nugget, range, and sill. The data were then kriged to the model grid and the above/below Escarpment maps were merged. The site monitoring data and MECP wells form two mostly non-overlapping data sets. Interpolation to a grid cell was done by selecting the nearest eight wells in each quadrant. Thus, within the vicinity of the quarry, the site wells dominate the interpolation, while outside the site vicinity, the MECP wells are generally the only data source used.	No further comments.	RESOLVED	RESOLVED.
137.	When presenting water levels and interpretations, it is important to note from the outset the important differences in the reliability of the levels in the MECP WWIS database and the average water levels inferred from the records for the Site monitoring wells.	See above	There is no recognition in the mapping of the very different reliabilities of the sources of water levels for the mapping.	RESOLVED	RESOLVED.
138.	How do the water level maps compare with the interpreted hydro stratigraphy? For example, are the levels for wells with completion depths less than 15.0 meter representative of the weathered top of rock, the “middle Amabel flow zone”, or some synthesis of both? Are the levels for wells with completion depths greater than 15.0 meter representative of the “middle Amabel flow zone”, the “lower Amabel flow zone”, or	It should be noted that most MECP wells are open hole and may be screened across the Upper and Middle zones, the Middle and Lower zones, or all three. The maps were intended to show general magnitudes and flow patterns in the groundwater data. General comparisons between these and model results were made on a study area scale. Detailed comparisons with particular wells in the site vicinity are also discussed.	The detailed questions of the comment are not addressed in the response. However, it is now understood that the maps were intended to show only general magnitudes and flow patterns in the groundwater data.	RESOLVED	RESOLVED.

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	again some kind of average for both intervals?				
142.	What is the sign convention adopted for the mapping of the head differences in Figure 5.15? Is the following interpretation correct (with h denoting hydraulic head)? Negative values: h(<15.0 meters) > h(>15.0 meters) ⟶ downward flow Positive values: h(<15.0 meters) < h(>15.0 meters) ⟶ upward flow	There is a typo in the caption; it should read: Vertical head differences (deep minus shallow groundwater levels, in m). We subtracted the shallow water levels from the deep ones. The vertical head differences are colour contoured where red-shaded values (negative) indicate higher heads in the shallow system (downward flow) while blue shading (positive) indicates higher heads in the deeper system and upward flow.	No further comments.	RESOLVED	RESOLVED.
150.	Why has a distance of 500.0 meters from the proposed extraction area been selected for particular focus? Is it expected that beyond this distance the potential impacts to private wells will be negligible? Does the calibrated model support this expectation?	The simulated 2-m average drawdown extends a maximum of about 500 m. It is expected that most wells would have more than 2-m of available drawdown and would not be adversely affected. This is consistent with Source Water Protection water budget analysis, which also considers natural seasonal variability in the identification of the WHPA-Q	No further comments.	RESOLVED	RESOLVED.

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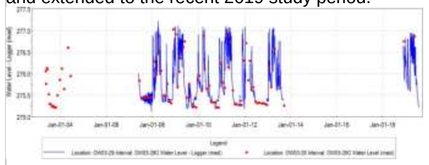
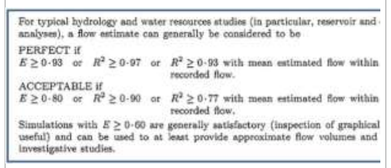
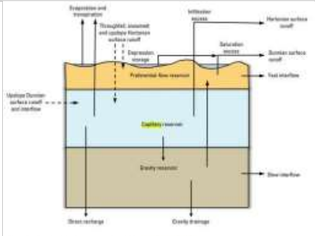
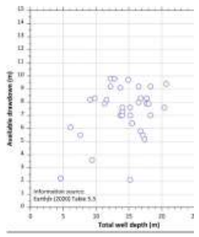
156.	Streamflow monitoring stations included in the GSFLOW calibration – Referring to Earthfx (2020; Sections 6 and 19), results from the calibration of the GSFLOW model are presented for 7 stream monitoring stations plus the Water Survey of Canada gauge at Grindstone Creek near Aldershot. Grindstone Creek near Aldershot (02HB012): WY2010-WY2013 [Figure 6.18, 19.1] 2. SW01 (Main quarry discharge [north sump]): 2014- 2019 [Figure 19.10] 3. SW02: WY2015-WY2019 [Figure 19.13]; 2017 [Figure 19.14]; 2018 [Figure 19.15] SW06 (South quarry discharge [south sump]): WY2015-WY2019 [Figure 19.11]; 2017 [Figure 19.12] 5. SW09: WY2017-WY2019 [Figure 19.7]; 2019 [Figures 6.20 and 19.8] 6. SW10[B]: WY2019 [Figure 6.19]; WY2017-WY2019 [Figure 19.5]; 2019 [Figure 19.6] 7. SW29: WY2017-WY2019 [Figure 19.9] It has been left with the impression that selective use has been made of the available data in the GSFLOW calibration. Results from the GSFLOW calibration analyses are presented for 6 of the 20 existing streamflow monitoring locations. No explanations are provided regarding why calibration results were not presented for the other 14 streamflow monitoring locations. e understanding is that the GSFLOW calibration period extends from WY2015 to WY2019 (i.e., 5 years); however, matches to the observations are reported only for varying intervals within this period. Referring to Earthfx (2020; Section 7), GSFLOW model results for baseline conditions are presented for only 6 on-site stream monitoring stations. SW07: Figures 7.14 and 7.15 SW09: Figures 7.4 and 7.5 SW10[B]: Figures 7.12 and 7.13 SW28: Figures 7.10 and 7.11 5. SW29: Figures 7.6 and 7.7 SW36A: Figures 7.8 and 7.9 The results for the streamflow stations are not sufficient to confirm that the GSFLOW simulation are a reliable representation of baseline conditions. • Only three (3) of the stations selected for the representation of baseline conditions have corresponding results from the GSFLOW model calibration. • The simulation of baseline conditions with GSFLOW extends from WY2010 to WY2019 (i.e., 10 years). However, as indicated in the notes on the streamflow stations included in the GSFLOW calibration, matches to the data over the full duration of this time period are not presented. Results for a relatively small subset of the existing groundwater monitoring locations have been reported for the calibration of the GSFLOW model. Furthermore, the calibration time interval is restricted to the five (5) year period, Water Years 2010-2014. No comparisons are presented for the extensive monitoring data collected between 2003 and	We tried to present a comprehensive but not exhaustive comparison of results. Still, it should be noted that although the reviewer states that selective use has been made of the available data in the GSFLOW calibration, of the 20 gauges, 10 were located more than 3.5 km from the site and, *of these, seven were outside the model boundary*. We found that no change in simulated flow occurs at or close to these locations. SW15 is on the opposite (north) side of the quarry and far from the expansion areas. SW7 and SW14 were discussed in great detail, so it was only SW2 which was omitted and the effects of the quarry extension were better seen in the upstream gauges. With regards to the Golder wells, the question was asked multiple times. Essentially, the model was calibrated over a 10-year period, WY2010-WY2019. Unfortunately, the Golder data mostly falls within WY2008 to WY2013 as shown by the data for OW03-29. The 2003 data are mostly manual monthly measurements with a large gap between May 2004 and August 2007. There is another gap from WY2014 to August 2018. Most wells show similar patterns but there is variation. OW03-15 and OW03-30, for example, are part of a group of wells that do not have logger data until 2010. The period selected had the best coverage and extended to the recent 2019 study period. 	An extensive response to Comment 156 has been provided. Our understanding is that the model was calibrated over a 10-year period, WY2010-WY2019. However, the Golder data mostly falls within WY2008 to WY2013 as shown by the data for OW03-29. It is not clear why the calibration period was not extended to include at least WY2008?	Again, we had difficulties getting a continuous 10-yr run under some of the scenarios. We wanted to include the most recent data and worked back from that. The issues related to the selection of the time period were discussed at length in the Nov. 2021 JART meeting.	NOT RESOLVED. The duration of the calibration analyses was discussed, but it remains unclear why the calibration period was not extended to include WY2008.

	2010 (Golder, 2010; Appendix D). It has been left with the impression that selective use has been made of the available data in the GSFLOW calibration. At a minimum, all locations for which water level data are available should have been considered in the calibration, for the full period for which data are available. If it was not feasible to include all the existing groundwater monitoring locations in the calibration analyses, the reporting should have at least included explanations regarding why some locations were included and others were not, and whether conditions changed between 2003 and 2015				
157.	Does it make sense to conceive of and distinguish between Hortonian and Dunnian runoff when only daily values of precipitation are available and the PRMS analysis has 1-day time steps? Wouldn't the simulated intensity of the rainfall generally be quite different from the actual intensity?	Without going into a long discussion of the differences between Hortonian and Dunnian flow and why the integrated model needs to separate them, there is a point to the question regarding intensity. By representing the rainfall as a 24-hr storm, the CN method will tend to generate less Hortonian runoff. We experimented with monthly intensity modification factors (e.g., to assume that the average January storm was a six-hour event while the average August storm was a two-hour event) but this did not substantially improve the model calibration and was not pursued further.	No further comments.	RESOLVED	RESOLVED.
160.	How is convergence checked in the GSFLOW simulation?	The model checks the standard specified closure criterion for changes in groundwater head and volumetric flow rate in MODFLOW-NWT. A specified closure criterion is checked for changes in storage in soil zone of PRMS.	No further comments.	RESOLVED	RESOLVED.
161.	Referring to Section 6.6, it is indicated that soil properties have a "significant influence on hydrological	While we started with book values for our first PRMS/GSFLOW analyses, the parameter values have been refined through close to 20 studies done in southern Ontario. Many of the studies were done in	No further comments.	RESOLVED	RESOLVED.
163.	Reference in the text is made to MNR Soil Survey Complex (2013). However, the date of reference in Section 14 is 2003, accessed in October 2014. What is the correct date for this mapping?	Comment noted. It is a bit confusing but both references are correct. The digital data was based on soil mapping compiled in 2003. The digital data keeps being updated. We had downloaded a version (in 2014) that was updated in 2013. The Ontario Land Information system now only provides access to the 2016 version but still based on the 2003 mapping.	No further comments.	RESOLVED	RESOLVED.
164.	It is indicated that parameters that controlled the partitioning of flow between interflow and percolation to the water table were also specified as soil-type properties. What parameters are referred to here, and what are the bases for the specification of their values?	There is a first-order slow interflow coefficient that can be specified for each HRU. We found that assigning the slow interflow coefficient by land use class helped improve the calibration. In short, because interflow is taken first, increasing the interflow rate decreases the amount of flow available for groundwater recharge and discharge to streams as base flow. Decreasing the coefficient results in a decrease in the peak flows and an increase in base flow.	Reference in the report is made to parameters that controlled the partitioning of flow between interflow and percolation to the water table were also specified as soil-type properties. However, the response refers only to "a first- order slow interflow coefficient that can be specified for each HRU". Is this the only parameter that is referred to?	There is a second order term that was set to zero, there are also fast interflow terms that were not used.	RESOLVED.
167.	It is indicated that an "acceptable" Nash-Sutcliffe efficiency of 0.44 was achieved with PRMS-only analysis of the Aldershot gauge, and an efficiency of 0.67 was achieved with the GSFLOW analysis. Chiew and McMahon (1993) is cited for the consideration of 0.6 as "a reasonable calibration value". It is worthwhile to consider exactly what Chiew and McMahon (1993) wrote.  For typical hydrology and water resources studies (in particular, reservoir and analyses), a flow estimate can generally be considered to be PERFECT if $E \geq 0{\cdot}93$ or $R^2 \geq 0{\cdot}97$ or $R^2 \geq 0{\cdot}93$ with mean estimated flow within recorded flow. ACCEPTABLE if $E \geq 0{\cdot}80$ or $R^2 \geq 0{\cdot}90$ or $R^2 \geq 0{\cdot}77$ with mean estimated flow within recorded flow. Simulations with $E \geq 0{\cdot}60$ are generally satisfactory (inspection of graphical useful) and can be used to at least provide approximate flow volumes and investigative studies. Generally satisfactory results for approximate flow volumes and preliminary investigative studies is not the same as "reasonable".	It should be noted that the Chiew and McMahon (1993) is based on matching **monthly** flows, a much easier task than matching daily flows. There is a much higher degree of difficulty associated with a distributed integrated hydrologic model that is not encountered in typical catchment modelling. The long run times (2 weeks versus 3-11 seconds per run for the model used by Chiew and McMahon), data limitations, and our parsimonious approach make it difficult to achieve the high NSEs level of calibrations more typical of that lumped-parameter catchment models. Lumped parameter catchment models, calibrated on a monthly basis, have limited predictive capability for engineering scale impact assessment.	No further comments.	RESOLVED	RESOLVED.
169.	Referring to Figure 6.4, what are the capillary and drainage reservoirs?	Here is a schematic from the PRMS v4 manual. The capillary reservoir accepts infiltration (after canopy interception and Hortonian runoff) and loses water to soil ET. Excess water above the storage capacity of the capillary reservoir (equivalent to above field capacity) goes to the gravity reservoir where flow is portioned into interflow and GW recharge.	No further comments.	RESOLVED	RESOLVED.

HYDROLOGIC/HYDROGEOLOGIC MODELLING COMMENTS

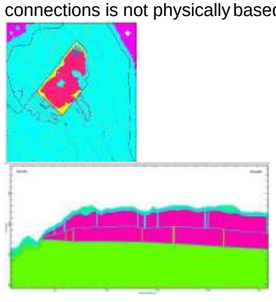
					
189.	The color scheme in Figure 6.39 and Figures 19.48 is confusing. In a copy of the report, the terms “Net outflow from storage” and “Net boundary flow in” have identical colors. Is it correct in understanding that the positive blue quantities denote the “Net boundary flow in” and the negative blue quantities denote the “Net outflow from storage”? The term “Net outflow from storage” is also confusing. If this is indeed a negative quantity, shouldn’t it correspond to sink for the groundwater system, with water going into storage, as MODFLOW would simulate during months of rising groundwater levels? And wouldn’t there be months during which groundwater levels declined and the changes in storage would be interpreted as sources in the groundwater budget?	The colours can be identified by their order in the legend. In the figure below, we changed the colour for Net boundary Inflow to lime green. Net boundary inflow is a very small term and, for this model is always negative. The term “Net outflow from storage” is meant to show that, from a MODFLOW point of view, outflow from storage constitutes an inflow to the aquifer similar to recharge. Thus it shows up in the summer months where water comes out of storage to balance other losses from the aquifer. In the spring, water is “removed” from the aquifer and goes into aquifer storage. 	No further comments.	RESOLVED	RESOLVED.

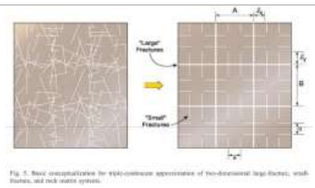
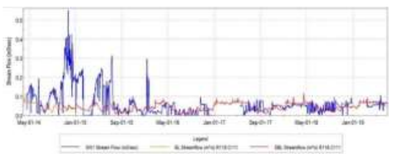
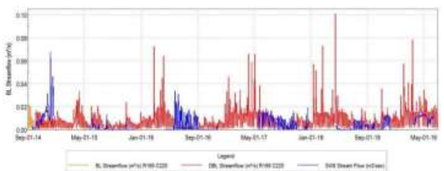
HYDROLOGIC/HYDROGEOLOGIC MODELLING COMMENTS

194.	The next-to-last paragraph on page 167 of the Earthfx report reads: Figure 7.3 presents a summary of the groundwater supply conditions in the study area. This figure shows the available groundwater drawdown in the Amabel Formation. At any location in the vicinity of the quarry a private water well could be drilled to the Layer 8 fracture zone and would have up to 22 m of available drawdown. Near the existing quarry that drawdown is reduced by the effects of the quarry dewatering, but many wells are both shallow, and in close proximity to the quarry, and yet have had suitable water supply for many years. It is not clear why model Layer 8 [Amabel Lower Fracture Zone] has been selected for the assessment of the available drawdown for baseline conditions. The depths of private wells within 500.0 meters of the extraction boundary are reported on Table 5.3 of the Earthfx report. As shown in the plot of these data below, it is likely that private wells extend only into the weathered top of rock (model Layer 4) or model Layer 6 [Amabel Middle Fracture Zone].  The impression is that it has been assumed in the modelling that the lower portion of the Amabel Formation is a productive aquifer. This assumption does not appear to be consistent with the results of packer testing (Figure 5.6), which does not show an interval of consistently higher productivity at the bottom of the Amabel (i.e., relatively higher hydraulic conductivity). It appears that the greatest weight has been placed on the results of the testing of BS-01 (Figure 3.25), a location that does not seem to be typical of the bottom of the Amabel Formation as shown on the profiles of packer testing (Figures 5.6, 5.7 and 5.8). Figure 7.3 shows a map of calculated values derived from two other maps of calculated values that are not provided. It appears that what is shown is the difference between (1) the simulated average water level in Layer 8 of the model (Lower Fracture Zone) for the period of WY2010-WY2019, and (2) the assumed elevation of the top of Layer 8. It is not possible to assess the reliability of this figure with the information provided in the report. No map of simulated water levels in Layer 8 is included in the report. The interpretation of the time period may not be correct. The description of Figure 7.17 in the preceding paragraph refers to a	Wells closer to the Medad Valley are frequently completed in the lower fracture zone. While wells further from the valley, including monitoring wells, are less frequent in the deep system, there are enough wells to conclude that it is a productive regional aquifer. It was chosen as wells can be deepened to that zone. The Golder testing was done for a south expansion. The private wells are located closer to the west expansion and, if replacement or deepening of wells is ultimately necessary, the presence of a lower flow zone and available drawdown, as indicted by the west boreholes (e.g., BS-01), is of critical importance. Please refer to Section 5.2.8 for a discussion of all the evidence related to the lower fracture zone, including Figure 5.10 and the observed effects discussed in Figure 5.11 and Figure 5.12, which clearly drain into the quarry, and yet continue to response to annual recharge event patterns.	In effect, relatively little of this substantial commentary is addressed in the response. Have the results of packer testing conducted for this study (expansion in a different direction) and data from wells closer to the Medad Valley confirmed that the lower fracture zone is a productive regional aquifer?	The interpretation was based on packer tests, private well response patterns (including water found, etc.) and photos showing discharge to the quarry (including winter ice on the quarry face). We have stated that there are enough wells to conclude that it is a productive regional aquifer.	NOT RESOLVED. As far as we are aware, none of the data assessment referred to here (packer tests, private well response patterns (including water found, etc.) and photos showing discharge to the quarry (including winter ice on the quarry face).) is documented with respect to a confirmation that the lower fracture zone is present and is a productive regional aquifer.

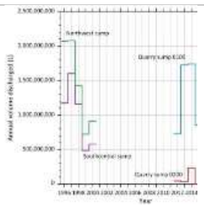
	time period of WY2015-WY2019. The retained consultant could also be wrong about the assumed elevation for calculating the available drawdown. It might be the middle or the bottom of Layer 8. The reporting of the thickness for layer 8 could not be found. It is described as 'representing a thin lower fracture zone' (page 481 second last paragraph). More important than simply checking the reliability of the calculation of the values of the available drawdown shown in Figure 7.3, it is not possible to assess the reliability of the simulated groundwater levels used in the calculations. In Figures 18.3 and 19.3, simulated average water levels are compared with water levels reported in the well records for the private wells beyond the site boundary. The results shown in these two figures suggest that the likely mismatch at the location of an individual well is relatively large, on the order of ±10.0 meters. No comparable assessment of the match to the average water levels for on-site monitoring intervals in the Amabel Lower Fracture Zone is presented in the report. Observed and simulated hydrographs for 12 observation wells are presented in Figures 19.22 through 19.33; however, there is no indication of the average levels, nor is it indicated which of the wells are open across only the Lower Fracture Zone. It is noted that there is a phase shift in these hydrographs resulting in a difference of 0.5 to 1.0 meter at the south end of the southern extension between measured and simulated water levels of the lower Amabel (OW03-17A, 18A, 19A, 29A -Figures 19-30, 19-31, 19-33, and 19-32, respectively). A similar difference is noted along the west side of the southern extension at MW03-01 (Figure 19-29). This difference increases to several meters closer to the existing quarry at MW03-02 (Figure 19-28).				
325.	Groundwater Level Monitoring – The groundwater monitoring stations considered in the Level 1/2 Hydrogeological and Hydrological Impact Assessment are shown in Figure 2.1 of the Earthfx (2020) report. Three different types of monitoring locations are indicated in the figure: "GW Monitoring Nests"; "Minipiezometers"; and "MECP Wells". A listing of the wells shown in Figure 2.1 is not presented in the report. It is indicated in Earthfx (2020) Section 15.5 that between November 2018 and October 2019, a total of 100 monitoring wells were monitored at 39 locations. An extensive compilation of earlier water level records (hydrographs) is presented In Golder (2010; Appendix D). Many of the records extend from April 2003 through August 2010. Hydrographs are presented for 133 monitoring intervals at	A spreadsheet providing data for of all monitoring wells is provided in Schedule E. The data is also presented in an MS-Word table along with figures showing well locations. The wells include many of the Golder wells plus additional wells drilled for this study and several private wells. Wells are classed as active or inactive and wells that are part of wells nests are identified. Information about the type of measurement (manual, logger, or both) is shown along with the period of record for each monitor and average water level. Schedule B and C contain borehole data for wells in the vicinity of the wetlands and water courses. Additional long-term hydrographs have also been included.	Are the following documents provided with the table of responses to comments? A spreadsheet providing data for of all monitoring wells (Schedule E). Data is presented in an MS-Word table along with figures showing well locations. Borehole data for wells in the vicinity of the wetlands and water courses (Schedules B and C). Additional long-term hydrographs have also been included.	Comment noted. If there is an outstanding question, could you please clarify?	NOT RESOLVED. We do not recall receiving copies of Schedules B, C and E for review. Are they embedded in other documents?

	81 locations: • 31 nests of the “MW” series, with 85 monitoring intervals; • 6 wells of the “GP” series; 2 wells “Pump well 1” and PW-2; 6 on-site quarry wells; 35 minipiezometers of the “MP” series; and • 1 staff gauge, SG-4.				
333.	The northing coordinate for the model lower left-hand corner cannot be 4,794,585,500 meters. Although no coordinates are indicated in Figure 18.4, the coordinate must be wrong by a factor of 1,000.	Typo. The “, 500” should have been deleted.	No further comments.	RESOLVED	RESOLVED.
334.	The right side of Equation (18.4) is missing an area term.	There is an area term, A_L. The second part of the equation (= - Kdh/dx) is a typo and does not belong there.	No further comments.	RESOLVED	RESOLVED.
336.	It is indicated that the model does not include the “many” constructed in-line and off-line ponds in the Medad Valley. On page 486 it is indicated that the final model included 40 MODFLOW “lakes” and the inspection of Figures 6.21 and 18.9 suggests that this includes many small features elsewhere. Why were small ponds included in some areas but not others?	We made sure to simulate the lakes, ponds, and inundated portions of wetlands above the Escarpment especially if they were close to the quarry. We did not expect significant changes below the Escarpment so there are about 5 ponds that are mapped in the Ontario Hydrologic Network (OHN) waterbody coverage that we did not include. There are also many small ponds along Cedar Springs Road, for example, that are not mapped in the OHN coverage but are visible in Google maps. We did not include these.	No further comments.	RESOLVED	RESOLVED.
338.	The expectation is that the horizontal and vertical hydraulic conductivity of the Halton Till is a critical parameter in the analyses, particularly the vertical hydraulic conductivity. Are the values of the horizontal and vertical hydraulic conductivities inferred through calibration, 5.0×10.0^{-7} meters/second and 2.0×10.0^{-7} meters/second (Table 18.4) consistent with estimates reported for other sites? A compilation of hydraulic conductivity estimates for the Halton Till is reproduced below (Gerber and Howard, 2000). Gerber (2010) has suggested the following representative average values for the Halton Till (Gerber, 2010): • Weathered Halton Till: K_H ~5.0×10.0^{-6} meters/second; $K_V = K_H$; and • Unweathered Halton Till: K_H ~5.0×10.0^{-7} meters/second; $K_V = 0.1\ K_H$. Sharpe et al. (2013; Table 4) suggest a value of 2.0×10.0^{-5} meters/second for the vertical hydraulic conductivity of the weathered Halton Till. The value of the vertical hydraulic conductivity of the Halton Till inferred through calibration appears to be substantially smaller than literature values. This is not to imply that the values specified in the groundwater model are inappropriate. However, there is no discussion of how the values were inferred through calibration. How sensitive is the match of the calibration targets to the values of the vertical hydraulic conductivity of the Halton Till that are specified? How sensitive are the predictions to the vertical hydraulic conductivity of the Halton	Yes. The values are consistent with the literature that you cited. The values are also within the range of packer testing by Golder which varied several orders of magnitude. The values worked well in terms of matching observed responses in the wetlands and were felt to be conservative. In earlier responses, we discussed the fact that because the till is fractured, there are likely to be areas with more vertical fractures and areas with less. The location of these areas is unmapped and generally unknowable. An extensive discussion of the testing, analysis and simulation of the Halton Till is included in our response to the MNRF comments. Copies are provided in Schedules B and C. The calibration to more than 20 minipiezometers is included.	No further comments.	RESOLVED	RESOLVED.

	Till, in particular the predicted impacts to shallow features such as wetlands?				
339.	Final calibrated values of the hydraulic conductivities for each model layer are listed on Table 18.4. There is no indication as to whether the inferred uniform values for each hydro stratigraphic unit are consistent with the results of independent testing. This is an essential check for model acceptance. Previous summaries of hydraulic testing presented are reproduced below (Golder, 2010; Figures C.2 and C.3). These compilations should be updated, with the values inferred through calibration superimposed. A well-by- well, or test-by-test review is not expected. Rather, some general appraisal of whether the hydraulic conductivity values inferred through calibration are consistent with the bulk of the available estimates from site hydraulic testing is expected	We looked at the packer test, slug test, and pump test results and the range of values they encompass. These helped us select reasonable initial estimates for aquifer properties. As per earlier responses, we did replicate the aquifer tests at an early point in model development as well as applying PEST with pilot points to try and determine larger–scale spatial variability in bedrock and overburden properties. In the end, we felt the spatial variability was a result of variable fracture properties at a smaller scale that could not be reliably determined. Therefore, we used reasonably conservative uniform values for the properties that produced good but not perfect matches to the observations.	No further comments.	RESOLVED	RESOLVED.
340.	The approach that has been adopted to incorporate hydraulic connections between the weathered top of rock and the middle flow zone, and between the middle and lower flow zones is shown in Figures 18.20, 18.21 and 18.7 of the report. The approach is illustrated below. The approach that has been adopted to incorporate the vertical hydraulic connections is not physically based.  The approach does not provide either an improved representation of the fractures in the bedrock system, or the hydraulic connections between the flow zones. The approach that has been adopted is not internally consistent. Finally, the approach compromises the reliability of the predictions of potential impacts of the quarry expansion. Although reference is made in the reporting to “fractures”, the features incorporated in the model are in fact a random distribution of “chimneys”. In the area of the model with a refined grid, the chimneys are prisms with areas of 15.0 meters by 15.0 meters. In the retained consultant’s experience, we have yet to encounter a site where such chimneys are encountered. There are no data to constrain the assumed distribution or properties of the chimneys. At a minimum, the fractures to follow the jointing patterns in the underlying rock is expected. As shown below, the distribution	We strongly disagree with the assertions that the approach does not provide either an improved representation of the fractures in the bedrock system, or the hydraulic connections between the flow zones, that the approach that has been adopted is not internally consistent, and that the approach compromises the reliability of the predictions of potential impacts of the quarry expansion. No quantitative proof was provided with these statements; while, on the other hand, we have shown the improved calibration to response in the deep system and at the quarry face. We agree that the size of the higher hydraulic conductivity connections are not ideal to represent individual fractures but are more representative of small zones with higher frequency of vertical fractures. Both would likely give identical response at distances within 2 to 3 times the aquifer thickness. As locations of fractures or fracture zones are unknowable, the calibration focused on the frequency of these occurrences. This is how we settled on the 5% occurrence. This is your figure compared to the model extent and scale. Other than noting that there may be a fault in the underlying Precambrian, I am not sure how we could incorporate this information We disagree that this is counter to an EPM approach. For example, the dual-continuum approach has been extended into a triple- continuum approach in a similar manner to our representation. Wu et al. (2004) recognized that there is a network of larger and smaller fractures that are important to represent in the simulations of the Yucca Mountain site. Wu, Y.S., H.H. Liu, and G.S. Bodvarsson. “A triple-continuum approach for modeling flow and transport processes in fractured rock,” Journal of Contaminant Hydrology, 73: 145-179 (2004). In Response 123, we provided maps showing that there are small differences in heads locally due to proximity of the fracture zones, more so in Layer 6 than Layer 8. If anything, the presence of a fracture zone in the vicinity of a wetland or stream feature would magnify the effect of quarry dewatering rather than minimizing it, thus yielding a more conservative analysis of possible impacts. We did not imply any knowledge of locations of vertical fracture zones, but noted that these were placed randomly to mimic the random, unknowable occurrence of vertical fracture zones in the study area.	It is indicated that "fractures" are included in the model to mimic the physical response of the groundwater system to randomly occurring vertical fractures, specifically, to increase the vertical connection between units without compromising the semi-confining nature of the bulk units. Although repeated reference is made to "fractures", these features as represented in the model are vertical prisms (i.e., chimneys) that have dimensions of the grid blocks in which they are located (15.0 m x15.o m). It is indicated in the response that the "fractures" do not appreciably affect head distributions or flow patterns. This response does not appear to be consistent with the response to Comment 346. In the response it is noted that at MW03-2 the difference between the observed average water level at this location (about 259.5 m amsl) and the simulated average level (267.5 m amsl) may be related to its location immediately beside a randomly placed vertical fracture. Contrary to what is suggested in the response, in our opinion the sensitivity of model results to the location of a randomly placed chimney <u>does</u> raise concerns regarding the predictive capabilities of the model. We appreciate the effort that has been made in the response to Comment 346 to highlight the differences in scales between the Site and the regional interpretations of joint patterns. Golder (2010) included a site-scale analysis of rock structure (Appendix A; Section A5.0). Was the assignment of the random fractures informed by the inferred trends of the vertical features shown in Golder (2010; Figure A. 10 and Attachment A.3)? October 28, 2021 Page 9	There is a subtle difference between being able to predict local affects and the ability to predict the effects at a particular observation point. Observed response is affected by the presence and absence of fractures, where the presence and absence and properties of these features is unknowable. The model uses randomly placed fractures to mimic the aggregate response of the local system in the vicinity of the quarry. Thus, the placement of a fracture may degrade the ability to match the response at an observation point where no fracture exists, but without the placement of the random fractures, the model would not be able to match the general pattern of drawdowns (as seen by examining the response of multiple wells). What is important is that the model matches the levels and seasonal fluctuations in the near, intermediate and far field from the existing quarry, including the large seasonal fluctuations observed in the intermediate distance, as these define the extent of the quarry influence. Replicating these patterns are key to understanding the effects on wetlands, streams and private wells.	NOT RESOLVED. It is recognized that there is a distinction between being able to predict local affects and the ability to predict the effects at a particular observation point. However, it is noted that what are referred to as “fractures” in the model bear no relation to physical fractures. Rather, the features in the model are prisms, that is, “chimneys” that have the dimensions of the grid blocks in which they are located. Although their inclusion in the model is intended to mimic the bulk-average response of the local system in the vicinity of the quarry, their representation is not physical. Nor is their specification in the model constrained by any fracture mapping data.

	of the chimneys bears no relation to regional joint patterns interpreted by Mazurek (2004) [based on the work of Sanford et al. (1985) and Carter et al. (1996)]. The bedrock in the study area has been simulated using the equivalent porous medium (EPM) approach. Bulk-average hydraulic conductivities are assigned to the bedrock units, the weathered top-of-rock zone and the middle and lower flow zones. This approach is appropriate given the scale of the potential impacts of the development, and recognition that the results of the model are not predictions of what is likely to happen at discrete locations but what is likely to happen on average. However, the introduction of the chimneys runs specifying bulk-average vertical hydraulic conductivities, rather than introducing discrete artificial features. The bulk- average vertical hydraulic conductivities would account, in an average sense, for the presence of discontinuities that might give rise to enhanced connections between the horizontal flow zones. The introduction of the chimneys compromises the reliability of the predictions of potential impacts of the quarry expansion. The predictions of the model at particular locations will depend on the proximity to one of the simulated chimneys, about which nothing is known. The simulation approach introduces an impression of exactitude that is not supported by any data.	 			
341.	A key result for any model calibration is the match to observed groundwater discharges. The understanding is that the North Quarry discharge corresponds to the flows measured at SW1, and that the final model results are compared against the observations in Figure 19.10. Why is the discharge shown for only 5 years? The impression is that the model results do not approximate the observations. It is further understood that the South Quarry discharge corresponds to the flows measured at SW6, and that the final model results are compared against the observations in Figure 19.11? Why is the discharge shown for only 7 years? The impression is that again the model results do not approximate the observations. The annual quarry discharges from 2012-2019 are listed in Tatham (2020; Table 1). In the following figure the values reported by Tatham are supplemented with sump pump between 1996 and 2003 (Golder, 2010; Table E-8). The impression is that there have been important variations in the quarry discharges. How have these variations been considered in the analyses?	The available discharge data starts in April 2014. The restarted baseline (drought period) started in August 2015. We assumed that there would be enough overlap to show the correspondence. The figure below shows the results of the first baseline run for April to December 2014 (in orange) covering the missing simulation results. Quarry discharge is lower than observed in 2014 and early 2015 but settles down and the match is good over the rest of the five year simulation and seems consistent with current quarry operating procedures. A revised hydrograph for SW6 is shown with the missing baseline data in orange. Again, the match improves in the last 5 years as we get closer to current operations.  	Referring to the plot shown in the response to the comment, it is indicated that quarry discharge is lower than observed in 2014 and early 2015 but settles down and the match is good over the rest of the five-year simulation and seems consistent with current quarry operating procedures. Is the implication that an acceptable match to the observations is achieved only to periods representing current conditions? Would a similar mismatch be expected with the opening of the proposed extension	There are two components to the quarry discharge. The first is a specified flow that is based on current operations (a constant discharge for the NW sump and a weekday-only discharge for the South sump). For the second component, all quarry inflows under the different scenarios are picked up in a series of floor drains and routed to the sumps. A control elevation was specified for the sump and any volume of water above the elevation is also routed to the discharge ponds. This allows for the model to compute an increase in discharge under the P12, P3456, and RHB1 scenarios. Significant losses can occur between the sump and SW1, especially during the summer months, so the full amount of the pumped volumes does not reach the gauge. Also, operations of the sumps were more on an ad-hoc basis in the early years of the simulation period, while in the later years, the discharge has been more consistent.	RESOLVED.

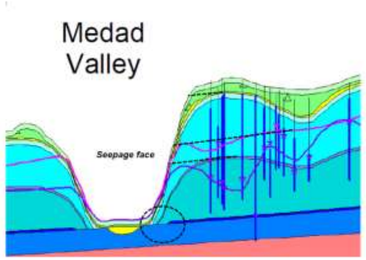
HYDROLOGIC/HYDROGEOLOGIC MODELLING COMMENTS

					
342.	Simulation results are presented for stream gauge SW2 in the Medad Valley. Referring to Figure 19.4, were results also obtained for the other stream gauges in the Medad Valley, SW14 and SW7? The impression is that the reach between SW14 and SW7 will be critical with respect to an appreciation of potential impacts to streamflow's of the proposed extension.	These were shown in Figure 8.72 and 8.73	The response to Comment 342 refers to simulation results for SW14 and SW7 are shown in Figures 8.72 and 8.73. These figures are reproduced below. Are any observations available for these stations, which would allow us to assess the match of the model to the observations?	See follow-up response to Comment 109	RESOLVED.
346.	It is indicated that the simulated deep water levels at MW03- 2 is "somewhat higher than the observed values." The inspection of Figure 19.28 suggests that the simulated average water level is about 267.5 meters amsl, substantially higher than the observed average of 259.5 meters amsl. It is also noted that the match shown to MW03-01A levels is also relatively poor, capturing none of the significant declines that are observed through time. The observed levels range from 271.5 to 267.0 meters amsl, compared with the simulated range of 271.0 to 269.0 meters amsl.	As noted above, this monitor is adjacent to the stream carrying the south quarry discharge. The monitor is also immediately beside a randomly placed vertical fracture; that is also under a wetland cell fed by the south quarry discharge. In summary, this cell probably receives too much leakage from above, explaining the high simulated water level. This is expected given the placement of the random vertical features and does not raise any alarms about the model.	It is not clear why there be a substantial difference between observed and simulated groundwater levels at a monitor adjacent to the stream that carries the South Quarry discharge. Is there something fundamentally problematic in the representation in the model of the interaction between the stream and the groundwater flow system? October 28, 2021 Page 10	No, it is just that a high rate of continual discharge to a stream that naturally had lower flows and that varied seasonally will have higher stage, greater wetted perimeter, and more leakage than other similar nearby streams. The south quarry discharge is more intermittent than the main north quarry discharge and has not been historically tracked with a high degree of accuracy, making it difficult to quantify the effects of this leakage.	RESOLVED.
351.	Referring to Table 19.1, the "inflow" reported for evaporation from interception represents 125.0% of the precipitation. If the correct percentage of the precipitation is indeed 12.8%, the correct value must be 26,070.0 cubic meters/day.	Typo during round-off. Should be 26071	No further comments.	RESOLVED	RESOLVED.
352.	It is not possible to reproduce the reported overall discrepancy in the GSFLOW groundwater budget for WY2010- WY2014 (Table 19.1). The components of the budget are reproduced below. **Item** / **Volumetric r (m^3/d)** **INFLOWS** Recharge 28,155 Stream leakage 2,885 Lake leakage 2,103 **Total inflows 33,143** **OUTFLOWS** Evapotranspiration from the water table -2,817 Discharge to the soil zone (rejected recharge?) -28,482 Net boundary outflows -84.3 Groundwater discharge to streams -2,498 Groundwater discharge to lakes -1,229 **Total outflows -35,110.3** Assuming that "net outflow from storage" represents a source of water to the groundwater system from a net decline in groundwater levels, the overall water budget discrepancy is written as: In contrast, the reported % Discrepancy is -0.6%.	Your analysis is correct, but the table was reporting the discrepancy in the last column, that is, as percent of precipitation.	No further comments.	RESOLVED	RESOLVED.

HYDROLOGIC/HYDROGEOLOGIC MODELLING COMMENTS

354	The final calibration of the GSFLOW model is presented in Appendix E (Section 19). It is not clear from the presentation what the targets for the calibration were (apart from the total streamflow at Aldershot), what parameters were varied during the calibration, and how the ranges were established over which the parameter values would be adjusted to match the calibration targets. Upon review of this section, these were left: Which parameters make a real difference in the calibration, and are there data to constrain the most important parameters?	The basis for this comment is unclear. The reviewer acknowledges that there is an entire section discussing the calibration of the GSFLOW model, with 46 pages including sections on calibration strategy, region calibration to streamflow (the Aldershot gauge mentioned) and regional groundwater levels, local-scale calibration to 8 streamflow gauges, calibration to quarry discharge, calibration to groundwater levels at the quarry face and the need to adjust hydraulic conductivities to match the observations along with discussions, tables, maps, and hydrographs of model results. This section follows two other sections providing detailed discussions on the input data and preliminary calibration of the hydrologic and groundwater sub models. The calibration was done over a two-year period with multiple revisions, innovations, improvements to derive a good match to the observations (particularly in the shallow subsurface), and reasonably constrained parameter values. This was all accomplished using a highly advanced integrated model, despite long run times and instabilities related to the Niagara Escarpment, in a fractured rock/till environment, and with highly complex GW/SW interaction between headwater streams and shallow wetlands. We do not believe that there has ever been such a complex integrated transient analysis ever done in Ontario to analyze a proposed quarry extension. We believe that we accomplished the goal of producing a model that can successfully predict the likely changes in streamflow, groundwater levels, and wetland stage under the quarry extension scenarios considered. Results from this model provided useful input to other team members evaluating the impact to hydrologic and natural heritage features. Please refer to Response 61 and 63 for additional discussion.	The response does not address the questions asked: What parameters were varied during the calibration? How were the ranges established over which the parameter values would be adjusted to match the calibration targets? Referring to Comment #61, we did not see in the documentation support for the belief that the model can provide reliable predictions of the likely changes in streamflow, groundwater levels, and wetland stage under the quarry extension scenarios.	We stand by our original response. Please also refer to earlier comments including Comment 61.	NOT RESOLVED. We stand by our contention that our follow-up questions have been addressed.
JART Comments (June 2023) **These comments are provided in response to the Earthfx Incorporated Memorandum, dated April 19, 2022. Additional, new comments may be provided at any time during the JART review process based on additional information provided by the applicant**.					
361.	The assessment of the potential effects of the proposed infiltration ponds is model-driven, rather than data-driven. At the present time there are no data to confirm the reliability of the predictions.				
362.	On page 3 it is concluded that “the prediction of future response under quarry expansion is expected to have relatively low uncertainty.” The area between the proposed west extension and the Medad Valley has not been subject to extensive field investigations. Therefore, in our opinion the modeling predictions should be considered highly uncertain.				
363.	We are confused by the stated purpose of the irrigation pond. It is indicated in the third bullet of Section 1.1 that the irrigation pond is intended to maintain heads and the flow divide between the quarry and Cedar Springs Road. However, it is also indicated that the infiltration pond is not required. Are the bedrock groundwater levels and the flow divide between the quarry and Cedar Springs Road maintained if the irrigation pond is excluded? It is not possible to tell from the additional simulations results that have been provided.				
364.	Our understanding of the results of the additional simulations is summarized below. **Condition** / **Description** / **Key results** 1 / Baseline conditions Existing golf course ponds (Earthfx 2020/04; Figure 7.2) / Simulated leakage from the existing golf course ponds is 130 m^3/day 2 / Baseline conditions / Simulated decline in water				

			Existing golf course ponds excluded	levels (beneath the existing ponds) ranges from 1.5 m to 2.5 m			
		3	P3456 West lands excavated, golf course ponds replaced with infiltration pond (Earthfx 2020/04 Figures 8.41 and 8.42)	Simulated leakage from the irrigation pond is 780 m^3/day			
		4	P3456 West lands excavation, golf course ponds removed and not replaced (Earthfx 2022/04 Figure 1b)	The simulated decline in water levels ranges from 4.5 m to 5.5 m beneath the area of the existing ponds and 1.5 m to 4.5 m along Cedar Springs Road. The simulated decrease in the baseflow to Willoughby Creek is 2 L/s [we presume near SW7]. The simulated decrease in peak flows is “generally” less than 10 L/s.			
365.	For Condition #3, the leakage from the irrigation ponds is predicted to be 780 m^3/day (9 L/s). This strikes us as a substantial. What data are available to confirm that this leakage rate is realistic?						
366.	On pages 2 and 11 it is indicated that “very conservative assumptions” have been invoked in the simulation of the proposed infiltration pond. We understand “conservative” in this context to mean “simulated in such a way as to minimize the predicted leakage from the pond”. We understand that although the pond will be excavated to the top or into the weathered bedrock, it is assumed that it will develop a natural, low hydraulic conductivity liner [how low is never indicated]. The assessment would be more instructive if results are also presented for a simulation in which there was no liner along the bottom of the pond. For that case, we speculate that inflows might have to be much higher to maintain the pond and that leakage from the pond might be substantially higher that predicted. Larger leakage rates would exacerbate any threats to water quality in private wells posed by the pond water.						

367.	Referring to pages 4 to 8, Earthfx indicate that the LIDAR data shows that the Medad Valley has steep walls. In our opinion, the LIDAR data support our contention that the model layers (including the hypothetical middle and lower fracture zones) are more likely to terminate at the valley walls, as indicated by the dashed lines in the excerpt from Earthfx (2020) Figure 5.2, instead of diving down into the valley. The Amabel fracture zones are referred to in the Earthfx (2010) report as bedding plane features, so it is unlikely that they have been pushed down beneath the valley floor as has been simulated.  Source: 2nd Side Road Section, excerpt from Earthfx (2020) Figure 5.2				
368.	Inspection of the 2nd Side Road Section also suggests that the lower fracture zone does not have an outlet to the Medad Valley. This does not appear to be consistent with the photograph in Earthfx (2010) Figure 5.10, which suggests an interval of groundwater discharge at the base of the quarry. The truncation of the lower flow zone prior to the Medad Valley may have the effect of artificially supporting groundwater levels in the deeper portion of the Amabel unit.  Figure 5.10: Lower zone quarry discharge near OW03-15 (Worthington Groundwater, 2006)				
369.	On page 11, reference is made to the “leaky response” observed during the BS-06 pumping tests. However, as indicated on Earthfx (2020; pages 376-378), that is <u>not</u> the conceptual model that has been invoked to interpret the pumping test data. Instead, the observations have been matched with the Neuman (1974) analytical solution for an unconfined aquifer. That is, the conceptual model does not consider leakage from sediments overlying the bedrock. In fact, the discussion of the test on page 378 specifically excludes the possibility of leakage from an overlying aquitard. *The test response for the Westerns Lands is*				

	unique in terms of the unconfined response and is attributed to the local setting at the pumping well. This is stated since the bedrock profile at the pumping well is overridden by a thickness of sand which has not been seen elsewhere on the Western Lands and the Southern Lands. This delayed response (i.e., late-time unconfined response) is attributed to the overlying sand sequence as opposed to the larger interconnected fractured rock network. This also accounts for the fact that the same response was not observed during the former Golder pumping test sequences (Golder, 2006). The clay till overburden evident over the regional setting has no capacity to yield any significant response.				

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Proposed Burlington Quarry Expansion
Interim JART COMMENT SUMMARY TABLE – Hydrogeology

Please accept the following as interim feedback from the Burlington Quarry Joint Agency Review Team (JART). Fully addressing each comment below will help expedite the potential for resolutions of the consolidated JART objections and individual agency objections. **These interim comments will be finalized following the breakout meetings between JART and Nelson and any changes will be marked using "track changes". Additional, new comments may be provided once a response has been prepared to the comments raised below and additional information provided**.

	JART Comments (February 2021)	Applicant Response	Interim JART Response (February 2022)	Applicant Response (June 2022)	JART Response (June 2023)
21.	POSTULATE: The Halton Till does not have a uniform K; is not an aquitard; and has not been appropriately characterized with regard to wetland hydrology and model layer input. Earthfx separated their responses to MNRF between an overview covering "common points" as well as separate point-by-point responses. B.l Section 1.4 Long-Term Observations of Wetland and Quarry Interaction. The overview discussion section 1.4, page 962 (also section 4.2, Figure 30, page 998) discusses observations of the effects of quarry development on individual wetlands. I had commented that I do not believe that the Halton Till was an aquiclude/impermeable and that there is a hydraulic connection between at least some wetlands and the bedrock aquifer (my JART comments #21 through 25). Figure 5 on page 962 of the MNRF response shows Golder MP 13 logger data and bedrock well levels for wetland 10 (13105). The wetland water levels appear to be unaffected by the approaching face of the quarry despite continuously declining bedrock water levels. These data are considered to be "observational proof' that the quarry will have no impact on wetlands. However, this figure shows a totally different story. Note the 'lock-step' declines in both wetland levels and bedrock levels during 2007 — a noted drought year. Then notice that the wetland levels remained high during 2009, again in 'lock-step' with high bedrock groundwater levels. A late year drop in wetland levels during 2009 is also mirrored by a decline in the wetland water level. These are clearly hydraulically connected. The fact that wetland levels don't decline further as the quarry face advances is misleading. The wetland piezometer is at the bottom (can't go lower) and the wetland is dry every year (except 2009). It doesn't matter how low the bedrock groundwater levels go, the wetland can only go to Apparent filling of the wetland in fall and spring are simply short-term responses to wet periods including rain and snowmelt. The soils are silty clays so there is some capacity to refill each year, just not for any significant period as long as bedrock water levels are below the base of the wetland	The unweathered Halton Till has a low primary hydraulic conductivity and acts as a regional aquitard. The till is likely to have some vertical fracturing that fully penetrates the unit's thickness. These fractures are sparse and randomly distributed, so their locations are unknowable. We used a conservative estimate of the hydraulic conductivity of the Halton Till based on geometric means of the available testing data. (Conservative in this sense means that we allowed for more interaction with wetlands and streams than if we had assumed a lower value for the hydraulic conductivity)	The primary point of my comment #21 focuses on wetlands not modelling. We seem to agree that there are deep vertical fractures penetrating the unit's thickness. Where these occur beneath wetlands, there is a high probability that there will be a direct connection between the wetland water level and the underlying bedrock aquifer. The presence of direct wetland – bedrock hydraulic connections is demonstrated by the hydrographs provided by Golder (see comment #29). This results in a direct and significant impact to the wetland during excavation which needs to be documented as part of an impact assessment.	We respectfully agree to disagree that vertical fractures beneath wetlands will result in a significant impact to wetlands. This is because the sparse fractures allow heads to equalize and response in similar manner over time (as noted in the original comment) but the volume of water transmitted by small, sparse fractures is small. Our conservative modelling analysis assumed greater connection than is likely and, therefore, generally over-estimated the degree of impact of quarry expansion on the perched wetlands. Regardless, the monitoring, threshold, and mitigation plan has been designed to protect these features. Please see the updated AMP.	Please provide the data demonstrating that till fractures under wetlands are "sparse" and "small". Golder's hydrograph data demonstrates direct, rapid connections between wetlands and underlying bedrock – undeniable. I note that the applicant never responded to my point regarding Figure 5, page 962 of the MNRF in their June 2022 comments.

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22.	The determination of matrix permeability (primary permeability) in tills is a grossly misleading determination of the potential for surface water to infiltrate to (in this case) the underlying bedrock. Tills are well known to have fractures, especially finer-grained materials, which create a secondary permeability that can be orders of magnitude higher that the primary permeability. Secondary permeability is achieved through drying-out and contraction over time (especially in fine grained tills); fracturing due to glacial isostatic flexing; soil pipes created by the downward suffusion of material into underlying bedrock (especially where karst is present); root channels; and animal burrowing.	It was assumed that the upper part of the till was weathered and densely fractured and likely has higher hydraulic conductivity than the unweathered, less fractured portion. See previous response regarding the unweathered till.	See responses to Comment #21 (above) and #23 (below).	We acknowledged that there are likely to be sparse, vertical fractures. Even though the fracture has higher permeability, the sparsity of fully-penetrating fractures yields a lower effective vertical hydraulic conductivity and volume of flow. It should be noted that desiccation fracturing is likely to be higher in upland areas which dry out quicker than the low-lying wetland areas. Deposition of wetland sediments will also limit vertical flow through the fractured till. See responses to Comment #21 (above) and #23 (below).	Again, please provide data showing that the fractures that "fully-penetrating fractures" are "sparse". Till fracturing occurs in response to a number of environmental conditions such as isostatic rebound and root penetration not only desiccation. I don't recall seeing any soil profiles for the wetlands indicating the presence of wetland 'soils'.
23.	Till fracturing has been well documented. Freed (1993) for example, notes that: "Recent studies show (a) fractures in tills can greatly alter…hydraulic conductivity and storativity by allowing more fluids to move through the till… (b) fractures can alter the bulk permeability over the matrix permeability by several orders of magnitude…(c) isolation of surface contaminants from aquifers may not be possible due to fractures in the underlying unweathered till… and (d) fractures increase the median in-situ hydraulic conductivity by three orders of magnitude…" The MNRF comment requests "wetland-specific" hydraulic conductivities for the Halton Till. I have already made the point that the although the model treats the unweathered till as one layer, it does not account for the presence of fractures. Earthfx's response to MNRF is totally inadequate, referring to the model layer and stating that "no patterns of lateral spatial variation have been observed" and because it is a glacial ("regional scale") deposit, none is to be expected. There is no glacial geological basis for this statement. As I noted, the fracturing of glacial tills is well documented (my comment and response #23). These deposits are flexed downward by glacial loading then upwards by isostatic rebound. Also, what is meant by not observing lateral spatial variation? What have they done to support this statement? No assessments of field-scale tests of hydraulic conductivities of the Halton Till have been provided. These comments are wetland specific but in each case request specific hydraulic conductivity data from beneath the wetland. See my comment #B3 above	Freed (1993) was quoting a study by Keller (et al.) of low permeability clay tills in Saskatchewan. These tills had laboratory K's of 10^{-11} m/s and bulk values closer to 10^{-9}. The Halton Till in the study area is much thinner and is likely to be slightly more fractured at depth (the calibrated model has a bulk K of 10^{-7} m/s. The assumed value is more conservative in that it allows for a greater connection between the overburden and bedrock.	Freed (1993) was quoting several studies, including one in Wisconsin. The point is that tills are known to be fractured and bulk hydraulic conductivities do not represent the entire deposit. Individual fractures can have much higher orders of magnitude conductivities. Freed's own studies in Michigan demonstrated this and he noted that, although the intensity of fracturing varied, all sites had deep fractures. When located beneath wetlands, the wetland water level will be affected/controlled through hydraulic connections to any underlying aquifer.	As above, the sparse fractures can transmit the pressure response but do not transmit large volumes of water. The presence of fractures may be limited beneath wetlands and the deposition of fine-grained wetland sediments may further decrease the transmission of water.	No data has been provided to support the June 2022 response from the applicant.
24.	The movement of a contaminant through deep silty clay materials into underlying karstic bedrock was clearly demonstrated during studies into the Smithville Ontario PCB 'spill' during the latter part of the last century (Worthington and Ford 1998). Although not a till per se, the deposit is a 9.0 – 12.0 meter silty clay glaciolacustine deposit which, based on personal observations, may in fact be a reworked till. Worthington and Ford (1998), based on electrical conductivity measurements, indicated a double permeability with the presence of "…wide-aperture pathways through the overburden. These pathways currently allow low-EC precipitation to rapidly flow through the overburden…the open fractures would have allowed prompt contamination of the bedrock very	Each area is different and glaciolacustrine clays are not clay-silt tills. Again, the model uses a relatively conservative value, much higher than those likely used in Smithville for competent glaciolacustrine clays.	As I had noted in my original comment, the Smithville deposits are not "competent glaciolacustrine clays". They are in fact reworked tills as demonstrated by a large component of stones and cobble. The point of my comments on the Halton Till is not that the matrix has low permeability but that every glacial deposit is fractured due to glacial loading and isostatic flexing.	See comment above.	Also, see comment above.

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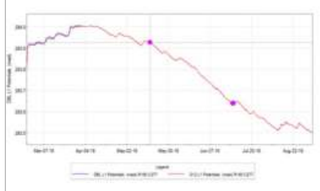
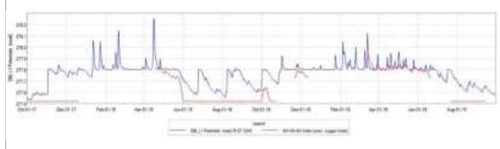
	shortly after wastes started to leak from their containers."				
25.	The hydrographic data provided for the study area, originally by Golder (Golder Associates Ltd. data files, 2010), and subsequently in the current investigation's Level 1 and 2 Hydrogeological Assessment report do not support the hypothesis that the Halton Till is a single, continuous tight layer or aquitard.	See above. No specific logs are referred to. The Golder lab and slug tests showed a wide range in values as they sampled weathered and unweathered portions of the till.	Again, there is a wide range in conductivities due to fractures whether weathered or not. See response to Comment #29.	See comments above. It should be noted that the till was simulated as a two-layered system when at surface. The upper layer was assumed to be weathered with a higher fracture density. When overlain by other materials, the unit was represented as a single layer with the relative low vertical hydraulic conductivity ($1x10^{-7}$ m/s) representing a till with sparse vertical fractures.	"Simulated" and "assumed". Please provide direct evidence of a "two-layered system".
26.	A wetland (or pond) underlain by material having a very low permeability should demonstrate a very gradually lowering water level over the course of the hydroperiod assuming the level is not directly supported by underlying aquifer(s). For example, as the till aquifer level declines following snowmelt and spring precipitation, then the surface water level in the wetland should decrease very gradually over the course of the hydrological period potentially being recharged by rainfall but otherwise demonstrating a gradual but continuous decline.	Yes. There would be leakage over time through the low permeability sediments. This is seen in the Golder staff gauges and minipiezometers as a general recession in water levels from the late spring to fall. The behavior is complicated by response to rainfall events that continue to occur over this period that convey overland runoff and, in many cases, streamflow. The late winter/early spring rise and late spring/early fall recession is also typical of every aquifer in the study area.	Comments 26 through 29 are all part of common narrative: wetland hydrographs are critical in defining the degree of hydraulic connection to the underlying aquifer. A direct connection has been demonstrated between wetland 17/13033 by Golder's hydrograph data covering a particularly dry year (2007). We seem to agree that a wetland with a low permeability substrate should show a pattern of very slowly declining water levels controlled primarily by evapotranspiration regardless of water levels in the underlying aquifer (Earthfx response to my comments #26 and 27).	We agree that the wetlands can show a gradually declining water level over due to a number of factors. For a wetland underlain by low permeability geologic material as well as accumulated wetland deposits, the primarily factors should be (1) evapotranspiration and (2) decreased runoff during the summer as infiltration is higher in the surrounding upland soils. Drainage through the wetland bottom is likely to be a minor factor as demonstrated in our analysis. Wetlands underlain by a sandier soil would likely show enhanced declines in water levels as under-drainage would be a more important component of the water balance.	The point is that your and Golder's hydrographs demonstrate many wetlands are dry ("0" depth) by May, these do not represent a low permeability system only drained via evapotranspiration.
27.	This behavior was, in fact simulated for Wetland 13032 (Figure 1). Following snowmelt and early precipitation from late March through early April, the water level gradually declines, responding only to rainfall events (as shown by each of the slight upticks) through the season reaching annual lows in late July/early August. Figure 1. Simulated water level showing a spring recession pattern typical of wetlands underlain by low permeability materials (Figure 6.35 for Wetland 13032 in the Level 1 and 2 Hydrogeological Assessment). In this simulation, lowest wetland water levels are not achieved until August – September. 	Yes, the integrated model was capable of simulating the seasonal response of wetland stage. This is the main reason we went through the effort of building a very complex, transient, integrated model of the site vicinity.	See my response to comment #26 above.	This response is as expected. Losing 300 mm of water to ET during the late spring and summer would be normal behavior. The response levels off at the end of August when ET processes begin to shut down.	See response above and my original comment under point #28 below.
28.	However, this pattern is not demonstrated in all wetlands located on the site. Table 42 (page 86) in the Surface Water Assessment report indicates that levels in at least four wetlands (SW11/13027; SW12/13022; SW13/13016) and SW16/13201) all reach "0" (based on 0.0 meter reading on staff gauge) prior to late May on the 20-year monitoring and most prior to the first week of May. These indicate a pattern of snowmelt/spring precipitation fed systems immediately drying out by relatively rapid infiltration through the underlying till unlike the pattern demonstrated in Figure 1.	Some tills underlying the wetlands are thinner than others. A few are affected by seasonally high water tables. We, and other reviewers, noticed some longer lags in the fall recovery in the model while the staff gauge response shows a rapid recovery once ET processes shut down. We believe that the wetlands were likely assigned too much soil zone storage so we are not exactly mimicking the quick filling of soil zone storage and rapid increase in stage. The same problem would tend to slow the simulated recessions in the late spring. The staff gauges show very steep recession once ET processes get under way with a quick drop in stage. 	Earthfx's response to this comment appears to blame a "quick drop in stage" within the wetland as being due to the onset of ET processes. ET is not a switch – one doesn't either have or not have ET – the process is continuous and dependent on temperature/cloud cover. Increasing ET, during most years, is gradual which is shown by a gradual decline in wetland water levels, where wetland substrates have low permeability's, with additions due mostly to rainfall (which is measurable).	ET processes, as noted by the review, are driven by temperature, solar radiation, other climate factors (humidity, wind speed), and the availability of moisture in the root zone, the types of plants and growth stages, and other factors. Evaporation processes are continuous in the model. The model does have a switch related to temperature that turns on transpiration processes after a number of consecutive warm days in the spring and shuts down transpiration in the fall after consecutive cold days. This may be a somewhat simplified representation of reality. Regardless, we feel that ET processes are the dominant ones in these wetlands. One other possible explanation for the steepness (200 mm in 2 weeks) observed at one specific point in the wetland might be Internal drainage within the wetland and that the staff gauge may not be at the lowest point in the wetland.	ET process do not dominate where wetlands are effectively dry by the end of April. Please see my original comment with Golder's figure from 2007 #29 below.

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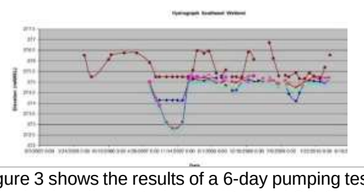
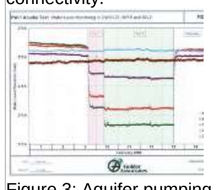
29.	Figure 2 indicates that surface waters in the wetland are in fact directly connected to the underlying bedrock aquifer as shown by the precise correlation between the levels in MP-5 and all underlying wells. This behavior is particularly well marked during the late Spring to early Winter period of 2007. The data are monthly, hence could mask some delay in response, however, such a direct correlation in levels as shown, even over monthly intervals indicate the presence of a direct hydraulic connection with the bedrock aquifer (compare to Figure 2 to Figure 1). Figure 2. Manual water level hydrograph of MP-5, SG- 4, OW3-22B as well as at three adjacent wells (OW03-24B, 27B, and MW03-04B). The "Southeast Wetland" of Golder Associates Ltd. (2006) is equivalent to Wetland 17/13033 in the Earthfx (2020) report (Figure 19-50). Page 975 and Figure 8, page 981. I had spoke to this in my original comments on the report and responded to Earthfx's response to the JART table (my comments #29-30). Pumping a well over only 4 days draws down the well, and a portion of the pumped aquifer, it does not draw down the overlying sediments. As I notes before, the pumping test should have been conducted in the order of 30 days. The 2007 dry year was effectively a 4-month pumping test, demonstrating a hydraulic connection between wetland 13033 and the underlying aquifer. 			Hydraulic connection can ensure that the heads correlate across the units. The fact that a pressure response is transmitted does not necessarily mean significant volumes of water have been transferred.	The hydrographs, especially the 'lock-step' timing of the wetland hydrograph with the underlying bedrock – both downward and upward – certainly does show a significant water flux.
30.	Figure 3 shows the results of a 6-day pumping test in bedrock wells located near MP-5 and SG-2 during February 2006. The lack of any evident response in the mini-piezometer and staff gauge (brown and blue lines, respectively) was provided as proof of the aquitard characteristic of the Halton Till. However the next year – 2007 – was a drought year and the full year hydrograph for the wells, mini-piezometer and staff gauge demonstrate a direct connection (Figure 2). It is clear that a 6-day pumping test is not long enough to determine connectivity.  Figure 3: Aquifer pumping test results showing water levels in bedrock wells (OW03), the wetland surface (MP-5), and a staff gauge (SG-2) in the southeast wetland during February 2006 (Golder Associates Ltd.	No. The pumping test was a direct local stress on the aquifer. The system responded and reached equilibrium in an extremely short time with no indication of a significant impact on the wetland. Prolonging a test after equilibrium is reached makes no hydrologic sense. That both the shallow system and bedrock respond to seasonal change indicates that, on a regional scale, sparsely-spaced deep vertical fractures provide a higher degree of connectivity than would occur through an unfractured till. As in the bedrock, the occurrence of these vertical fractures is random and not mappable. A 30-day pump test would not provide any additional information in this regard.	There are two systems here – the wetland system (MP-5 and SG-2) did not respond at all during the 6-day pumping period. You will note that pumping test well (OW03-22B) did show a direct correlation of wetland and aquifer levels (yellow in preceding figure) during the dry 2007 period which was effectively a four-month pumping test. B.2 Section 2.4.2 Golder In-Situ Test and Pumping Test Page 975 and Figure 8, page 981. I had spoke to this in my original comments on the report and responded to Earthfx's response to the JART Table (my comments #29 — 30). Pumping a well over only 4 days draws down the well, it does not draw down the aquifer. As I noted before, the pumping test should have been conducted in the order of 30 days. The 2007 dry year was effectively a 4-month pumping test, demonstrating a hydraulic connection between wetland 13033 and the underlying aquifer.	We stand by our original comment. Each step of the test came to equilibrium within an hour or two. Prolonging a test after equilibrium is reached makes no hydrologic sense. The statement that "Pumping a well over only 4 days draws down the well, it does not draw down the aquifer" similarly makes no hydrologic sense as there are not 4 days of storage in the well.	Then explain Golder's result showing both the aquifer and wetland reacting identically (downward and upward) during a dry year which effectively simulates a 3-month pumping test.
31.	Recommendation: : A 30-day pumping test should be conducted in at least 2 wetlands (e.g., 17/13033) to determine degree of connectivity between wetlands and the underlying aquifer.	See previous response	A 30-day pumping test is not unreasonable when determining potential impacts to a PSW.	See previous response.	No further comment at this time.

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32.	Recommendation: : Wetland hydro periods will be impacted during quarrying and prior to excavation lake filling (and potentially after filling depending on final levels). These impacts need to be assessed and potential mitigation measures should be developed.	The modelling and additional hydrologic assessments specifically assessed the likely changes to the perched wetlands.	The modelling assumes that the Halton Till unweathered layer has a low permeability is not based on actual data of fracture permeability's.	The purpose of this study was to make reasonably conservative assumptions, quantify the likely changes to water levels and hydroperiod, and provide an adaptive management plan that addresses these changes. We carried out these analyses using an advanced integrated modelling approach and reported our results. No alternative method for conducting these analyses was suggested by the reviewer.	I would point out that you only considered bulk hydraulic conductivity
33.	Recommendation: : The Halton Till layer in the hydrogeological model requires better hydraulic conductivity definition (absolute K values and spatial distribution).	Noted	Earthfx's response of "Noted" seems to agree that "better hydraulic conductivity definition" is required for the Halton Till. Although Worthington's response to my comment #47 is applied to bedrock fractures, it points out that the model does not consider flow through fractures. The same applies to fractures in till. Unless you are specifically aware of them, which you indicated in your response to comment #21 that they are "unknowable", then the model can never account of enhanced leaking through till fractures, which we know does	Testing by Golder provided a wide range of hydraulic conductivity values. We analyzed the data and found no apparent spatial pattern in the results. We were just acknowledging that it would be better if it were possible to know the absolute values of the hydraulic conductivity of the Halton Till at all locations within the 83 km^2 area, but that is clearly not possible.	Your studies made no attempt to determine the range in till k values across a single wetland let alone the entire site. The current proposal only significantly affects one wetland (re. the southern extension).
34.	POSTULATE: Groundwater flows to the Medad Valley have not been adequately characterized; these flows involve flow through discrete karst conduits (not EPM); and impacts to the valley and its wetlands have not been adequately defined.	Karst surveys (Worthington, 2006, 2020) were conducted and identified springs, "disappearing" and re- emerging streams, and other karst features. Where data were available, these were simulated explicitly in the integrated model, including a stream reach on the east arm of the West Branch of Mt. Nemo Creek and on the unnamed tributary to Willoughby Creek, and the springs emerging in the Medad Valley. Otherwise, we believe the network of multiple short fractures and zones of moderately fractured bedrock behave as an EPM.	The model was 'verified' using a wide range of well data from throughout the entire site. I have worked my entire career along the Niagara Escarpment and it is common knowledge that there is a 1 to 2 km zone back of the scarp which has much higher secondary and tertiary permeability (e.g., Frank Brunton) due to the opening of joints and bedding planes from isostatic loading and unloading and the capture of surface waters. You will note that Worthington's karst features in the study area are exactly within that zone. It is unreasonable to assume that the model has the same efficacy across the entire site, especially nearest the escarpment including the entire proposed western expansion area.	The original comment dealt with the way the springs and karst features were characterized and we responded saying that these were represented as discrete features where we had adequate data. The response has raised a second issue related to enhanced fracturing within a short distance of the Niagara Escarpment. During model development, we added a fracture zone with experimented with a 500 m to 1 km enhanced fracture zone, but model results (i.e., matches to observed water levels) were not improved.	"Adequate data" you refer to only exists for the two small karst systems traced by Worthington…there are no data (other than the one-time March 2006) observations) for the majority of springs feeding the Medad Valley. Of course your 'enhanced fracture zone' would not change the modeling because all you did was re-create a coarser EPM matrix. The enhanced fracture zone I referred to in my earlier comment provides opportunities for enhanced FLOW (i.e., tertiary permeability) which you could not possibly model.
35.	The Medad Valley is a Provincially Significant Wetland (PSW) and lies within the Niagara Escarpment Planning Area. It is also designated as a Provincially Significant Earth and Life Science ANSI. The wetland complex within the valley is formally identified by MNRF as the "Medad Valley Wetland Complex". The proposed west extension is currently zoned as "Escarpment Rural Area" and the valley itself is predominantly "Escarpment Natural Area" surrounded by "Escarpment Protection Area".	Comment noted.	As per #36.	Refer to response to # 36.	No further comment at this time.
36.	PSW's are designated as significant natural heritage features under the Provincial Policy Statement which, as defined in the Natural Heritage Reference Manual, specifies no development within a PSW and a full impact assessment is required where developments are proposed within 120.0 meters of the PSW boundary.	Comment noted. We extended our analysis to and beyond the Medad Valley despite it being more than 120 m from the quarry.	Earthfx's response does not address the need for an EIA as required by the PPS. Specifically, page 61 of the Natural Heritage Reference Manual which notes that "development or site alteration will not be permitted within adjacent lands [lands within 120m] unless the ecological function of the adjacent lands has been evaluated, and it has been demonstrated that there will be no negative impacts on the natural features or on their ecological functions. This critical evaluation of the adjacent lands is one of the most important parts of an EIS."(highlighting mine). Such an EIS has not been prepared.	As we noted, the Medad Valley wetland is outside the 120 m buffer around the license boundary for the quarry expansion. Excavation and the infiltration pond will be outside that buffer and further from the wetland. Despite this, we felt it important to assess the magnitude of changes that would likely occur in the larger area.	Not clear what assessing the "magnitude of changes that would likely occur in the larger area" actually means. Please identify where the EIA for the Medad Valley wetland is provided.
37.	Ontario Regulation 162/06 (HRCA under the *CA Act*) also prevents developments within wetlands that "could interfere with the hydrologic function of a wetland, including areas up to 120.0 meters of all provincially significant wetlands…"	See previous response	As per #36.	Refer to response #36	No further comment at this time.

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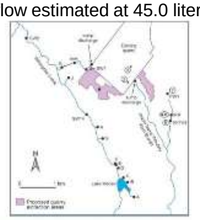
38.	The Niagara Escarpment Commission Plan also requires a natural heritage evaluation in cases where a development is proposed within 120.0 meters of any key natural heritage feature or key hydrologic feature (Policy 2.7.6) and the evaluation should demonstrate that "the connectivity between key natural heritage features and key hydrologic features located within 240.0 meters of each other will be maintained…" (Policy 2.7.6d).	See previous response	As per #36.	Refer to response #36	No further comment at this time.
39.	Although the Natural Environment Report (Savanta Inc. 2020) and Surface Water Assessment Report (Tatham Engineering 2020) provide some description of form and function of the Medad Valley Wetland Complex, wetland impact assessment is principally associated with fish habitat in creeks within the valley. There is no discussion of wetland water balance and potential impacts on hydrological (other than valley stream flows) and hydrogeological function nor impacts to flora and fauna (other than fish) due to the proposed quarry extension. Wetland water balances are provided for many wetlands but not for the Medad Valley Wetland Complex (Earthfx ID #24).	See previous response Our analysis was primarily focused on likely changes to streamflow which includes discharge from karst springs. Access to the Medad Valley was limited and specific information needed for more detailed modelling was also limited.	As per #36.	There have been follow-up discussions with MNDMNRF regarding the Medad Valley, changes to the wetland water balance (particularly groundwater discharge), methods to minimize the predicted impacts, and additional monitoring. See updated AMP.	Will defer further response until after November 3, 2022 site visit.
40.	The discharges are not masked as indicated in the Level 1 and 2 Hydrogeological Assessment and have been mapped by Worthington (2006, 2020) as discrete features.	There is likely unmapped diffuse discharge occurring along the flanks of the Medad Valley wall and upwelling in the valley floor as well as the mapped discrete discharge points	What evidence does Earthfx have pertaining to diffuse discharge along the flanks of the Medad Valley – I have seen no prior evidence of this. Earthfx's response that groundwater upwells in the Medad Valley floor is curious. The noted (and mapped springs) are at/near the base of the carbonate sequence (my comment #42 which Earthfx appears to agree with) flowing under unconfined conditions. Hydraulically, these springs would drain fractures of the main aquifer. "Upwelling" implies artesian conditions so even if a carbonate unit extended beneath the valley (Reynales?), what is driving the head? The Reynales is not confined and any up-dip flow would likely be captured at the springs and not underflow them only to upwell in the valley. Further, the Level 1/Level 2 Report notes that "The Medad Valley is incised into the Cabot Head shale aquitard" (2nd para, page 23; page 53).	The Medad Valley was walked by Tatham and Worthington. The Medad Valley wetland is a large feature and the western part of the wetland would not likely be there if only a few discrete springs (Locations G and H) were supplying flow. Gradients are presumed to be upward in this area with groundwater discharge from the lower fracture zone that we mapped as buried beneath the valley infill sediments. Please refer to Schedule 1 and 2 for additional details.	There are undoubtably springs located along the western wall of the Medad Valley. Please clarify the specific bedrock unit(s) underlying the Medad Valley. Your answer implies there is some degree of confinement to the 'lower fracture zone', which if true would only enhance spring flow along the base of the wall within the valley. Please provide elevations of the mapped springs.
41.	Worthington (2006 and 2020) documented the presence and location of 10 springs in the Medad Valley. He provided one-time flow estimates (March 23, 2006) that ranged between 3.0 and 32.0 liters/second at the time of observation. Springs G, H, J, and K are all within about 1.0 kilometer of the western extension and spring J is within about 500.0 meters (see Worthington Figure 1a below). These four springs have a combined flow estimated at 45.0 liters/second.  This comment parallels my comments and responses #41 pertaining to impacts to springs in the Medad Valley and requesting flow monitoring of the springs. Earthfx's response is simply that the modeling does not show an impact. Curiously they	Below is a graph comparing Worthington flows against the average March flow predicted by the model under baseline conditions. The pattern in the simulated water levels appear reasonable (e.g., high simulated values match high observed values) but are consistently lower. Spring flows vary on a daily basis. It should be noted that 2006 had higher annual precipitation than any successive year. There were 47.1 mm of rain in March 2006 (30-year average for March = 43.3) prior to the Worthington measurements and January and February precipitation values were well above the monthly averages (79.1 vs. 56.8 for January and 84.1 versus 57.2 for February, respectively) so it is not unexpected that the Worthington instantaneous measurements are higher than average simulated March flows.  It should be noted that the Worthington measurements were not used as calibration targets. This post-analysis verifies that the calibrated model captured key features of the hydrologic and hydrogeologic conditions in the study area.	Where did this figure come from? What are the assumptions/data used to create it? It seems to contradict Worthington's response to my comment #55 that "EPM models do not simulate flow in individual fractures". The springs are not diffuse but are supplied by specific fractures. The springs are noted by Worthington (2006) to be "small karstic groundwater basins" (page 5) with larger conduits closer to the springs (also page 5). Simply using an area measurement (if that is what was used) will not be useful to model karst conduits using an EPM model. In part because surface and subsurface watersheds can be quite distinct in karst setting.	Worthington's comment is technically correct, it is just that we applied a hybrid approach where we simulated discrete fractures or fracture zones within the model when we had sufficient data to represent them. Otherwise, the EPM assumption was made. The March 2006 flows presented were the simulated flows in the stream segments at the point where the springs emerge. The springs all seem to be located within erosional features so the simulated streams are likely incised reasonably close to the depth of the karst conduit. A key point is that we were able to simulate the contribution of the springs to the Medad Valley reasonably well and the model indicated that upwelling was also occurring throughout the Medad Valley with the highest values close to the valley walls. This gave us the confidence to make the statements that the reviewer questioned.	The only "data" you had (as mentioned in your response to point #34) is very limited. The first two sentences in the second paragraph don't make sense. Does the model actually demonstrate that "upwelling was also occurring" or simply simulating water levels on the valley floor?

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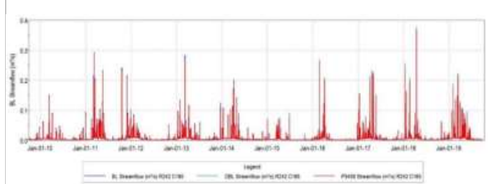
	note that "Several of the springs emanating from the face of the Medad Valley were explicitly represented in the model." They do not provide any data but this could be the one-time sampling and one-time model simulation that they had provided in response to my comment #41.				
42.	All springs are located at or near the base of the carbonate aquifer (Goat Island/Gasport), either at the top of the Cabot Head or more likely, at the interface of the Irondequoit – Rockway formations (F. Brunton, Ontario Geological Survey, field trip notes, September 2008).	Comment noted.	Earthfx "notes" my comment which I assume means that they agree.	RESOLVED	As per #40, above, please provide a detailed stratigraphic section across the Medad Valley including elevations and depth/nature of soils
43.	In either case, they lie near the base of the valley wall. Spring elevations are not documented but are likely at about 250.0 meters amsl based on visible contour flattening (see Site Plan, Page 2) which is very close to the final quarry floor at 252.5 meters. The springs are approximately 20.0 meters below the top of bedrock at the northwest corner of the western extension but will be only a couple of meters below the proposed quarry floor.	Comment noted.	Earthfx "notes" my comment which I assume they agree with.	RESOLVED	Noted that Earthfx has confirmed eastern Medad Valley springs are only 2.5 m below the proposed quarry floor (western extension).
44.	The northwest corner of the western extension quarry is within 200.0 meters of the base of the Medad Valley wall, thus yielding a pre-development hydraulic gradient in the order of 1:10 and post- development gradient of 1:80; an approximately eight times shallowing of the groundwater surface. Spring J would have a pre-development hydraulic gradient in the order of 1:25 and spring K about 1:50: both well above the post-development condition. This comment mirrors my comments #44 and 45 regarding a lowering and shifting of the groundwater divide between the Medad Valley and proposed western extension. Earthfx's simply states that the new divide will be beneath the infiltration pond and this will function to "maintain flow to the Medad Valley (Wetland 24)." Again, no proof is provided (see comment B.l. above).	It is over 200 m but close. Based on Layer 8 potentials for baseline, the gradient to Spring J is 0.01 not 1:25. Under P3456 it increases to 0.03. However, it is unclear what the relevance of these calculations is. We note that streamflow is slightly reduced on average at Spring J, from 1.5 L/s under baseline to 0.6 L/s under P3456. Spring K flows are a function of the quarry discharge and increase slightly from 47 to 49 L/s.	A gradient of 1:25 is 0.04 and 1.50 is 0.02 to compare to your notation. The apparent 'increase' is actually a shallowing of the gradient due to a lowering of the surface in the area of the proposed western extension. The gradient is based on rise over run from the bedrock surface where precipitation enters the aquifer. Layer 8 is a construct not a measured flow.	In follow-up discussions with JART and MNDMNRF, we presented simulations of P3456 with and without the infiltration pond to quantify the incremental change in water levels, streamflow, and upward gradients in the Medad Valley. The assumptions in representing the pond were conservative and had the Halton Till underlying the pond. Additional analyses were made at the request of MNDMNRF to determine the effects of deepening the pond by excavating through the till. Model results indicated that upward gradients would generally increase in the Medad Valley. Please refer to Schedule 1 and 2 for additional details.	Cross-section B-B1 on page 4 of the Site Plans suggests that the entire pond is contained within bedrock. I don't recall much Halton Till on the western portion of the western extension – a number of bedrock outcrops were visible. I will leave discussion of model simulation results to our model reviewer (Chris Neville).
45.	The potentiometric surface is not discussed nor portrayed in the Level 1 and 2 Hydrogeological Assessment report however Figure 6-37 provides isolines of the March average simulated groundwater heads. These suggest a groundwater divide at between 265.0 and 270.0 meters amsl which lies directly within the proposed extension. The figure does not show a detailed potentiometric surface but the steep hydraulic gradients toward the escarpment face, in combination with an approximately 20.0 meter lowering of the plateau surface within the western extension will, without question, lower the divide and, by definition, reduce groundwater flows toward the Medad Valley Wetland Complex.	Yes. Changes in streamflow in the Medad (Willoughby Creek) are discussed in the report.	Figure 6.37 is the only mapping I could find that includes a potentiometric surface. However, this diagram is not sufficiently precise for this application (see my comment to response #187). Yes, changes in streamflow are discussed under scenario P3456 as you note, however, as I point in comment #301, the noted changes are an artificial construct of one simulation (post-development) over another simulation ("baseline"). Baseline is not based on actual measured data so we have no idea to what degree the noted changes are real.	The purpose of a modeling analysis is to use the best available technology to reproduce the functioning of a complex hydrologic system so as to better understand the factors that control the behavior of the system and its responses to change. In a comparative analysis, we calibrate the model to reproduce a baseline condition and then change those conditions and analyze the subsequent response. Despite this being an "artificial construct", there is no better way to predict the likely impact of a quarry expansion without actually excavating the quarry and measuring the response.	Yes, of course, all depends on the success of calibration. However, I am still awaiting the presentation of an acceptable potentiometric surface map (5 m intervals is not acceptable).
46.	Worthington (2006) estimates that spring C (27.0 liters/second) has a groundwater basin of 1 to 5.0 square kilometres (Page 5). He also notes that this spring is located 2.4 kilometres "from the closest point of the [southern] extension lands, and…it seems possible that this spring may drain part of the [southern] extension lands." The currently proposed southern extension, although smaller in area than that proposed in 2004, remains within about 2.4 kilometres of spring C.	Comment noted. There are slight changes in average Spring C flow between the baseline and P3456. The changes are mostly related peak event flows while base flow shown insignificant differences. 	Again, as noted in comments #45 and 301, the simulation is artificial not based on measurements. Further, Worthington's response to my original comment #47 is that the model does not determine flow through fractures individually but collectively. I would point out that the surface watershed and bedrock aquifer watershed are seldom the same in karst settings.	See previous responses.	No further comment at this time.

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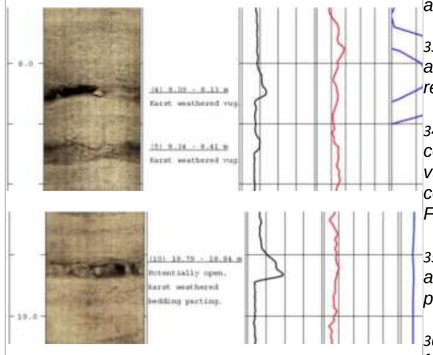
47.	Although Worthington was relying on the former Golder model to make these area determinations, that model is also an EPM-based model and neither the Golder Model nor the Earthfx Model account for flow along fractures (secondary permeability) or karst conduits (tertiary permeability). Secondary and/or tertiary permeability pathways in simple sinkhole to spring systems along the escarpment in southern Ontario, can be much longer that 1.0 kilometer and, in the retained consultant's experience working on the Niagara Escarpment, distances from source to spring in the order of 2.0 kilometres is not uncommon. Worthington (2020) notes that given the high "bulk hydraulic conductivity of the aquifer (~10¯5 to 10¯4 m/s)…almost all the flow is through the fracture network."	See Earthfx Response 34. **Worthington Response** The abbreviation EPM stands for Equivalent Porous Medium, and uses for the concept that aquifers may behave as porous media at a large enough scale. EPM models do not simulate flow through all the millions of individual fractures through which water flows in the aquifer, which would not be practicable and has never been done at the scale of the Earthfx modelling. However, the model does simulate flow through the fractures collectively rather than individually.	Please define "a large enough scale" in the context of the site. I believe that Worthington's response here meant to read as "small enough" scale. Large scale represents more detailed areas than small scale (e.g., 1:10000 is a larger scale than 1:250000). Spring C has a watershed in the range of 2.5 km^2 which is a large-scale representation under any system.	Worthington is referring to the scale of analysis (e.g. on the order of kilometers rather than 10s of meters. Again, we took a hybrid approach with a mix of EPM and discrete fracture analysis.	No further comment at this time.
48.	Worthington (2006) mapped and traced karst conduit systems to the south (West Tributary) and north (Willoughby Creek – spring K). The latter indicates that karst conduits directly feeding the Medad Valley springs are, in fact, present. He did not observe sinkholes within the western extension area (Worthington 2020), however, his Figure A7 (partially reproduced below) indicates the presence of "Karst" weathered vugs along bedding planes in borehole BH06-1. These are found at 8.09 meters, 8.34 meters and 18.79 meters below ground surface adjacent to the southern extension area. Figure 2. A portion of Figure A7 (Borehole BH06-1) from Worthington (2020).  	Comment noted. Spring K was modelled explicitly. **Worthington Response** The several lines evidence on flow in the aquifer presented in the 2006 and 2020 reports consistently shows that most flow in the dolostone aquifer is through solutionally-enlarged fractures. Such flow is common and is expected to occur in dolostone and limestone aquifers. Some of that evidence is listed in Cowell's comments (Peer Review Comments: Proposed Burlington Quarry Extension) , including: *32. Worthington (2006) mapped and traced karst conduit systems to the south (West Tributary) and north (Willoughby Creek – spring K). The latter indicates that karst conduits directly feeding the Medad Valley springs are, in fact, present. He did not observe sinkholes within the western extension area (Worthington 2020); however, his Figure A7 (partially reproduced below) indicates the presence of "Karst" weathered vugs along bedding planes in borehole BH06-1. These are found at 8.09 m, 8.34 m, and 18.79 m below ground surface adjacent to the southern extension area.* *33. The uppermost vug is particularly interesting being up 4 cm wide and open. It also shows a significantly higher specific conductivity (blue vertical line) than the remainder of the core indicating the presence of carbonate-rich water.* *34. Borehole BH06-1 is located northeast of the proposed southern extension. The continuity and extension of these "vugs" are not fully known but at least the uppermost vug provides indications of water transmission which suggests some continuity. This is confirmed by the flowmeter results from wells OW-03-30 and OW-03-31 (Worthington Figures A8 and A9) which show strong flows in the 7 to 8 mbgs depth.* *35. The final quarry floor in the western extension will be at an elevation of 252.5 m amsl which is well below the elevations of all three of the "karst-weathered" bedding planes.* *36. The Level 1 and 2 Hydrogeological Assessment also documented open fractures in boreholes located within the western extension. This included references to the presence of "moderately open" fractures in the composite video log (Appendix A, Figure 4.2.3) and several of the borehole logs were annotated as "heavily fractured" (BS01), and "larger fractures" (BS02).*	The Earthfx response requires explanation. How was spring K modelled? Please provide the details of the modelling. This is curious since flow in individual fractures cannot be represented in the EPM model (Worthington response to my comment #47, above. My original comment was disaggregated from my primary point which is expressed in my comments #51 and 52 regarding the elevation of these solutionally enhanced fractures being above the proposed quarry floor. The interception (or not) by these fractures of infiltration from the recharge pond as well as the elevation of the mound relative to these fractures are critical to the determination as to whether the recharge pond will in fact mitigate the shift and lowering of the groundwater divide west of the proposed extension. This has not been evaluated by Earthfx.	See previous responses regarding the approach and spring flows. We did a comparative analysis of the P3456 conditions with the infiltration feature to evaluate the effect of the quarry of water levels and streamflow. We do not understand the reviewer's follow up comment.	I would think the concept of elevation of the fracture relative to the elevation of the infiltration pond is pretty straight forward.
49.	The uppermost vug is particularly interesting being up 4.0 centimeters wide and open. It also shows a significantly higher specific conductivity (blue vertical line) than the remainder of the core indicating the presence of carbonate-rich water.	Comment noted.	See comment 48 above	See response to #48	No further comment at this time.
50.	Borehole BH06-1 is located northeast of the proposed southern extension. The continuity and extension of these "vugs" are not fully known but at least the uppermost vug provides indications of water transmission which suggests some continuity. This is confirmed by the flowmeter results from wells OW-03-30 and OW-03-31 (Worthington Figures A8 and A9) which show strong flows in the 7.0 to	The model simulated upper, middle, and lower zones of enhanced permeability to represent the presence of these solution enhanced fractures within the EPM model.	See comment 48 above	See response to #48	No further comment at this time.

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	8.0 mbgs depth.				
51.	The final quarry floor in the western extension will be at an elevation of 252.5 meters amsl which is well below the elevations of all three of the “karst-weathered” bedding planes.	Comment noted.	Earthfx’s “notes” my comment but then seems to ignore it in their response to my comment #52.	The original comment was a statement.	No further comment at this time.
52.	The Site Plan and AMP note that an “infiltration pond” will be constructed immediately west of the quarry face in the western extension. The specific role and character of this pond is not detailed in the supporting documentation but appears to serve a dual purpose of water supply for continuing sump operations and providing some form of groundwater mounding. Again, this is not quantified but the infiltration will likely be mostly directed toward the open quarry floor (which is continually drained) and will not provide any significant flow toward the escarpment face in the Medad Valley. MECP had requested a “discussion of discharge water quality in relation to recharge areas, including at the new infiltration pond feature in the West Extension…” Although I did not commit on water quality, I had noted that Earthfx had not demonstrated the efficacy of the proposed infiltration pond (my comment #52/page 14) in directing groundwater toward the Medad Valley. Earthfx’s response to my comment was simply, that “some” recirculated water would flow “towards the Medad”. Interestingly their response to MECP pertaining to infiltration pond water quality they raised a point that water from the existing golf course ponds reaches the deeper groundwater as demonstrated by well temperature profiles provided by Dr. Worthington in his karst report (Appendix B, Level 1 and Level 2 Hydrogeological report). In fact, they suggested that temperature was actually used as a “tracer”: “Dr. Worthington (Worthington Groundwater) reported a shift to higher temperatures in the groundwater at BS-07 during the aquifer testing program. This shift represents the warmer pond water entering the groundwater regime. Temperature was the only parameter that could be used as a tracer as the groundwater and pond quality are one in the same (pond water is source d from the quarry sump).” [second full paragraph, page 127] At no point did Dr. Worthington refer to temperature as a tracer and the only discussion of temperature profiles in well BS-07 is to note “changes” in temperature between 8 and 8.5 m and between 16 and 19m (Worthington’s Figure A12). Both of these “changes are declining temperatures along fractures, not rising	The pond will create a groundwater mound with some of the infiltration returning to the quarry to be recirculated and some flowing towards the Medad.	Earthfx’s response that the infiltration pond will flow to both the quarry and to the Medad Valley has not been demonstrated. There is no evidence that any flow will be directed to the Medad Valley – this will be a function of the coincidence (or not) of specific fractures which my comment #48 above suggests may be well above the groundwater mound.	Simulations indicated that water levels would rise relative to baseline in the upper bedrock but heads would decrease in the lower zones. A divide would form in the upper bedrock layer and flows would generally split between being directed to the quarry or to the Medad. Of the water directed to the Medad, some would move vertically into the lower layers. Of this water, some will be captured by the quarry (the divide is located west of the shallow bedrock divide) and some continue on to the Medad Valley. Please refer to Schedule 1 and 2 for additional details - average incremental change due to the infiltration pond is discussed (infiltration pond model simulation).	It would be useful to have a water balance comparison between pre-development and post-development to show the effect of the extracted approximately 50% of the aquifer between the existing quarry and the Medad Valley. Given that the western extension extraction area is all within the existing divide, virtually all the water currently within the aquifer to be extracted must be successfully directed to the Medad Valley.

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	temperatures. Dr. Worthington makes no mention of any effect of the golf course ponds on deeper groundwater MNRF is requesting alternative mitigation measures to the infiltration pond in the western extension in the event the groundwater mound does not reach the intended water level. They are also requesting further demonstration that the proposed mitigation will work. This overlaps with my comment #52. Earthfx's response to MNRF is more complete that it was for mine. They note construction of the new ponds will eliminate fine grained soils allowing better infiltration and that groundwater levels will be monitored at 5 wells. However, Earthfx provides no alternative mitigation measure(s) should the designed infiltration pond fail.				
53.	These statements are based on simulated model stream flows for “baseline” (current) and post-quarrying that show net average reductions of about 2.0 liters/second in flow downstream of SW07 (Willoughby Creek below spring J) resulting in “no significant change downstream at SW1.”	Comment noted.	#53 and #54 are actually part of the same comment re. Identification/naming of SW02.	Agree to disagree. Please refer to Schedule 1 and 2 for additional details.	Please clarify what we are disagreeing about…
54.	[Note: SW1 is the main quarry discharge station which is located above the Medad Valley; it is likely that this is an error as the station below SW07 is SW02 located at Bronte Creek. Worthington (2006) appears to have made the same error in Table 1 although this is corrected in his 2020 karst report.]	The naming differs between Worthington 2006 and Tatham.	Response that this is a naming “difference” between Worthington and Tatham is not satisfactory. SW1 has always been SW1 going back to the original expansion studies.	Agree to disagree.	Not resolved.
55.	These statements are based on simulations from an EPM model that can’t model flow in individual fractures, particularly if enhanced by karst solution (tertiary permeability). The presence of karst conduits is known to occur based on the presence of the sink to spring system in the Willoughby Creek headwater (spring K).	See Response 34. **Worthington Response** Agreed. EPM models do not simulate flow in individual fractures, of which there are millions in the area modelled, but that is not a drawback of the model, which is well suited for modelling flow in the aquifer under natural conditions and the changes in response to quarrying. It is not intended to model flow in the aquifer at a very local area (e.g. meters to tens of meters).	It appears Worthington agrees with my statement that flow in individual fractures can’t be simulated but believes it doesn’t matter as the model simulated aquifer response to quarrying. This does not exactly make sense as he seems to agree the response to quarrying can’t be simulated in individual fractures (springs) or at very local scales. Springs are very local features fed by individual fractures – he seems to contradict himself that the EPM model can simulate changes due to quarrying but not for individual springs? He also seems to be contradicted by Earthfx’s response to my comment # 41, page 12 which actually provides flow simulations for individual springs? Worthington’s comment that the model “is not intended to model flow…at a very local area (e.g. meters to tens of meters)” is curious.	See previous response regarding our hybrid approach.	No further comment at this time.
56.	Recommendation: : Continuous spring flow monitoring should be undertaken for (at least) Medad Valley springs C, G, H, J and K commencing at least 2 years prior to quarrying in the western extension and throughout the period of rehabilitation.	Comment noted.	Earthfx “notes” my comment on continuous monitoring for springs C, G, H, J and K. I assume this means they will be undertaking such monitoring.	No. It means that a statement was made and we acknowledge that the statement was made. The AMP sets out the monitoring locations and schedule. Please refer to AMP Please refer to Schedule 1 and 2 (infiltration pond model simulation).	So clearly Earthfx will not monitor spring flow to the Medad Valley.
57.	Recommendation: : Monitoring should include flow, temperature, conductivity and suspended solids, at a minimum, and be added to the AMP with designated targets and contingency triggers and response.	Comment noted.	Earthfx “notes” my comment on minimum required water quality parameters for monitoring purposes – I assume this means they will incorporate into a revised AMP.	No. It means that a statement was made and we acknowledge that the statement was made. The AMP sets out the monitoring locations and schedule. Please refer to the latest AMP Version.	So clearly, Earthfx will not monitor spring water quality.
58.	Recommendation: : A detailed potentiometric surface should be provided.	One was provided	Earthfx responded to my request for a “detailed” potentiometric map by stating “one was provided”. The only one available in the Level 1/Level 2 report (Figure 6.37) is not detailed. The scale of the map provided and groundwater	See response to #187	A five-meter interval potentiometric surface is not acceptable.

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			level interval is much too small to be useful in a significant project such as this (see my comment re. response #187.		
59.	Recommendation: ɟ Dye trace(s) should be conducted between boreholes in the western extension and the same springs noted above in recommendation #1	**Worthington Response** Mr. Cowell does not explain the rationale for tracer testing between the western extension and springs in Medad Valley. Tracer tests (sometimes called dye tests because dyes are often the tracer used) are useful for (i) delineating flow paths such as checking which spring(s) are connected to a sinking stream, and (ii) for characterizing aquifer characteristics such as fracture apertures, spacing, and connectivity. Both types of test were carried out at the site and documented in the 2006 karst report. For the karst investigation documented in the 2020 report, it was decided to assess preferential flow in wells using a flowmeter and to profile electrical conductivity and temperature during a pumping test. It was decided that there was no need to do further tracer tests. Contour maps of measured and simulated water levels in wells (e.g. Figures 5.13, 5.14, 6.37, 6.38, and 7.2 in the April 2020 Earthfx report) all show that groundwater flow from the quarry area is towards the Medad valley, so tracer testing is not needed to understand the groundwater flow direction. The second reason for tracer testing would be to characterize fractures apertures, spacing, and connectivity. There has been substantial assessment of fractures in the aquifer in the 2006 and 2020 karst reports. A number of methods were used, including tracer testing, monitoring water levels at a spring for pressure pulses from quarry discharge, observation of flow from fractures in the existing quarry, profiling of flow, temperature and electrical conductivity in wells, packer testing in wells, and visual observations in wells using video and tele viewer. There is no reason to suppose that fracture aperture, spacing, and connectivity is substantially different between the Western Extension and Medad valley, so tracer testing is not needed to understand flow in the aquifer. Furthermore there would be substantial challenges in carrying out such tracing, including: i) There are many domestic wells between the Western Extension and Medad valley. Consequently, it is possible that some of the dye would be intercepted by one or more of the domestic wells, which would not be desirable for aesthetic reasons (i.e. the tap water might be coloured by the dye). For this reason, it is rare for tracer testing to be carried out where there are domestic wells between an injections well and springs. ii) The distance between the wells in the Western Extension and Willoughby Creek varies from 250 m to 800 m. The distances to springs C, G, H, J, and K are even further. It is rare for tests with tracer injection into wells to be carried out over such long distances, and such tests often fail. For comparison, the 2006 karst report documents eight tracer injections into wells that were 14 - 24 m from a pumping well, with seven of the eight tests being successful. For the above reasons, the tracer testing suggested by Mr. Cowell is not recommended.	My recommendation of conducting a dye trace to the springs is withdrawn – I agree that there is a potential for domestic well interception.	RESOLVED	No further comment at this time.
60.	Recommendation: Following quarrying, the western extension should be rehabilitated to lakes.	A portion of the west extension is being rehabilitated to a shallow lake. As JART is aware, the existing approved rehabilitation plan for the Burlington Quarry requires dewatering to stop and the site to naturally flood to a lake with no off- site discharge. As part of the Burlington Quarry Extension application, Nelson agreed to modify the existing quarry rehabilitation plan to maintain off-site pumping to improve conditions for surrounding lands compared to existing approvals and maximize land area for future after uses. The proposed modification to the existing quarry rehabilitation also results in the West extension being maintained in a dewatered state.	A final lake in the western extension would ensure permanent flow to the springs in the Medad Valley and more resemble pre-development conditions.	This could result in adverse impacts to fish habitat supported by quarry discharge (as per DFO), although as noted earlier fish habitat has been impacted by the many in-line ponds and the dam between SW1 and SW2. Re: Medad Valley, please refer to Schedule 1 and 2 (infiltration pond model simulation).	Not resolved.
75.	The Level 1 and 2 Natural Environment Report states (page 22) “The numerical simulations confirm that the majority of the wetlands and streams are isolated from the water table by the low permeability Halton Till.” This is echoed on page 24 of the Level 1 and 2 Hydrogeological Assessment report.	Yes	My original comment #75 was not intended to be a statement of fact that I agreed with – my comment was taken out of context in the JART Response Table. Refer to my earlier comments pertaining to Halton Till permeability (especially comment #29).	RESOLVED	Not “resolved”.

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76.	The Level 1 and 2 Hydrogeological Assessment report notes (Page 24, Executive Summary) that "The Medad Valley is a locally significant groundwater discharge area that receives the majority of the groundwater that flows in and around the existing and proposed quarry [western extension]. The development of the West Extension will shift some of the groundwater discharge to the north, through the North Discharge pond, but ultimately all of its discharge simply enters the Medad Valley in a similar manner to the current discharge." (Highlight mine).	The Executive Summary may have oversimplified a more complex observation. Dewatering for the West Quarry Expansion will direct flows to the North Discharge Pond. Some of this water is diverted to the proposed infiltration pond which will, as noted further in the summary, help preserve the current groundwater and surface water flow conditions created by this existing golf course ditch and pond system (i.e., groundwater discharge to the Medad Valley). The remaining water will be discharged to the unnamed tributary to Willoughby Creek and to the karst sink that also contributes to groundwater discharge to the Medad Valley.	Earthfx has not demonstrated that "all of its discharge [area of proposed west quarry extension] simply enters the Medad Valley in a similar manner to the current discharge." Model simulations/predictions have not been verified and Earthfx has no data on spring or stream flows within the valley.	All the groundwater is currently (baseline) intercepted and discharged to the creek or flows to the Medad Valley and discharges naturally. Under quarry expansion, different proportions of the water will be intercepted or discharge naturally. The statement is a general observation, not the specific outcome of a model simulation.	Yes, it is the proportions and where they go that is the issue. The groundwater divide between the existing quarry and the Medad Valley is both lowered and shifted; all depends on the efficacy of the infiltration pond which has not been demonstrated
100.	On page 71 (Section 3.1), the hydrogeological report goes even further referring to the till as an "aquitard", limiting any interaction between surface and groundwater. During the August 10th video call, E.J. Wexler spoke about a "uniform K value for the Halton Till" (personal notes) and, in reference to Golder's MP16, suggested there may be "too much storage in the Halton Till…and [the till] may be even tighter" (personal notes). The Halton Till forms layer 2 in the model and is characterized as a uniform layer having a hydraulic conductivity of $5.0x10.0^{-7}$ (Table 18-4 and Figure 18-12).	See previous notes. It should also be noted that the hydraulic conductivity of the Halton Till likely varies spatially, but the variability may be random, or may be correlated with thickness, or with location (e.g., lowland versus upland). Insufficient data are available so a reasonable approach was to use a uniform value that felt close to a middle value in the wide range of reported field testing.	Earthfx agrees that Halton Till hydraulic conductivity "varies spatially" but states that the variability "may be random". This speaks to my concern that the wetlands are not universally underlain by Impermeable materials ("aquitard") and thus are subject to having a hydraulic connection with the underlying bedrock aquifer. By noting the spatial variability Earthfx seems to leave the door open to such a hydraulic connection. Further, the "variability" although spatially random will be based on fundamental structural factors (roots, fractures etc.).	We concur that there are likely to be some fractures that span the till thickness and, just as likely there are areas that will have no fractures. The assumption is that the mean vertical hydraulic conductivity, taking into account the low probability of these extremes, is about $1.67x10^{-7}$ m/s, which is a reasonably high value for Halton Till. To address reviewers concerns with uncertainty, please refer to the AMP.	I disagree that the stated value is relatively high for the Halton Till especially since you are using a bulk hydraulic conductivity, which as noted, can be 2 or more orders of magnitude lower than fracture conductivities.
112.	However, on page 155 of the Level 1 and 2 Hydrogeological Assessment Report (and in Figure 6.31), in reference to Golder data (MP5), it is noted that Wetland 17 "both receives and loses to groundwater, depending on the time of year." Further, the Surface Water Assessment report notes (page 86, Table 42) that three wetlands effectively dry-out ("0.0 m water level") by late April to early May (SW11/13027; SW12/13022; and SW13/13037). These dates are identified in order to determine thresholds should impacts from quarrying result in earlier drying out (mitigation proposed on page 90, third bullet).	Comment noted.	No Earthfx response. My original comment was intended to show that Earthfx's data also shows a rapid decline in wetland water levels (wetlands 13027, 13022 and 13037) which supports my contention that at least some wetlands are hydraulically connected to the underlying bedrock aquifer.	It is inaccurate to relate the date at which some wetlands dry out to the rate at which water levels decline. Some wetlands hold little water and standing pools have limited depth and would therefore dry out sooner. Particularly if they are not being fed by groundwater.	See comment #29…clearly some wetlands show rapid declines in water levels with declines in bedrock groundwater levels.
149.	The Level 1 and 2 Hydrogeological Assessment (Page 115) notes that: "With increasing distance from the quarry, the difference in head between the shallow and deep system is reduced. At 300 m from the face, the difference in head has decreased to 10 m…and the water levels in the deep system become much more variable (as much as 6 m). This variability is due to the effects of seasonal recharge that serve to replenish the lower system. During the spring freshet, higher rates of recharge and higher water table are able to fill the vertical fractures and drive flow to the lower system faster than it drains laterally to the quarry... at 650 m from the quarry face…up to 4 m in head difference." (highlighting mine)	Comment noted.	No Earthfx response. My original comment was intended to point out that significant declines in head/shallow bedrock water levels are significant up to 650 m from the face of the quarry. This will impact wetlands in the proposed southern extension (that are hydraulically connected to the bedrock aquifer) as well as springs in the Medad Valley which are in the order of 200 m (or less) from the western face of the proposed western extension.	We agree to disagree. The effects of the quarry in all directions have been delineated by the integrated model. Re: Medad Valley, please refer to Schedule 1 and 2 (infiltration pond model simulation	Yes on the basis that the model considers fractured carbonates as an equivalent porous medium in all directions!
187.	These estimates are based on borehole measurements around the existing quarry and EPM model simulations. They represent conditions on the upper bedrock plateau and do not represent conditions between a quarry wall and the escarpment face. The steep hydraulic gradients noted above, in combination with extensive bedrock fracturing (as well documented), creates a very steep potentiometric surface in the unconfined aquifer which drains through fractures and emerge as discrete springs at the base of the escarpment face (a discharge face).	Figure 6.37 is a potentiometric map of average simulated heads in March. We do not understand the question in reference to this figure.	Figure 6.37 is provided as a "potentiometric" map of average March heads. My primary point is that it is a useless Figure. To provide groundwater potential elevations at such a small scale with a 5 m interval is not acceptable. Potentiometric maps, in every groundwater report I have reviewed, are much more detailed with intervals of 1 m or even 0.5 m. Potential significant groundwater characteristics, such as groundwater troughs and precise groundwater divides cannot possibly be portrayed at this small scale/imprecision.	We agree to disagree that these figures are "useless".	Golder had provided potentiometric surfaces at 1m interval; five times more detailed than those provided by Earthfx.

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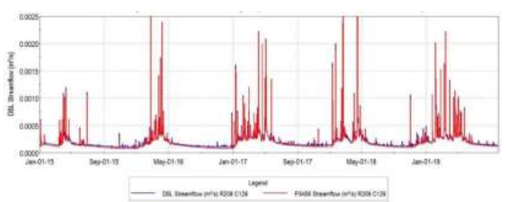
211.	The Level 2 Impact Assessment of the Hydrogeological Assessment report (Section 8) refers to the Medad Valley as a “significant discharge area” (Page 192, first paragraph). Table 8.1 specifically identifies the need to evaluate springs: “Springs located down gradient of the Site in the Medad Valley, and headwater streams located in and around the Mt. Nemo escarpment area” for which there is a need to “assess potential impact on springs.”	Comment noted.	No Earthfx response. The only “impact assessment” undertaken for Medad Valley springs in the Level 1 and Level 2 hydrogeological report are EPM model simulations of ‘baseline’ and post development conditions (e.g., P3456) of streamflow in the valley. There is no specific discussion of springs. Within Earthfx’s response to the original JART comment table, an upwards of 60% decline was noted at Spring J (comment #44). It is unclear how this was determined but if so would be significant and needs to be evaluated with regard to physical and biological/ecological impacts.	Please refer to Schedule 1 and 2 (infiltration pond model simulation) and the AMP.	Model simulations at SW 14 and SW 7 demonstrates significant post-quarry declines in surface flows – these have not been evaluated against impacts to the wetland system.
212.	The Medad Valley Wetland Complex is within 120.0 meters of the proposed western extension development boundary yet Table 8.1 does not identify the need to assess impacts to the wetland complex per se as required under the PPS and under HRCA Regulation 162/06. Although most of the western extension quarry operations will technically occur beyond 120.0 meters (but within the 240.0 meters specified by the NEC), there is no doubt that impacts to groundwater flows to the springs could significantly impact “hydrological and hydrogeological functions” in the Medad Valley Wetland Complex.	Changes in groundwater and surface water flow to the Medad Valley were addressed in the simulations and analyses of model results.	The Earthfx response does not address the issue. Although there were some baseline post-development simulated flow data for Willoughby Creek, the impact assessment did not deal specifically with changes in spring flows (see comments #44 and 211). Simulations showed measured changes in post-baseline surface water flow. The PPS requires a detailed assessment of these changes on flora and fauna. With the exception of the determination of estimated spring flows on one occasion (Worthington 2006), there is no data on spring flow either seasonally or through time.	Please refer to Schedule 1 and 2 (infiltration pond model simulation) and the AMP.	Model simulations at SW 14 and SW 7 demonstrates significant post-quarry declines in surface flows – these have not been evaluated against impacts to the wetland system.
239.	Further, Section 8.7.6 of the assessment report concludes “Overall, the construction of the west extension has a minor impact on the Medad Valley. No water is diverted away from this natural discharge zone, but some water is discharged slightly to the north via north quarry discharge stream.”	Comment noted.	No Earthfx response. My original comment was simply quoting Earthfx’s hydrogeology Level 2 study. It is not intended as my position.	Comment Noted.	No direct Earthfx responses.
301.	Although the springs in the Medad Valley are singled out as a target of impact assessment and mitigation in Table 8.1, there is no other mention of springs in the remainder of the document other than a brief note in the summary (Section 11.2, page 324) “There are other groundwater springs (karst discharge features) in the Medad Valley, but these are masked by the wetlands that fill the valley.”	From a modelling perspective, we noted the presence of springs and “disappearing” streams and represented them as best as possible in the model. The representation of the subsurface flow is discussed in Response 120.  nsient measurements at these features for comparison. There are relatively small changes in the event-driven flows at the locations of the springs discharging to the Medad Valley under the different scenarios. For example, the figure shows simulated drought flows under baseline and P3456. There are small changes in the peak flows (0.1 to 0.2 L/s) and very small changes in the very small base flows. There were no significant changes under P12. The cumulative effects of changes on flow in Willoughby Creek were discussed in the report.	My original comment remains valid – there are no data for spring flow other than Worthington’s 2006 one-time survey and there are no data for Willoughby Creek flows. The figure you presented in the response, as well as Figures 8-49, 8-73, and 8-74 in the Level 1 and 2 report (and all other stream ‘hydrographs’) are simply two simulations compared to each other. Baseline does not include stream flow measurements in any form. Where are the stream gauges on Willoughby Creek? Data?	Please refer to Schedule 1 and 2 for a detailed assessment of the Medad Valley.	No direct Earthfx responses.

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303.	In addition, groundwater discharges to the Medad Valley occur via discrete spring locations which are clearly fed by one or more fractures (“karst discharge features” page 324). Enhanced solution of these fractures is on-going for some distance above the springs. If EPM conditions existed along the Medad Valley escarpment face, the entire lower portion of the face would discharge groundwater not only at discrete spring points.	Yes, there are discrete fractures that have become solution enhanced over geologic time. Where data were available, these were simulated explicitly. Otherwise, we believe the network of multiple short fractures and zones of moderately fractured bedrock behave as an EPM. There is likely diffuse discharge along the flanks of the Medad Valley wall as well as discrete discharge points. The effects on the Medad Valley are discussed in more detail in the package of interdisciplinary tables integrating wetland and watercourse characterization and analysis that has been prepared and provided in Schedules B and C. **Worthington Response** The entire lower portion of the face would discharge groundwater if the aquifer were a porous medium. However, an EPM model explicitly assumes that an aquifer is not a porous medium, but behaves very similar to one for the purposes for which the model is used.	Which data were used to explicitly “simulate” the discrete fractures (which fractures?)? What evidence is there for “diffuse discharge along the flanks of the Medad Valley”? What are the implications of these discharges to the existing springs which Worthington refers to as “small karst basins” (Worthington 2006, page 5). Worthington’s response is confusing. It is noted that if the aquifer were an EPM, the entire face would discharge water. It doesn’t so it follows that the aquifer is not an EPM. Worthington also notes that the EPM model “explicitly assumes that an aquifer in not a porous medium but behaves very similar to one for the purposes for which the model is used.” Again, confusing is it an EPM or not? How does is explicitly assume that the aquifer in not an EPM in terms of model parameters?	Please refer to Schedule 1 and 2 for a detailed assessment of the Medad Valley.	No direct Earthfx responses.
353.	The Level 1 and 2 Hydrogeological Assessment also documented open fractures in boreholes located within the western extension. This included references to the presence of “moderately open” fractures in the composite video log (Appendix A, Figure 4.2.3) and several of the borehole logs were annotated as “heavily fractured” (BS01), and “larger fractures” (BS02).	Comment noted.	No Earthfx response. My original comment relates to earlier points that I made in comments #48 and 52 pertaining to the efficacy of the proposed groundwater infiltration pond proposed for the proposed western extension.	Please refer to Schedule 1 and 2 (infiltration pond results)	No direct Earthfx responses.
JART Comments (June 2023) **These comments are provided in response to the Earthfx Incorporated Memorandum, dated April 19, 2022. Additional, new comments may be provided at any time during the JART review process based on additional information provided by the applicant**.					
370.	Section 3.1 bottom of page 4: I do not understand the statement that ”Figure 5, in particular, **confirms** that there are no discernible seeps and stream channels emanating from the east valley wall and joining Willoughby Creek.” (emphasis mine). Although LIDAR imagery may not show the springs, nor would that be expected, the presence of springs has been well documented by Worthington and others.				
371.	Section 3.1 last paragraph on page 8: What does “distributed manner” mean? As per their comment noted above, this suggests that both the model and LIDAR can't find the springs we know to exist. Further evidence of the inability of ‘the model’ to characterize and detail karst features.				
372.	Section 4, second paragraph: The pump test at B5-06 and resultant temperature profile does not provide evidence of a temperature increase in the well. The so-called temperature increase shown in Figure 8, page 12 is about 0.06 degrees C. Temperature changes between surface and deep groundwater are typically in the range of 10 to 20 degrees at this latitude. Further, temperature can not be used as a tracer in karst studies. Although it could be an indication of what to look for (in this case there is no definable temperature increase) tracers by definition must have a well-defined source that can be documented principally by the introduction of a known chemical or physical element in known quantities at the source under investigation.				

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Proposed Burlington Quarry Expansion
Interim JART COMMENT SUMMARY TABLE – Hydrogeology

Please accept the following as interim feedback from the Burlington Quarry Joint Agency Review Team (JART). Fully addressing each comment below will help expedite the potential for resolutions of the consolidated JART objections and individual agency objections. **These interim comments will be finalized following the breakout meetings between JART and Nelson and any changes will be marked using "track changes". Additional, new comments may be provided once a response has been prepared to the comments raised below and additional information provided**.

	JART Comments (February 2021)	Applicant Response	Interim JART Response (February 2022)	Applicant Response (June 2022)	
6.	The hydrogeological analysis and resulting conclusions rely heavily upon the results of the integrated computer modelling and simulations and does not provide due consideration to conflicting field data. For example, the assumption of the modelling that the local bedrock aquifers behave hydraulically as equivalent porous media when field testing such as pump tests and previously conducted borehole flow testing shows significant variability in hydraulic performance of the under lying bedrock layers. In addition, computer model simulations of groundwater mounding beneath the existing irrigation ponds in the Western Extension area and the proposed recharge ponds within this area are not supported with field data to confirm groundwater mounding and the recharge characteristic of these ponds.	We recognized that the bedrock in the immediate quarry vicinity (within several hundred of meters) or in the zone of influence of the pump test behaves more like a fractured rock than an EPM. The EPM approach is valid and extremely useful for predicting likely affects beyond the local zone, in this case extending from the quarry boundary to below the Niagara Escarpment. We used an innovative approach to better account for the effects of bedding plane and vertical fractures within the model by adding the extra fracture layers and the enhanced vertical connectivity in places to evoke a more fracture-like response in the quarry vicinity. The field data regarding mounding beneath the irrigation ponds are limited. Reasonable conservative estimates for the hydraulic properties of the accumulated pond sediments were made. The proposed infiltration pond will mostly be excavated to the top of the fractured bedrock and it was assumed that leakage from this feature would be higher than from the existing ponds.	It is agreed that groundwater within the area of greatest concern with respect to the influence of the existing and proposed quarry expansion (i.e., within a few hundred meters) is expected to respond as a fractured bedrock medium. The groundwater model is therefore expected to have limitations in providing accurate and reliable estimates of water level impacts from the proposed quarry expansion. More information and field data are required from the local private wells to provide more certainty with respect to the potential for impacts including water quality on local private wells.	Again, our hybrid approach was to represent discrete fracture zones and vertical fracturing to get a better match to observed response in the local area and to make the predicted assessment more accurate and reliable. The model considered and incorporated extensive field data that was more extensive and had a longer period of record than typical quarry expansion studies. The monitoring and protection of the domestic water wells is regulated by the Ministry of Environment, Conservation and Parks (MECP). As noted, upon licensing a detailed water well survey will be completed to ensure that we have accurate information on the key receptors, such as well location, well depth, historical water issues (quality and quantity), available drawdown, etc. Until residents participate in this survey, additional information cannot be obtained. . This work will be a condition of the ARA license as well as a requirement for any future ORWA applications to be submitted and reviewed by the MECP.	The limitations of the computer model simulations have not been acknowledged with respect to the accuracy of the impact predictions and mitigation measures in relationship to the proposed quarry application on a detailed site specific scale. No additional site specific field data have been provided to support the computer model simulations and mitigation recommendations and conclusions. The concerns expressed in this comment have not been adequately addressed.
7.	The hydrogeological analysis has failed to address the potential for groundwater and surface water contamination and is therefore incomplete.	The exiting quarry has been operating for over 70 years without contamination of surface water or groundwater resources. Private wells operate immediately adjacent to the existing quarry without impact. Quarry discharge has been used extensively for downstream golf course operation and ecological function. There is no planned change in quarry operations and therefore there are no expected impacts on groundwater and surface water quality. Water quality monitoring is discussed in the AMP, with additional data and discussions in our response to the MECP comments.	The impact on groundwater quality from the proposed use of the infiltration pond for the proposed quarry western extension has not been demonstrated. Questions remain regarding the effectiveness of this infiltration pond in maintaining water levels in down gradient private wells and potential impacts on well water quality. In addition, measures to protect groundwater quality within the quarry ponds and sumps from significant potential sources of contamination such as the adjacent Sun Oil pipeline have not been adequately addressed.	We respectfully agree to disagree. The golf course ponds have been in operation for several decades, which rely on the quarry discharge as the primary source of water. The same water will be infiltrating as currently occurs. Water quality data were re-examined in response to this comment (See Schedule 1). There were no water quality issues in monitoring and private wells close to the quarry and down gradient from the golf course ponds. The only issues identified related to water quality samples were indications of road salt contamination away from the quarry. The model was originally developed with these ponds as aesthetic features (ponds were built on existing grade with till beneath). However, since recognizing that the ponds are responsible for raising water levels in the bedrock system, the model has been updated with these ponds functioning as infiltration ponds (model now has these ponds on the weathered bedrock surface). The model was primarily updated to look at springs in the Medad Valley but can be used to look at groundwater mounding beneath the ponds. Please refer to Schedule 02. (Updated model results)	The response relies upon an understanding of the functioning of the existing infiltration ponds. This understanding is not fully supported with field data. No shallow overburden monitors were installed within the proposed western extension and there is relatively little groundwater data from the underlying bedrock to confirm the functioning of the existing irrigation ponds and the extent to which these ponds are creating a groundwater mound. Although it may be a reasonable assumption that there is leakage from the irrigation ponds, this remains an assumption and has not been supported by long term groundwater monitoring data including the shallow overburden. No information was provided in the groundwater modelling report on details of the irrigation pond. The function and impact on the groundwater system from the irrigation ponds are based largely upon unverified assumptions. Additional groundwater quality information was provided from a private well near the existing quarry (Goodchild Well – response to MECP comment 4). This well is located some distance from and upgradient and east of the proposed western extension. Details of the water quality sampling procedures are missing as are critical parameters such as and not limited to bacteria. The existing irrigation ponds as well as the proposed infiltration ponds may be a source of surface water contaminants including bacteria. The water quality data summary provides useful information in characterizing existing groundwater quality as presented in Schedule 1. It is noted that sodium and chloride appear to be elevated at on-site groundwater monitors BS-01A and BS-02A. This has been attributed to road salt impacts. Examination of the distribution of sodium and chloride within shallower monitors at these locations shows a decreasing trend in the level of sodium and chloride with decreasing depth. If road salt was the source of the sodium and chloride at BS-01 and BS-02 the opposite trend would be expected. Typically, contaminant concentrations diminish with increasing

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					distance from the source and not the opposite. Monitor MW03-02A, within the south extension lands and removed from local roads, also shows elevated sodium and chloride as well as sulphate levels compared to shallower monitors completed into the upper Amabel. Monitor MW03-02A is a deep monitor completed into the Reynales and Thorold Formations as described on the borehole log. These data suggest the source of the observed elevated sodium and chloride levels noted by Earthfx, quite likely originate from the deeper bedrock zones lying near and below the proposed quarry depth of excavation. From the perspective of private well vulnerability to water quality, a more complete investigation of private wells down gradient from the proposed quarry application is required prior to the issuance of an ARA licence. The response has not adequately addressed the concerns expressed in this comment.
8.	Groundwater quality monitoring is outlined in the AMP report. There is limited documentation of water quality provided in the Earthfx report. Water quality information is provided in Appendix A with a discussion of general water types. There is an incomplete analysis and discussion of ground water quality and the interrelationship of surface water discharge to groundwater quality through infiltration mitigation measures. There is no link between parameters for groundwater quality monitoring and surface water quality monitoring parameters. A discussion is lacking of groundwater water quality results with respect to Ontario Drinking Water Standards (ODWS, 2006), groundwater quality thresholds and mitigation measures. This should be included in the report.	See response to comment 7. Quarry discharge is currently diverted into the golf course pond system where a portion likely leaks to the groundwater system (or infiltrates as part of the irrigation operations). This discharge has been successfully used to support golf course operations for over 50 years without impact to surface water or ground water quality. The proposed infiltration pond system will function in the same manner as the golf course pond system. Water quality monitoring is discussed in the AMP, with additional data and discussions in our response to the MECP comments.	There are no groundwater quality data presented from the Golf Course lands to support the contention that there has been no impact to groundwater quality. There are also no field data to demonstrate the extent to which the existing Golf Course Pond is infiltrating the groundwater system.	We respectfully agree to disagree. Water quality results from domestic wells, the quarry discharge, the golf course ponds, etc. have been provided to JART along with our assessment (See Schedule 1). As noted above, there were no water quality issues in monitoring and private wells close to the quarry and down gradient from the golf course ponds. Furthermore, water is continuously entering the golf course ponds from the quarry sump which indicates that there are water losses beyond evaporation.	The response is similar to comment 7. The response statement that *'Furthermore, water is continuously entering the golf course ponds from the quarry sump which indicates that there are water losses beyond evaporation.'* No water budget analysis has been completed on the irrigation ponds to support this contention. The amount of water used for irrigation has not been quantified in support of this statement.
9.	The hydrogeological investigations have failed to clarify the issue of overburden hydraulic conductivity and interconnection of the overburden with under lying bedrock. Previous pump test conducted in 2004 by Golder Associates (Golder), (Golder, September 2010) demonstrated apparent hydraulic connectivity between overburden and underlying bedrock underlying wetlands adjacent to previously proposed Nelson Quarry Extension. The pump test completed by Azimuth in the Western Extension lands monitored a nearby surface water level but did not monitor the overburden units during this pump test to determine the degree of hydraulic connectivity between overburden and the underlying bedrock.	An extensive discussion of the testing, analysis and simulation of the Halton Till is included in our response to the MNRF comments, and provided as Schedules B and C. Included is a detailed presentation of the calibration to shallow minipiezometers. Estimating hydraulic properties of the overburden and the interconnection of the overburden with underlying bedrock was a key component of the model calibration effort. Hydraulic testing (single-well testing) of the units yielded a wide range of possible values with no recognizable pattern (as discussed in our MNRF response). The model calibration focused on obtaining appropriate mean values for these units. Previous testing by Golder work went through a number of phases, but final conclusions were that the wetlands did not respond to pumping.	The wetland water levels did not show a measurable response to the Golder Pumping tests conducted in 2004 and 2006. This could be due to a number of factors including time lag, limited duration pump test, and a substantial surface water reservoir that may have buffered the pumping test impact on the wetland. A possible snow melt condition may also have influenced the wetland water levels. The possibility of return pump discharge flow cannot be discounted due to the relatively flat topography of the area. A number of the overburden monitors (i.e., C series monitors) did however show a measurable response to pumping from the underlying bedrock during both the 20004 and 2006 pumping tests completed by Golder Associates (Golder). This suggests a hydraulic connection between the overburden and the underlying bedrock. Since these shallow overburden monitors were advanced to the top of the bedrock, the question remains, is the response representative of the overburden, the bedrock or both? The pump test completed by Azimuth was not able to shed light on this as no overburden monitors were included in the pump test. The Earthfx report and the wetland characterization attached to this table, points to the lack of a water level response in the wetland and the shallow mini-piezometer as evidence of hydraulic isolation of the wetland from the underlying bedrock. Alternative explanations of this lack of response are proposed. It is suggested that the hand auger hole construction of the mini-piezometers may have smeared the borehole thus muting the hydraulic response to the pumping tests. The relatively fine grained nature of the shallow soil underlying the wetlands would naturally have low hydraulic conductivity which would result in a delayed water level response from pumping the underlying bedrock. The pumping test may have been of insufficient length to provide a water level response in the mini-piezometers. The fine grained nature of the soil directly underlying the wetlands are expected to be subjected to periodic drying during seasonally dry periods. Fracturing of fine grained soil during	We respectfully agree to disagree. One can propose any number of extraneous factors for a false-negative response where the monitoring shows no connection but one presumes that there a connection exists. A simpler explanation is that the monitors were installed correctly, that the pump test stressed the aquifer until equilibrium was reached, and that the wetlands are generally perched above low-permeability sediments and sparsely fractured Halton Till. Our response to MNDMNRF (March 2021) provided hydrographs clearly showing wetland water levels and hydroperiod that unchanged by the advancing quarry face. Further, included model simulations hydrographs match exceptionally well. In our response to similar comments, we noted that where the wetlands are not perched, the sparse fractures allow heads to equalize and over time but the volume of water transmitted by small, sparse fractures is small. Our conservative modelling analysis assumed greater connection than is likely and, therefore, generally over-estimated the degree of impact of quarry expansion on the perched or connected wetlands. Regardless, the updated Adaptive Management Plan address any uncertainty that may come out of the work completed by Earthfx and Tatham.	With respect to the Golder pump test completed in 2004, relying upon a water level response in a surface water body as an indication of a lack of groundwater connectivity between the surface and groundwater system, is in my view, insufficient in supporting the conclusion of the lack of hydraulic interconnection. There are a number of factors that could contribute to the lack of a water level response in surface water from a pumping test. Groundwater monitors within the shallow overburden as part of the pump test completed by Azimuth would have been more definitive in support of the Earthfx conclusion regarding hydraulic connectivity and resulting groundwater mounding beneath the irrigation ponds. There is insufficient field data from the pumping test conducted by Azimuth to support the conclusion by Earthfx of the interconnectivity between surface water and the groundwater system. Earthfx appears to be arguing for both a hydraulic interconnection from the Azimuth pump test and a lack of hydraulic interconnection from the Golder 2004 pump test between surface water and the underlying bedrock through the Halton Till. Clarification is required to explain this apparent contradiction in the hydraulic properties of the Halton Till.

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			drying is commonly observed due to shrinking clay particles. This process is expected to provide opportunities for direct hydraulic connection to the underlying overburden and bedrock. Water levels measured by Tatham in the shallow groundwater under wetlands 13027, 13022, 13016, and 13031 show groundwater levels seasonally above ground surface which indicates seasonal discharge conditions.		
10.	Hydrographs illustrating groundwater level trends are provided in the documentation however there is incomplete documentation of monitoring data including manual water level measurement from previous studies as well as the current investigations. Some of the missing data was subsequently provided in a computer input file format some of which was not readily decipherable.	A package of interdisciplinary tables integrating wetland and watercourse characterization and analysis has been prepared and provided Schedules B and C. Included in those tables are additional long-term hydrographs. The groundwater level and other monitoring data from this and previous studies were assembled and uploaded into a project database to facilitate analysis and to allow data to be shared across disciplines. We can work output this data in other formats, if needed. The data from previous studies are also available in the scanned Golder reports. No data was "missing" and all was included in the database and used in the analysis. Not all data is insightful or even useful, however, and we feel "padding" the report with low value information only serves to confuse the inexperienced reader and waste the valuable time of the review team. We recommend the industry proven VIEWLOG and Sitefx Integrated modelling and data management systems if you are having difficulty managing the complex data. Virtually all the maps, cross sections, well logs, and hydrographs in the report were prepared in VIEWLOG with full integration between the relational database and transient model. We would be happy to answer any specific questions about the data.	For review purposes, it would have been useful to have included in the hydrogeological report some of the key hydrographs from the previous Golder studies, particularly those from two pumping tests, one completed in late February and early March, 2004 and the second completed in February 2006. Some of this information is provided in the attached response to MNRF.	We respectfully agree to disagree. JART reviewers have already reviewed and commented on the Golder work under a different ARA application. Work completed by other professionals is commonly referenced in technical studies. If it is known that this work has already been reviewed, it is unclear why this information needs to be presented and reviewed twice. However, we did present all available data as hydrographs in our meeting with JART team members.	Examination of the Golder pump test results would have been helpful with respect to supporting or validating results and conclusions of the more recent field investigations completed by Azimuth. Without such comparison, it leaves some doubt with respect to consistency between the earlier work of Golder and the more recent investigations. Some of the original Golder information has been provided although not fully evaluated by Earthfx. Earthfx states *'The model was primarily updated to look at springs in the Medad Valley but can be used to look at groundwater mounding beneath the ponds.'* It is noted that the model was updated without the benefit of new field data including shallow groundwater monitor data, monitoring of spring flows or a comprehensive survey of seepage areas along the Medad Valley to correspond to the model identification of these features.
12.	Appendix A describes the completion of a well survey however no results providing details of this well survey are included in the report. This should be provided in the documentation. Copies of 26 well survey forms were provided, September 29, 2020. Of the 156 private properties included in the well survey, it is not clear what information if any, exists on the remaining well survey properties. A summary table of well information from the well survey should be included in the hydrogeological report. The MECP well record data base would be useful in providing information on local private wells.	Additional details about the well survey are included in the AMP document (together with a map showing the locations that responded). The AMP also states that a follow-up well survey will be completed at a later date due to again invite well owners to participate. The seven wells to which access was provided in the first survey did not provide significant insight beyond the publicly available well record. Additional documentation could be provided now, however the AMP states that Nelson's website will have a page dedicated to Private Well Monitoring details once the second survey is complete.	A summary table with the well survey results along with well record information (i.e., bole log) would be useful to assess the viability of the recommended mitigation measures for private wells, specifically the deepening or replacing of impacted wells as outlined in the AMP.	See response to Comment #8	Refer to comment 7 and 8 above.
13.	The documentation is lacking a detailed and comprehensive analysis of vertical hydraulic gradients associated with wetland features and the implications to the computer modelling analysis and conclusions.	Long term hydrographs illustrating the monitoring nest gradients are included in the package of interdisciplinary wetland and watercourse characterization tables that have been provided in Schedules B and C. Extensive documentation of the observed stage and minipiezometer data, in comparison to the simulated shallow wetland response, is included in our response to the MNRF comments (Schedules B and C). The results indicate that the model is very closely matching the shallow soil moisture levels that control the vertical gradient to the lower system. The numerous transient hydrographs presented in the Level 2 report indicate that model is replicating the complex seasonal and interannual water level fluctuations in the underlying bedrock. The integrated model explicitly represented the hydrologic and hydrogeologic conditions in 22 wetland areas. The model match to the observed staff gauge, minipiezometer, and well data was examined for each of the instrumented wetlands. Water budgets were formulated for the baseline conditions and compared to those formulated for each quarry extension scenario. We know of no other quarry impact assessment with this level of detail and comprehensive analysis of predicted wetland response.	The response to MNRF provides additional information and a detailed discussion of hydraulic conductivity of the overburden materials. Most of this is based upon work completed by Golder and Associates. The issue of hydraulic connection between the bedrock and the wetland is discussed using the Golder pump test data. As noted in comment 9, the lack of response in the wetland water level and shallow mini-piezometers is provided as evidence of hydraulic isolation of the wetland from the underlying bedrock during the pumping tests. It is noted that the mini-piezometers were completed by hand auger mostly into fine grained clayey silt materials. The hydraulic testing could be influenced by the method of piezometer installation and may not be representative of the in-situ hydraulic conductivity. Completion of hand auger holes in fine grained materials often result in smearing of the borehole thus restricting groundwater movement and masking the actual hydraulic response.	We respectfully agree to disagree. Our MNDMNRF response contained hydrographs and model results that extend significantly beyond the time frame and analysis provided by Golder. The extended monitoring and modelling clearly show that the wetlands are not impacted by the advancing quarry face. Driving wells into fine grained sediments can cause smearing. It was assumed that normal procedures for developing the wells were followed. It was further assumed that the lack of response in the wetland water levels and minipiezometers was due to a lack of response in the wetland.	The wetlands are characterized within the wetland characterization tables as '*perched and isolated from the groundwater system'* This is in contrast to the hydrograph information provided by Tatham which consistently shows shallow groundwater levels at least seasonally above ground surface at the five wetlands monitored by Tatham. This apparent contradiction requires clarification. Vertical hydraulic gradients at wetlands have not been defined. Most of the hydrographs provided in the Earthfx report do not show ground surface which would facilitate the interpretation of hydraulic connection between wetlands and surface water, and the groundwater system. See comment 14, 99, 185, 197, 204, and 266.

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14.	The report states that 'A total of 5 of the 22 wetlands mapped in and around the quarry receive groundwater in the spring.' Page 23, 6th paragraph. This implies the remaining wetlands do not receive groundwater in the spring. Tatham Surface Water Report indicates only five of the wetlands appear to have been instrumented with piezometers to confirm this. Confirming shallow groundwater level measurements are missing for the remaining wetlands.	As noted, our wetland characterization tables and response to MNRF comments (Schedules B, C, and D) provide extensive additional information for each wetland. Earthfx Section 2.2.1 in that document provides details on over 62 minipiezometers, soil core boreholes, and Guelph Permeameter test locations. Table 13 lists twelve of the key wetlands that have one or more minipiezometer, including MNRF Wetland 13033, which has 5 minipiezometers. Simulations allowed us to extend the analysis to other wetlands.	It is acknowledged that a number of wetlands have been previously instrumented by Golder. Only 5 of the 22 wetlands referred to have received recent instrumentation by Tatham. The newly installed boreholes and groundwater monitors on the proposed western extension are not directly associated with wetlands. It is noted that hydrographs of the shallow groundwater monitors installed by Tatham (SW5B, SW11B, SW12B, SW13B and SW16B) all showed seasonally high groundwater levels above ground surface. This is indicative of potential seasonal groundwater discharge conditions and contradicts the conclusion that these wetlands are hydraulically isolated from the groundwater system as indicated in the attached wetland characterization tables. See comment 9, 13, and 99.	No, seasonally high water levels are consistent with enhanced runoff during the spring freshet.	No additional information has been provided to address this comment. Earthfx does not accept the Tatham hydrographs as evidence that there is hydraulic connection between the shallow groundwater table and the wetlands. This comment remains unresolved. See comment 13, 99, 185, 197, 204, and 266.
15.	The report does not discuss cumulative effects i.e., existing impacts vs additional impacts from expansion. The report should include a map showing the existing cone of influence and drawdown resulting from the existing quarry	The report does, in fact, clearly delineate the "cumulative effects" of all existing and proposed excavations in the water level maps and hydrographs presented for each development scenario phase. The results were presented in terms of absolute water levels and streamflow's, not just in terms of change, so the cumulative impacts were fully taken into consideration. We also present incremental drawdowns from a fully transient 10-year baseline, and both average and minimum remaining available drawdown in the aquifers. As noted above, there is limited value in presenting the incremental drawdown from the pre-quarry 1953 conditions to current conditions because data from prior to 1953 is extremely limited. The purpose and scope of this study was to examine the likely impacts from future expansion and rehabilitation and the existing quarry effects are already approved under the existing license. Finally, our simulations of Rehab Option 2, allowing the quarry to fill as a lake, can provide some insight into the water levels and streamflow patterns under unmanaged conditions.	The existing conditions as defined in the Earthfx report includes the impacts of the existing quarry. This condition is determined by Earthfx to be the 'baseline condition' upon which the impact assessment was defined and as such provides a quantification of the change from the current condition to the proposed quarry expansion conditions. What is not defined is the impact that the current "baseline' condition has had on pre-quarry conditions. This has relevance for the proposed preferred rehabilitation scenario which will perpetuate the current conditions. This will require a revision to the already approved closure plan for the existing quarry. It is likely that the approved rehabilitation and closure plan for the existing quarry will result in conditions that more closely align with pre-quarry conditions compared to the preferred rehabilitation scenario which is expected to perpetuate pumping from the quarry excavation and the existing surface water and groundwater impacts Calibration of the integrated surface/groundwater model to the available groundwater and surface water data, should make it possible to provide a reasonable estimate of pre-quarry conditions. Proposed rehabilitation scenarios include the existing quarry as well as the proposed expansion and should therefore be compared to pre-quarry conditions. This would provide a clearer picture of the relative merits of the proposed quarry rehabilitation scenarios.	As we noted, the baseline selected represented a stable period where the quarry has expanded to its licensed footprint and no further drawdowns due to ongoing operations are expected. The RHB1 option considered the effect of creating a new landform that would require continued dewatering. The RHB2 option considered halting dewatering and letting the quarry fill back to a new equilibrium level. The model simulated these options and presented likely groundwater levels, streamflow's, and wetland water balances under the two options so that they could be compared.	No additional information has been provided to address this comment. Earthfx does not specifically identify the impact of the existing quarry but rather includes that impact within *'baseline conditions'*. This comment remains unresolved.
16.	The investigations have failed to demonstrate through on-site monitoring that the selected 'background monitoring well at 2377 Collins Road has not been affected by the existing quarry operations.	As noted in the report, (Section 9.4.2), the purpose of this background monitoring well at 2377 Colling Road is to document the natural variability of the groundwater elevation fluctuations and trends under various future climatic conditions. The well is located on the northwest side of the quarry, well away from the extension area. Modelling analyses showed that this background monitoring well would not likely to be affected by the proposed quarry extension. As noted in the previous comment, the quarry has been in existence since 1953. Changes in water levels may have occurred over the years in response to excavation within the quarry footprint and changes in water management operations.	Background monitors are generally considered to represent areas unaffected by an anticipated impact from proposed development. As stated in Section 9.4.1 of the Earthfx report, "The background monitoring well is a domestic water well located north of the existing quarry at 2377 Collins Road (referred to as DW2; Figure 9.1). The purpose of this background monitoring well is to document the natural variability of the groundwater elevation fluctuations and trends under various future climatic conditions. This background monitoring well has shown to have no drawdown from the proposed quarry extension." This private well may be useful in achieving the purpose of defining seasonal variations in groundwater levels, however, without a considerable period of record of water levels, it may not be possible to determine whether this well has been impacted by the existing quarry and whether these impacts are continuing to influence water levels within this well. Such conditions could affect the usefulness of this well as a 'background monitor'. Active use of this well could also limit its usefulness as a background monitor.	Given that there are no other up gradient wells with data, an up gradient well with 2 years of record is extremely useful. Despite this, a new well will be installed. Please refer to the AMP, which recommends that the background monitoring well be installed on Conservation Halton lands.	The Earthfx Preliminary Adaptive Management Plan has indicated that a background groundwater monitor will be installed on Halton Conservation Lands located at least 500m north of the existing Nelson Quarry. It has not been demonstrated that this proposed location lies beyond the area of influence of the existing Nelson Quarry. The suitability of the proposed background location as a background monitor location is therefore in question.
17.	The hydrogeological analysis is based upon the assumption that current conditions represent baseline conditions. Predicted changes in groundwater levels are compared to current baseline conditions. There is no discussion of the impacts from the historical operation of the existing quarry and relevance to closure requirements of the existing quarry license. This should be included in the report.	It is correct that the current conditions represent baseline conditions. Predictions of absolute water levels and streamflow's as well as changes in streamflow and groundwater levels (drawdowns) through the Scenario analyses were compared to current baseline conditions. (See response 15 for more discussion)	See response to comment 15.	We respectfully agree to disagree. See our reply to follow up comment 15.	Earthfx has not provided any additional information to address this comment. The baseline condition defined by Earthfx does not identify the impact of the existing quarry or the extent of this impact which has implications for the selection of background monitors. See comment 16

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18.	With respect to Rehabilitation Scenario 1 (RHB1), how does the retained consultant know that the infiltration pond for the western extension will provide adequate supplies of water (i.e., quantity and quality) to the deep bedrock (model layers 6 &8) and not short circuit groundwater infiltration to the shallow bedrock (model layers 4&5) and the local overburden sand deposits into which the infiltration pond is to be constructed. This does not appear to have been considered or accounted for in the computer model. There is also no analysis of implications of the proposed infiltration pond to water quality of the down gradient wells. This should be included in the report.	The purpose of the infiltration pond is to replace the golf course ponds that contribute to groundwater recharge in the area. The new infiltration pond will be constructed in good hydraulic contact with the bedrock surface and almost certainly will provide higher leakage than the golf course ponds that have over 50 years of accumulated sediments. The infiltration ponds were fully represented in the model scenarios, and simulate all surface water and groundwater flow paths through all layers (including interflow in the soil zone, seepage, and runoff). This full representation of surface water and groundwater flow is fundamental to an integrated model such as GSFLOW, so it was fully accounted for in the model. (Leakage and recirculation of a portion of the infiltrated water back through the excavation is fully represented in the model.) Water quality is discussed in Response 7 and 8.	The hydrogeological report states "the newly constructed infiltration pond, which will locally support groundwater levels in a similar manner to the current golf course ditch and pond system." (Section 8.7.5, Earthfx page 243) What field data is there to support the conclusion that the existing golf course ponds support groundwater levels? It is assumed that one of the functions of the proposed infiltration ponds is to assist in maintaining groundwater levels in down gradient wells. To what extent has the model considered interception of infiltrated groundwater from the proposed infiltration ponds by granular materials overlying the bedrock? The assessment of water quality in Appendix A, Section 15.6, Hydro geochemical Testing, is focused on identifying the source and type of water. "The water quality package is a standard package routinely utilized to characterize the water type and can be used to identify aquifer recharge areas, aquifer flow processes, and the degree of hydraulic connection between differing aquifers." Section 15.6, 1st paragraph, page 397). The Earthfx report should consider the drinking water implications of infiltrating quarry sump water for down gradient private wells. Golder Associates (S. McFarland Witness Statement 2010, Appendix F and G) has provided an analysis of groundwater and surface water quality in the vicinity of the proposed southern quarry extension with respect to exceedances of Ontario Drinking water Quality Standards and Provincial Water Quality Standards (for surface water). Although the Hydrogeological Report by Earthfx and the AMP identify groundwater and surface water monitoring locations and water quality parameters to be monitored, a discussion of critical chemical parameters and the identification of threshold water quality levels for protection of down gradient groundwater quality in private wells are missing.	Refer to response #6. The operation of the infiltration ponds will mimic what has been in place for several decades (golf course irrigation ponds). Modelled calibration to water levels shows mounding beneath the pond system which is indicative of groundwater recharge. Water quality has been discussed several times and we believe this comment has been addressed. Specifically, water quality results from domestic wells, the quarry discharge, the golf course ponds, etc. have been provided to JART along with our assessment. There were no water quality issues in monitoring and private wells close to the quarry and down gradient from the golf course ponds. For additional discussion of the pond functions and water quality, please see the attached schedules.	No additional information has been provided to confirm Earthfx's contention regarding the function of the existing irrigation ponds. Comment is unresolved.
19.	Rehabilitation Scenario 1 (RHB1); There is no discussion of seepage into the main quarry area from the rehabilitated lake in Phase 1/2 and long term potential effects on stability of the intervening area and on No. 2 Side road. This should be addressed.	The restored elevations in the P12 pond are generally (1-3 m) lower than the baseline groundwater levels. Seepage into the quarry area would therefore be less than under current conditions. Seepage is fully represented in the integrated model. The northern portion of P12 is "benched" to create a step-down profile so that a beach and gradual entrance to the deeper water will occur. Similarly, rehabilitation sediments have already been placed along the south face of the existing quarry (across the road from P12). The benching and rehabilitation has created a gradational profile and support for the south wall.	The impacts of a fracture halo around the edge of the proposed southern expansion and the impact this may have on hydraulic connection and seepage between the proposed pond and the existing quarry excavation should be considered. The revised site plan for the existing quarry (MHBC Draft revisions April 2021, Sheet 3 of 4, attached to the Progressive and Final Rehabilitation Monitoring JART Summary Table) shows a vertical quarry wall adjacent to a part of the proposed Southern Extension. The potential for enhanced seepage through and long-term stability of the intervening rock mass should be evaluated as part of the site rehabilitation and closure of the aggregate operations.	Blasting technology has advanced to the point that significant blast effect hydrogeological halos are not observed or expected. The south wall of the existing quarry is already partially rehabilitated in the area of P12. This, together with the significant benching in the P12 excavation area, will limit any seepage.	No additional information has been provided to address this comment which remains unresolved. Earthfx has not provided sufficient information to address the concern regarding seepage between the rehabilitated South Extension and the existing quarry.
20.	The statistical methods for establishing groundwater level trends and thresholds appear to rely solely on simulated groundwater levels calibrated against water level data with significant data gaps and simulated climatic conditions. It is not clear that simulated climatic conditions will accurately reflect current climatic data. Threshold levels have only been assigned to deep monitoring wells completed into the lower Amabel Formation. This does not recognize local wells that are completed into shallow zones and their sensitivity to drawdown affects from the proposed quarry expansion. Threshold levels for shallow and intermediate depth wells should be included in the report.	The question is not clear but we suspect that this refers to AMP thresholds. Please refer to the companion AMP discussions in the MECP response to comments (attached as Schedule A). Input to the model consisted of 10 years of climate data that reflect current climate conditions including drought years. The model was calibrated to match the available groundwater observations, groundwater response to quarry development, streamflow data, and soil zone response. It is expected that the range in response predicted by the model should be close to what is likely to occur under a variety of climatic conditions within the range of those observed between 2004 and 2019. It was recognized that shallow wells will be more sensitive to drawdown effects from the quarry expansion. It is expected that these wells may need to be deepened if they are impacted under drought conditions. A number of maps showing the available drawdown were included to demonstrate that shallow wells could be deepened.	The periods of missing groundwater monitoring data include the period between 2004 to 2008 and between 2013 and 2019. To what extent do these data gaps in groundwater level monitoring affect the reliability of the simulated groundwater levels or limit the simulations to represent the climatic range of conditions occurring during these data gaps? Given there are no threshold levels identified for shallow wells, it is assumed that shallow wells will be included in the mitigation measures outlined in the AMP that are triggered by the threshold levels being achieved in the bedrock monitors. Since shallow wells are recognized as being more sensitive to drawdown effects from the quarry, they should receive priority with respect to proactive well mitigation measures and water well complaints.	Level 1 and 2 Hydrogeological Assessments that are completed to support an ARA license typically only rely on one full year of monitoring data. The Burlington Quarry extension has one of the most extensive water level databases used to support an ARA application. Therefore, we disagree that the assessment contains "data gaps" that would limit the reliability of the simulated groundwater levels. In any case, the data before and after the gap are highly consistent. Please refer to the AMP with regards to the groundwater threshold values.	The Earthfx response indicates that *'Level 1 and 2 Hydrogeological Assessments that are completed to support an ARA license typically only rely on one full year of monitoring data.'* One year of monitoring data is required, at a minimum, to define seasonal variations in groundwater conditions at a particular site. This is considered to be inadequate for purposes of defining year to year variations in groundwater conditions to reflect climatic variations that define wet and dry year conditions. The onsite monitoring data missing for the period between 2004 and 2008 includes the dry year of 2007 as identified in the Terms of Reference (Earthfx et.al., 2020, page 12, section 5.2.3 Simulation od Baseline conditions). This does not allow for calibration of the model results against actual on-site monitoring data for the specified dry year of 2007. The long term groundwater monitoring locations including recently installed monitors in the South Extension and existing and proposed monitoring locations in the West Extension area are listed in Table 1 and 2 respectively in the Preliminary Adaptive Management Plan, Earthfx et.al, June 2022. Threshold groundwater levels are not included for deep,

					intermediate, and shallow depth groundwater monitoring wells for the South Extension listed in Table 9 of Section 7.3.1. Instead, trend analysis is proposed for these groundwater monitors. As well, no groundwater quality threshold levels are proposed for these groundwater monitors. As a result, there is ambiguity with respect to the definition of potential negative unacceptable impact from proposed quarry operations on the groundwater system and on local domestic wells. As shown on Table 2, section 5.1, the AMP lists groundwater monitoring wells for the West Extension, including deep and intermediate depth bedrock wells. Threshold water levels that are yet to be determined are indicated for the bedrock monitors but do not include groundwater monitors that are proposed to be completed (MW22-04, MW22-05, MW22-10, MW22-11, and MW22-12). The depth of these monitors has not been provided so it is unclear whether they include overburden monitors. A typographical error for monitors is noted as described below under the AMP JART Table comments. Corrections should be made as required.
77.	'The quarry has been in existence since 1953 and has been operated by Nelson since 1983.' The report does not address the long history of the quarry specifically the existing operating conditions, environmental requirements including on-going monitoring, conditions of operations, and recognition of the existing impacts of the quarry operations on the pre-quarry conditions. This should be included in the report.	Technically," *the assessment report must address the potential effects of the operation* (in this case, the quarry expansion) *on any groundwater and surface water features located within the zone of influence, including but not limited to:* *a) water wells (includes all types e.g. municipal, private, industrial, commercial, geothermal and agricultural)* *springs (e.g., place where ground water flows out of the ground)* *groundwater aquifers;* *surface water courses and bodies (e.g., lakes, rivers, brooks)* *wetlands* *The assessment must include but not be limited to the following:* *f) a description of the physical setting including local geology, hydrogeology, and surface water systems;* *proposed water diversion, discharge, storage and drainage facilities;* *water budget (e.g. how water is managed on-site);* *i) the possible positive or negative impacts that the proposed site may have on the water regime;* *The Level 2 water report must also contain:* *monitoring plan(s); and* *k) Technical support data in the form of tables, graphs and figures, usually appended to the report."* Please refer to Response 15, above The report is a stand-alone study that focused on the impacts of the expansion that took into consideration approved impacts of the existing quarry. It was beyond the scope of the Level 1/2 study to recreate or analyze pre-development conditions. That said, the report provides estimates of predicted water levels and flows which incorporate the existing quarries effects, as opposed to just the change in flows and heads, as other quarry reports we have seen tend to do.	Since the proposed rehabilitation plan for the quarry extension ties the existing quarry rehabilitation plan with the proposed expansion, the requirements of the rehabilitation plan for the existing quarry and the rational for these requirements are relevant to the proposed quarry expansion. This is particularly relevant as the approved rehabilitation plan for the existing quarry is to be changed. The implications of the proposed changes to the rehabilitation plan for the existing quarry on the groundwater system and natural environment should be evaluated against the original requirements for closure of the existing quarry. This requires an understanding of the history of the existing quarry operations and the environmental conditions of operation and closure for the existing quarry.	Agree to disagree.	Issue not addressed. Earthfx disagrees that details of the history of the existing quarry including environmental impact should be discussed in their report as background to their investigation
78.	'A key aspect of this integrated model approach is that it evaluates the effects of the quarry extension on continuous multi-year basis, spanning a range of climate conditions.' The analysis does not identify the existing conditions as being impacted by the long operating quarry or whether the existing quarry operations are in compliance with environmental impact mitigation requirements that may exist. There is no cumulative impact assessment of the existing operations and the proposed quarry extensions. Cumulative impact analysis should be included in the report.	See response 77, above	See comment for item 15 and 77.	This comment has been addressed multiple times and in meetings with the JART team. At this point, we respectfully agree to disagree.	Same as Comment 77.

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80.	'In addition, this hydrogeological assessment has been completed in accordance with the Terms of Reference for the Level 1 and Level 2 Hydrogeological and Hydrologic Impact Assessment of the proposed Burlington Quarry Extension (February 2020).' The terms of reference were dated 2020, at about the same time as the hydrogeological report was issued. Studies in support of the hydrogeological report were initiated well in advance of issuing the Terms of reference. Typically, studies are based upon the terms of reference which are normally produced in advance of the studies being undertaken. The terms of reference appear to have been created from the completed studies. Due to the timing of the completion of the terms of reference, it appears as though the hydrogeological assessment could not have been competed in accordance with terms of reference which do not appear to have existed prior to completion of the assessment. This process did not allow for an opportunity for meaningful input and modification to the studies by review agencies.	Comment noted.	The absence of meaningful input to the Terms of Reference due to the production of the terms of reference after completion of the reports has resulted in deficiencies in the scope of investigations.	We respectfully agree to disagree. It is not unusual to begin collecting field data and conducting feasibility studies for a land development or quarry expansion prior to announcing the development plans.	Deficiencies identified in the documentation have not been addressed.
81.	This section describes elements of previous investigations and the time period over which they were undertaken. There is no description of the period of monitoring available for this study and for the existing quarry or the periods of data gaps that may exist. This should be included within this section of the report. Some of the data gaps are discussed elsewhere in the text.	A data gaps section could have been added; however, as the reviewer notes, the data gaps are discussed further on in the text. Additional long term hydrographs are presented in our response to the MNRF comments (Schedules B, C, and D).	Comment noted. See comment 14, 86, 132, 140, 159, 191, 217, and 235.	We respectfully agree to disagree. Reference to comment 14 is not relevant. Please refer to comment #20.	The significance of the groundwater monitoring data gaps, (i.e., 2004 to 2008 and 2013 to 2019) noted in comment 20, have not been addressed.
83.	Section 7 of the report presents a numerical simulation of the current or "Baseline' conditions at the site. A continuous transient (time-dependent) assessment is presented, illustrating how the surface water and groundwater systems behave on a daily basis over the last 10 years. Included in this assessment time period is a severe Provincial Low Water Response Level 2 drought (2016) and an above average wet year (2017). This baseline provides a realistic long-term frame of reference for comparison and assessment of the proposed quarry extension and rehabilitation phases.' Current conditions may be appropriate for assessing impact of the proposed extensions to the existing quarry. This does not however address the impact of the existing quarry operations. The cumulative impact of the existing quarry and the proposed quarry extensions should be considered for purposes of evaluating impacts on private wells, natural heritage features and rehabilitation options.	Please refer to Response 15, above.	See items 15 and 77.	We feel that the issue surround "baseline conditions" has been addressed.	The impact of the existing quarry has not been adequately accounted for with respect to comparing the proposed preferred rehabilitation scenario which requires a change to the approved existing quarry rehabilitation.
84.	'This report, the companion documents, the integrated model, and the detailed field investigations and analyses represent an exceptionally comprehensive assessment of the proposed development' The computer model analysis is focused on quantifying the water resources and the interaction between surface water and groundwater. Groundwater quality assessment is limited to characterizing the groundwater quality with respect to possible source waters, i.e. either groundwater or surface water. Water quality assessment is incomplete with respect to characterizing water quality with respect to drinking water objectives and potential sources of contamination. Groundwater quality thresholds as well as potential mitigation measures are also missing. An analysis of water quality threshold levels is missing and should be included in the report. There is also a limited period of water quality data with periods of record missing.	Please refer to our Response 7, above. As a general statement, dewatering for the quarry will result in inward gradients. This minimizes the risk of contaminants introduced into the subsurface from migrating offsite. The exception would be related to the infiltration pond which would infiltrate water discharged from the north sump. Water quality monitoring requirements for the quarry discharge would apply.	Impact assessment of the quarry expansion, especially the western expansion area, remains incomplete without addressing the groundwater quality issues associated with infiltrating quarry sump water to maintain down-gradient private well water supplies.	Water quality has been discussed several times and we believe this comment has been addressed. Specifically, water quality results from domestic wells, the quarry discharge, the golf course ponds, etc. have been provided to JART along with our assessment (Schedule 1). There were no water quality issues in monitoring and private wells close to the quarry and down gradient from the golf course ponds.	Additional water quality information and assessment has been provided in the Earthfx Memorandum of April 19, 2022, Schedule 1 of the applicant response to the JART Hydrogeology Table, June 2022. Earthfx states *'The sodium and chloride levels at BS-01 are slightly elevated, but this is not unexpected give(n) that the well is less than 30 m from the road salt applied to Cedar Spring Road. A stronger road salt impact is noted at BS-02A and BS-02B, located west of the quarry.'* (Schedule 1, page 14, 3rd paragraph, Section 5.2) Examination of the sodium and chloride results show increasing levels of these parameters with depth. This suggests the source of these elevated parameters is at depth and not from surface road salt as postulated. Should road salt be the source of elevated sodium and chloride in these monitors, it is expected that the level of these parameters would increase closer to the source and not decrease. See comment 7 above.

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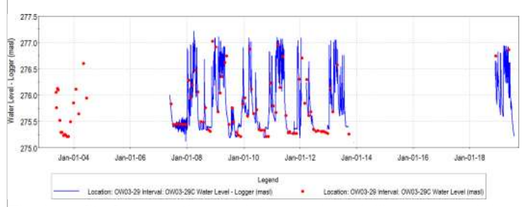
	The assessment is therefore not considered to be comprehensive.				Poorer groundwater quality at depth brings into question the viability of deepening wells as a mitigation measure for potential well interference from the proposed quarry expansion. Given the presence of elevated parameters in groundwater quality, it is considered critical to monitor groundwater quality with respect to Ontario Drinking Water Quality Standards as part of the long-term groundwater quality monitoring program. This should include groundwater quality thresholds for specific critical water quality parameters. These have not been identified and are missing from the groundwater monitoring program.
86.	'Local monitoring data and site characterization information collected for the Golder studies, as well as ongoing monitoring data, were obtained from Nelson and complied into a relational database for this study.' The period of record and data gaps should be identified.	Periods of record varied for each well and measuring point. A table of start and end dates for wells near the wetlands has been prepared for MNRF and are included as Schedule D. There are significant (multi- year) gaps in most of the data sets as shown below. This information was presented in the comparative hydrographs provided in the report.  The benefit of our continuous integrated modelling approach is that model results can be compared to available data even if there are gaps and non-overlapping surface water and groundwater measurement periods. Please also refer to Response 10 and 11, above.	Limitations of existing data gaps on the integrated model should be clearly stated in the reports. See comment 14, 81, 132, 140, 159, 191, 217, and 235.	We agree that there are data gaps in the data since 2003. As was noted earlier, most quarry expansion studies typically rely on 1-2 years of data. We do not feel that the data gaps adversely affect the model integrity.	Defer to the computer modeling peer review for comment on the impacts of data gaps on the certainty of the modeling results.
87.	'The effects of this quarry excavation and expanded dewatering have been observed in the monitoring data collected since 2005; ' It is not clear what changes in dewatering have occurred since 2005. It is also not clear whether the impacts of the changes in quarry dewatering have stabilized. This should be addressed in the report.	This is a reference to the changes that occurred as the active quarry face progressed with respect to observation wells on the south side of the quarry. Please refer to Figure 5.12 and Section 6.11.3 of Earthfx, 2020. For additional detailed discussions about quarry advancement please refer to Section 4 (Long Term Observation of Wetland and Quarry Interaction) of the Earthfx Response to MNRF comments. Little data are available for the period prior to the instrumentation in the south and gaps exist in the subsequent observations. Significant effort was made to extract useful information from this limited data set.	Figure 5.12 shows water level change in monitoring well OW03-14 between 2003 and 2012 with data gaps between May 2004 and August 2007 as well as between 2008 and August 2018. See Comment No. 69 above. The available data shows a drop in water levels of about 14 m. It remains unclear what changes in dewatering occurred historically and whether the zone of influence of the existing quarry has stabilized.	As was noted, the quarry has expanded to its licensed footprint and no further increases in dewatering or significant changes at the active face are expected. This stable baseline condition is the starting point of our analyses of changes expected due to the proposed quarry expansion and site rehabilitation.	No evidence has been presented to demonstrate the extent of the zone of influence of the existing quarry and whether this has stabilized. This issue remains unresolved.
89.	Typo. Location BS-063 should be BS-03. Also note that BS-06 is missing on this figure.	BS-03 and BS-06 are so close that their labels overprinted and appeared as BS-063. The map below shows the well locations. 	Clarification provided.	RESOLVED	Issue resolved
90.	Model layers should be labelled on this figure for correlation to hydraulic conductivity results from packer testing.	Model layering had not been introduced at this point in the report and would have complicated the figure .	Figure 3.7 could have been modified with the packer test information and model layers added and presented at an appropriate location in the text. Reference to the model layer could have been included in the text. This would have provided a useful visualization from a peer review perspective in order to more fully understand the model layer development. The bedrock formation names presented on this figure had also not been introduced at this point in the report.	Packer test data were discussed in Section 5 and Figures 5.6 – 5.8 present packer data with respect to model layers. We feel the discussion on model and layer development was clearly communicated.	Editorial comment remains unresolved. Labelling of the model layers on the packer test results would be helpful to the peer review.

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94.	Figure 3.22 West-East Section shows existing Burlington Quarry up-gradient of wells adjacent to Medad Valley. This illustrates that the up gradient source water area of these wells has to a large extent been excavated by the existing quarry. These wells therefore rely to a large extent upon on up-gradient infiltration including sump discharge via up gradient irrigation/infiltration ponds to replenish groundwater levels for down-gradient wells. Much of the up- gradient bedrock remaining between the existing quarry and the private wells along the Medad valley is to be excavated in the proposed west extension. This creates further reliance on the infiltration ponds for maintenance of down-gradient well water supplies. Please provide field data to confirm that the proposed infiltration pond will function as required	Please refer to Response 4, 6 and 18, above. It is unlikely that the wells, as you note, *"rely to a large extent upon on up-gradient infiltration including sump discharge via up gradient irrigation/infiltration ponds to replenish groundwater levels for down- gradient wells".* Golf course irrigation is limited to the summer months and the 50+ year old ponds are likely infilled with silt and fines that would limit leakage. Early simulations with and without the infiltration pond showed that higher drawdowns would occur in the absence of the feature, indicating that the feature would mitigate the effects of quarry. The design of the pond was adjusted by Tatham based on feedback from the modelling results and the extents of the pond were increased. There are no field data available as the pond has not been constructed, but creating an infiltration system that is more effective than a 50-year-old pond network will not be difficult. The principal of the design was to replace the limited infiltration from ponds excavated into the Halton Till containing accumulated sediments with a pond excavated to the top of the weathered bedrock. Significantly higher infiltration rates would be expected.	As noted, no field data exists to support the assumption that the existing golf course ponds are providing infiltration to the groundwater system. Since the purpose of the golf course ponds is to provide irrigation water for the golf course, it seems reasonable to assume they were constructed to minimize water losses by leaking or infiltration to the groundwater system. The effects of the proposed infiltration ponds are simulated based upon assumed and generalized local hydrogeological conditions. Figures 5.13 and 5.14 in the Earthfx hydrogeological impact assessment report show groundwater levels in the shallow and deep groundwater wells. Water levels contours in the proposed western extension area indicate a groundwater flow direction toward Medad Valley and the various private wells along Cedar Springs Road. Groundwater flow direction has been described as "In general, groundwater flow is radially outward from Mt. Nemo; however, the flow direction is predominantly to the southwest towards the Medad Valley' in the quarry vicinity (section 5.3.2, page 109, Earthfx 2020). The highest groundwater levels are reported to be at Mount Nemo which is a topographically high area surrounded by low lying areas. Groundwater within the Amabel formation beneath Mount Nemo is therefore logically derived from infiltration of precipitation falling within this area. The Amabel formation is truncated around Mount Nemo as shown on geological cross section along 2nd Side Road, Figure 3.21. Lateral groundwater flow in the vicinity of the quarry within the Amabel Formation is therefore limited to within the Mount Nemo area and is expressed as seepages and springs around the periphery of Mount Nemo and as seepages into the existing quarry along the quarry walls. Removal of the majority of the Amabel formation in the proposed western quarry extension area will further disrupt lateral groundwater flow toward the private wells along Cedar Springs Road adjacent to the proposed quarry extension. (See Figure 3.22) This will place heavier reliance on up- gradient infiltration to support the groundwater system down-gradient of the proposed western quarry extension. Private wells along Cedar Springs Road adjacent to the proposed western quarry extension are at significant risk of disruption from the proposed western quarry extension. The lack of field data in support of an important mitigation measure intended to compensate for disruption to private well water supplies provide a high degree of uncertainty with respect to the feasibility of this mitigation measure. Reliance upon model predictions of impacts on private wells is fraught with uncertainties due to generalized assumptions of site conditions upon which the model is based. Field data of groundwater conditions including pilot testing of infiltration measures along with groundwater tracing and private well response to infiltration measures is required to provide a reasonable measure of certainty with respect to the proposed mitigation measures for down gradient wells. In addition, detailed water quality testing of local wells and quarry sump discharge would be required to assess the suitability of infiltrating quarry sump water to maintain groundwater levels in order to support water supplies for down gradient wells.	In follow-up discussions with JART and MNDMNRF, we presented simulations of P3456 with and without the infiltration pond to quantify the incremental change in water levels, streamflow, and upward gradients in the Medad Valley. The assumptions in representing the pond were conservative and had the Halton Till underlying the pond. Additional analyses were made at the request of MNDMNRF to determine the effects of deepening the pond by excavating through the till. Model results indicated that, as might be expected, upward gradients would generally increase in the Medad Valley. Please refer to Schedule 2 which discusses the infiltration pond in detail. Regardless, the updated AMP includes additional monitoring wells in the Medad Valley.	Due to the lack of field data in support of the assertion that the infiltration ponds will provide sufficient infiltration to maintain the groundwater system, uncertainty remains regarding the functioning of the proposed infiltration pond and its ability to support down-gradient domestic water well supplies. The computer model simulations rely upon assumptions regarding subsurface hydraulic conditions at the proposed infiltration pond location. The assumption of an equivalent porous media for modelling purposes does not apply to groundwater flow through fractures at a site specific level of investigation to address well interference potential for individual domestic wells.
98.	The model layers should be shown on the borehole log to allow comparison of the Packer Hydraulic Conductivity (K) values to those used in the computer model.	See response to Comment 90	Suggested addition of model layer on Figure 3.35 would provide clarity and facilitate peer review. See response to comment 90.	See response to #90.	Editorial comment remains unresolved. Same as comment 90.
99.	'The till forms an effective aquitard where present. --- Golder (2006, p. 6) found that the presence of silty clay in the sediments effectively limited the interaction between the surface and groundwater systems.' There is some doubt as to the effectiveness of the Halton Till as an aquitard from pump test information provided by Golder (2010) where overburden monitor OW03-22C responded to a 2006 pump test of the deeper bedrock zones (See Figure 18, S.	Wells that penetrate to the top of bedrock (i.e., overburden/bedrock monitors) would be more likely to reflect the effects of water level change in the bedrock than short-screen wells carefully sealed into the center of the unweathered Halton. Golder (2006) noted that "*No water level response was observed in the piezometers completed in the shallow overburden sediments or standing water staff gauge locations at ground surface. This indicates that the hydraulic connection between standing surface water in the wetland and groundwater resources in the bedrock is weak".*	There appears to be sufficient information to demonstrate a hydraulic connection between the surface wetlands and the underlying bedrock. Shallow monitors installed by Tatham including SW5B, SW11B (wetland 13027), SW12B (wetland 13022), SW13B (wetland 13016), SW16B (wetland 13027) showed shallow groundwater levels seasonally above ground surface at the corresponding wetlands. This demonstrates seasonal discharge conditions and hydraulic connection between these wetlands and the shallow groundwater system. These wetlands therefore cannot be considered hydraulically isolated from the groundwater system as described in the wetland	We respectfully agree to disagree. In our response to similar comments, we noted that where the wetlands are not perched, the sparse fractures allow heads to equalize and over time but the volume of water transmitted by small, sparse fractures is small. Our conservative modelling analysis assumed greater connection than is likely and, therefore, generally over-estimated the degree of impact of quarry expansion on the perched or connected wetlands. Regardless, the updated and approved Adaptive Management Plan addresses any uncertainty that may come out of the work	Earthfx does not acknowledge the hydraulic head information indicating seasonal discharge conditions and hydraulic connection between wetlands and shallow groundwater system at the four wetlands instrumented and monitored by Tatham. Issue remains unresolved. See comment # 13, 14, 185, 197, 204, and 266.

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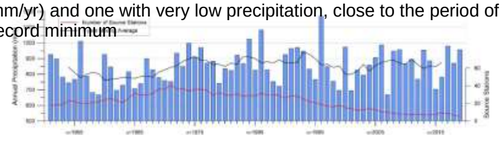
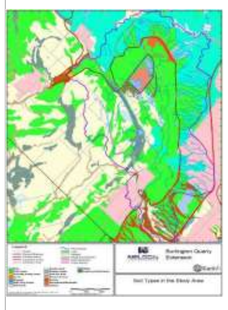
	McFarland Witness Statement, 2010, PDF page 1429). During a 2004 pump test completed by Golder on the same well, a number of shallow overburden monitors responded to a five day pump test. This included monitors; MW03-5A, MW03-04C, OW03-22C, OW03-23C, OW03-24C, and OW03-27C. Although these monitors were constructed as overburden monitors, they have been described as overburden /bedrock interface monitors. The response of these overburden monitors to pumping of the underlying bedrock raises the question of the ability of the shallow water table to respond to bedrock water levels and the interconnection between surface water and groundwater. Golder (2006), page 8, 2nd paragraph states in reference to the background monitoring results of OW03-22, MP-5 and SG-2 (Cluster2) 'These results indicate a strong degree of hydraulic connection between groundwater levels in the bedrock and the surface water levels outside of the wetland area.' It should be noted that MP5 is within the wetland area. The borehole log for MP5 shows 1.35m of clayey silt, presumably Halton Till. This information is contradictory to the Earthfx conclusion that the till forms an effective aquitard where present. This contradiction needs to be addressed.	That said, it is recognized that the Halton Till is an aquitard in the sense that it **limits** the degree of interaction between the shallow overburden and the bedrock. There is likely to be some vertical fractures that span the unweathered till. This is why Golder observed a general response away from the wetlands to recharge events, which occur over a wide area, but no response to local pumping. That is why a relatively high ($5x10^{-7}$ m/s) value was used and not one or two orders of magnitude lower which would be more typical of an unfractured clay till. Golder (2006) indicated that lab tests showed K values as low as of $2x10^{-10}$ m/s. Our findings generally follow those of Golders.	characterization attachment to the JART Hydrogeological Table of comments and responses from Nelson. Corrections should be made to the wetland characterization tables for the above noted wetlands. See comment 9, 13, and 14.	completed by Earthfx and Tatham.	
103.	There is only one station within the study area below the escarpment at the edge of the study area as shown on Figure 4.1, page 77. There is no climate station in the vicinity of the Burlington Quarry nor is there a climate station representative of climatic conditions on top of the escarpment at Mount Nemo. It is noted that Mount Nemo is referenced in the report however there is no figure showing its location. The average annual precipitation of 853.0 millimeters/year varies from 655.0 and 1172.0 millimeters/year. The range in precipitation represents an increase of about 80.0% over minimum annual precipitation. Is this reflected in modeling scenarios and what impact does this have on the reliability of the integrated model predictions in representing site conditions at the Burlington Quarry?	The review is correct in regards to the number of stations within the study area. We therefore assembled a large number of stations from outside the study area. Mt. Nemo is labeled on the earlier figures (See Figures 1.1 and 1.2). The model simulation period study period contained three years with precipitation greater than one standard deviation (> 980 mm/yr) and one with very low precipitation, close to the period of record minimum  .	What is the impact on the results of the modelling, if any, of the lack of a climate station on Mount Nemo in close proximity to the subject property?	As noted, we interpolated data from a large number of stations from outside the study area.	Earthfx has provided an explanation of how the lack of a climate station on Mount Nemo has been accommodated in the computer modelling exercise. This is accomplished through a process of interpolating data from the nearest station. Earthfx has not clarified the impact of this on the certainty of the computer model predictions. Issue remains unresolved.
106.	Are the lime coloured areas on this figure clay loam? It is not clear from the legend that these colours are the same?	A figure with improved colour scale is provided below. 	Enhanced Figure noted. It appears that the lime coloured areas represent clay loam. The colour figures provide striking visualizations but may be difficult to interpret for individuals who may have difficulty in distinguishing colours of similar shades.	RESOLVED	Editorial comment clarified.
110.	'Many other small un-named natural and man-made features also exist in the study area, including a series of golf course ponds in the western extension lands' What role do the man-made irrigation ponds in the west extension area play in the maintenance of	Average simulated seepage from the golf course irrigation ponds was about 130 m3/d. Under Phase 3456, average simulated seepage from the infiltration pond was about 777 m3/d. Some of that flow is recaptured by the quarry drains and recirculated.	What degree of error can be expected for the simulated seepage and the recaptured flow by the quarry from the golf course irrigation ponds in the absence of hydrogeological information from the area of the ponds?	The assumptions in representing the pond were conservative and had the Halton Till underlying the pond. Additional analyses were made at the request of MNDMNRF to determine the effects of deepening the pond by excavating through the till. Model results indicated that, as might be expected, outflows are higher. (see Schedule 2)	Earthfx has not responded to the question of what degree of error can be expected for the simulated seepage and recaptured flow by the quarry of the golf course irrigation ponds in the absence of hydrogeological information from the area of the ponds. Issue remains unresolved.

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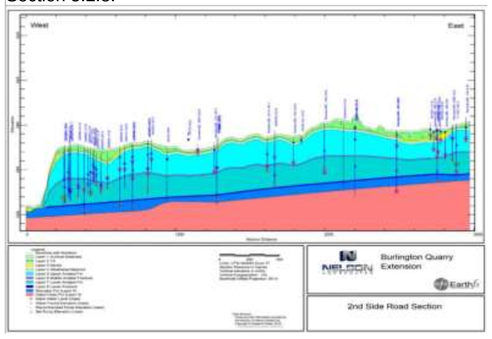
	discharge to down gradient springs/seeps? What evidence is there to support this role?				
115.	'The till is of low permeability and serves to limit recharge and/or leakage to the underlying aquifers.' Is Halton Till located beneath the existing irrigation ponds or the proposed infiltration pond? If so, what effect does this have on infiltration of quarry discharge water on groundwater levels? Has this been taken into account in the modeling? Is the Halton Till weathered anywhere in the study area and has fracturing been accounted for in assigning hydraulic conductivity to fine grained overburden deposits?	Yes, we believe that Halton Till underlies most portions of the irrigation ponds. Bathymetry data were used to determine the parts of the ponds that lie on weathered bedrock. Leakage varies based on the underlying material and on pond stage. As we have noted in several responses, the upper part of the Halton Till (Layer 1) is assumed to be weathered. The unweathered till is still relatively thin and is assumed to have some vertical fracturing, increasing the effective permeability of the unit (i.e. K = 5x10-7, rather than what might be expected of an intact clay-silt till). The location of the fractures and any spatial pattern in the fracturing was not determined.	Clarification provided. It is unclear the extent to which areas of thin Halton Till overlies bedrock. These areas should be identified.	Please refer to Schedule 2.	Clarification partially provided. Earthfx response refers to Schedule 2 which includes additional computer modelling results. No additional field data was provided addressing the question of identifying areas of thin Halton Till.
116.	Quarry excavation in the western extension is to 252.5 mASL which will effectively remove most of the Amabel Formation up-gradient of the private wells along Cedar Springs Road. Maintenance of groundwater levels within the bedrock wells will, to a large extent, be dependent upon recharge of quarry discharge water through the proposed infiltration pond. Most of the primary aquifer within the source water area for these wells will have been removed with the completion of quarry excavation. What field investigations have been completed to demonstrate the effectiveness of the existing irrigation ponds and the proposed infiltration pond in recharging the underlying aquifer? Under the model assumptions, it is anticipated that the infiltrated water from the infiltration pond will be intercepted in Model Layer 4 and will not be available to the down gradient wells. The viability of the proposed infiltration pond should be confirmed with supporting field data.	Please refer to Response 4, 6 18, and 92, above. This question has been asked several times. The purpose of the infiltration pond is to replace the golf course ponds that may have contributed to groundwater recharge in the area. It is assumed that the pond will be in good hydraulic contact with the bedrock surface and should provide higher leakage than the natural ponds with their accumulated sediments. Some form of long-term maintenance may be required in the final design to ensure that the infiltration pond does not become silted up. Some of the water will be picked up in the expanded excavation area and recirculated, but the main effect is to recharge the groundwater west of the quarry and maintain higher heads and prevent the private wells from going dry.	See comment 94 above.	See original response and response to #94 above.	The question of the effectiveness of the proposed infiltration ponds remains unconfirmed resulting in uncertainty with respect to the potential impact of the proposed quarry expansion on down-gradient domestic wells.
117.	It is noted on page 103, last paragraph, that 'Packer test results in the west area illustrate an increase in hydraulic conductivity in the Middle Amabel (Figure 5.6), but the evidence is less clear in the Golder packer test data (Figure 5.7 and Figure 5.8).' An explanation is required for this discrepancy. Clarification is required whether this has been accounted for in the integrated model. The source of the packer data should be indicated on the figures. The higher conductive lower fracture zone, of the lower Amabel, layer 8 of the model, is not reflected in the packer test results for the South Expansion Sections. This layer is also not clearly reflected in the packer results in the West Expansion Section. An explanation is required.	It is expected that the hydraulic conductivity of the fracture zone is likely to vary. As noted, there are multiple lines of evidence for the middle Amabel fracture zone. A cross section showing water found and well completion depth along 2nd Side Road shows a pattern consistent with the interpretation of the data from multiple sources. The question then becomes: how do you spatially distribute this information from multiple lines of evidence. For simplicity, we assumed that a uniform value, guided by the mean of the test data and refined through model testing and calibration, would serve as a reasonable approach. The evidence for the lower fracture is discussed later on in Section 5.2.8. 	The approach taken to account for variability appears to be a reasonable compromise for modelling purposes although there should be a qualifier describing the probable degree of error attached to the model results and perhaps a sensitivity analysis to account for local variability. It remains unclear why the packer testing data does not, in most boreholes tested, reflect the higher hydraulic conductivity of Layer 8, the Lower Amabel, and what evidence there is in support of the higher hydraulic conductivity.	As was stated in the report, domestic supply wells along Cedar Springs Road are drilled into this zone. It is productive there and is likely to be productive in other areas as well. The approach to sensitivity analysis is different for fully integrated, fully transient (daily time step) models. The calibration to thousands of daily measurements, with varying daily climatic stresses, and the corresponding match to observed time-varying water levels and flows, is much more exacting and insightful than numerous runs of a steady state model groundwater-only model. As noted, the packer testing is only one aspect of the evidence supporting the conceptual model.	Earthfx has not provided the requested expected degree of error in the modelling results due to the method of interpolation of data. In addition, no explanation has been provided for the apparent discrepancy between the packer test results and the inferred hydraulic conductivity of computer model layer 8 the lower fracture zone.

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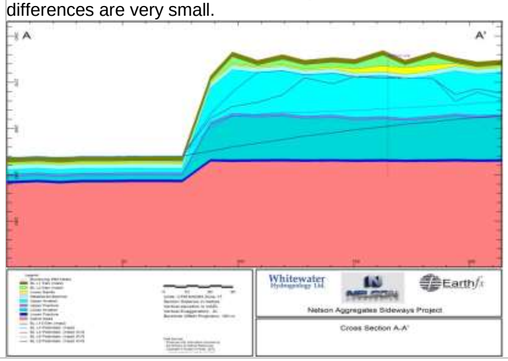
119.	Karst sinks were represented in the model as disappearing stream segments, where streams flowing across layer 1 drop down into layer 4. In layer 4, the karst flow is represented as a subsurface conduit that leaks or picks up flow' How does the retained consultant know that Layer 4 is the only layer that transmits karstic water? Could deeper layers not also contribute to surface discharge via springs/seeps?	Yes. We made the assumption that flow would likely be carried within the weathered bedrock layer, but it is possible that it could go through some deeper fractures. For an impact analysis perspective, we felt that heads in the weathered bedrock would be most sensitive to changes in flow and vice-versa, and therefore the assumption is relatively conservative.	Comment noted. What are the implications of the possibility of deeper layers contributing to seeps and springs in terms of model predictions of water level impacts from the proposed quarry expansion?	There are two sections of streams represented in this manner and for relatively short reaches. The method used was novel enough to mention, but these reaches are not critical to the overall conclusions of the impact assessment.	The possibility of bedrock layers deeper than model layer 4 providing flow to surface seeps has been acknowledged. Earthfx has responded that *'there are two sections of streams represented in this manner and for relatively short reaches.'* It is further concluded that *'these reaches are not critical to the overall conclusions of the impact assessment.'* It remains unclear what impact this would have on the maintenance of groundwater levels in downgradient springs and seeps.
124.	Typographicalerror? Reference to Worthington Groundwater (2019). Should this be Worthington Groundwater (2020)?	mment noted. Reference was to an initial draft. Correct reference is: Worthington Groundwater, 2020, Appendix B – Karst Investigation: in Level 1 and Level 2 Hydrogeological Assessment Proposed Burlington Quarry Extension – Appendix A and B, report prepared by Earthfx Inc. for the Nelson Aggregates Co., November 2019, 41 p.	Correction noted. Assume correction will be made.	RESOLVED	Editorial correction acknowledged.
125.	'The bulk anisotrophy of Layer 5 (upper bulk Amabel) was estimated to be 500:1 (Kh/Kv) and Layer 7(lower bulk Amabel) to be 1000:1 (Kh/Kv).' The above statement is in contradiction to the last paragraph of page 104 which reads as follows: 'It is widely recognized that the dolostones of the Niagara Escarpment have a high degree of vertical to horizontal anisotropy. Maslia and Johnston (1984) studied the "effectiveness of horizontal (bedding) joints versus vertical joints as water transmitting openings". They concluded that vertical hydraulic conductivity (Kv) to horizontal conductivity (Kh) anisotropy of 100:1 to 1000:1 was typical of Lockport (Amabel) Formation.' These are contradictory statements therefore one of the above statements must contain a typographical error. Please correct.	Typo on the h and v: Sentence should read: 'It is widely recognized that the dolostones of the Niagara Escarpment have a high degree of vertical to horizontal anisotropy. Maslia and Johnston (1984) studied the "effectiveness of horizontal (bedding) joints versus vertical joints as water transmitting openings". They concluded that horizontal hydraulic conductivity (Kh) to vertical conductivity (Kv) anisotropy ratios of 100:1 to 1000:1 was typical of Lockport Formation.'	Correction noted. Assume correction will be made.	RESOLVED	Editorial correction acknowledged.
130.	'A hydrograph from monitoring location OW03-15, south of the 2nd Side Road (see Figure 3.4) is shown in Figure 5.11. Water levels in the deepest monitor (OW03-15A) at this location are over 13 m below those of the water table (OW03-15C), clearly indicating that the lower system is connected to the quarry by a permeable lower fracture.' The above statement suggests that the existing quarry is draining the lower flow zone. What is the extent of the quarry influence on this flow zone?	As noted in the report, there are strong head differences between the shallow and deep system near the quarry face and, as noted, the outcrop of the lower fracture zone is likely helping to drain the deeper system. Leakage from above contributes to the inflow but at a rate that cannot bring the heads up to near shallow bedrock levels. Further from the quarry, at about 300 m of the quarry face, lateral flow towards the quarry face is better balanced by leakage from above and the head differences are much smaller. This is directly analogous to flow to a well in leaky aquifer.	What is the expected area of influence of the existing quarry excavations in the lower system?	As noted, within 800 to 1000 m from the quarry face. The figure shows a section through the quarry face near OW03-15. As can be seen, the average heads in Layer 8 are controlled by leakage at the base of the quarry (254 masl). The heads in Layer 6 are controlled by the base of the middle fracture zone (once you get a cell or two into the wall) at 264 masl. The heads in these layers do not change as dramatically due to seasonal recharge. The heads in Layer 4 are much more variable, as the layer is partially saturated most of the time. The fourth line shows the heads in Layer 4 on October 31, 2012 and they are near the top of the layer (273 m) but above the average heads in the layer. Differences in the simulated heads in the three units are getting smaller at only 150 m from the face. By 800 to 1000 m, the differences are very small. 	Extent of influence of the existing quarry is identified although not shown on a plan view figure illustrating areas within the area of influence. Issue partially addressed

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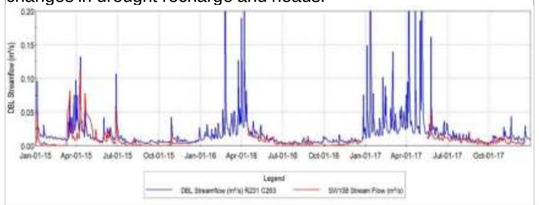
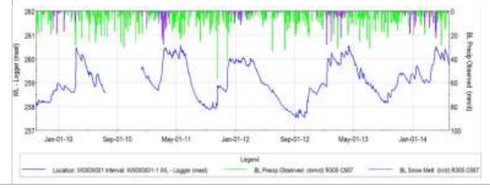
131.	'A hydrograph from monitoring location OW03-15, south of the 2nd Side Road (see Figure 3.4) is shown in Figure 5.11. Water levels in the deepest monitor (OW03-15A) at this location are over 13 m below those of the water table (OW03-15C), clearly indicating that the lower system is connected to the quarry by a permeable lower fracture.' A similar pattern is observed in monitor nest OW03-14 (Figure 5.12). When the monitor was installed in 2004, the quarry face was 175 m from the monitor (Figure 3.8). Between 2004 and 2009 the quarry face advanced to within 40 m of the monitor, and during that time the heads in the lower system dropped 14 m. This provides particularly useful information, for it suggests that the quarry influence is less than 200 m from the active face.' A much larger zone of influence of up to about 1000.0 meter is indicated in East Calibration Section, Figure 6.2.3 page 148. Have the impacts of the existing quarry stabilized or are the drawdowns continuing? A figure showing the cone of influence and drawdown from the existing quarry should be provided.	Head differences decrease relatively quickly with distance from the quarry face. At the quarry face there is about a 15 m difference between Layer 4 and Layer 8 heads. This decreases to about 5 m within 300 m from the face. By 600 m there is no difference between Layer 4 and Layer 6 heads and about a 1 m difference between Layer 6 and Layer 8. By 900 m, there is no difference in the simulated water levels. This is generally consistent with the observations, but the reviewer is correct that the model shows a slightly higher degree of influence and the model would tend to over-predict the impact of quarry expansion.	The model predictions of the area of influence of about 1000m appears to be a reasonable approximation of the measured water levels within bedrock flow zones. It is unclear whether the area of influence of the existing quarry has stabilized or is still expanding.	There is significant redundancy in questioning. The heads vary seasonally, but the drawdowns due to the existing quarry expanding to its limits have been stable since before 2009. This is due to the relatively low storage in the bedrock system and leakage from above and below.	The issue of stabilization of the area of influence has been resolved
132.	The hydrographs for monitoring location a OW03-14 and OW03-15 indicate data gaps between January 2004 and Jan 2008 as well as between January 2014 and late 2018. The data gaps include the drought period (2015/2016) and the wet period (2017) included in the model simulations as noted on page 31, Section 1.3.2. What impact does this have on the reliability of the model calibration?	There are gaps in the groundwater observations that Earthfx had no control over. With regards to the reliability of the model predictions for that period, our simulations of streamflow (along with estimated quarry dewatering) for the drought period compare well with the available observed data (see figure below for drought flows at SW10B). The integrated model shows that streamflow is reduced compared to average flows especially in the groundwater-level sensitive headwater tributaries. The ability to simulate drought streamflow gives us confidence in the model's ability to simulate changes in drought recharge and heads. 	Clarification of the limitation of the computer model simulations would be useful. See comment 14, 81, 86, 140, 159, 191, 217, and 235.	We stand by the original response.	Earthfx relies upon calibration of the model with streamflow data where there are data gaps in groundwater level data. The implications of the groundwater data gaps on the reliability of model predictions with respect to groundwater levels has not been addressed.
139.	'There are nearby Provincial Groundwater Monitoring Network (PGMN) wells; however, all are located outside the study area.' Were the PMGM wells used to correlate climate data to ambient groundwater levels?	A discussion of the seasonal response (Nov 2018-to August 2019) at PGMN well W00005-1 was provided in Section 5.3.3. The figure below shows a longer-term hydrograph for PGMN well W00001, located in Kilbride, about 5 km NE of the site compared to interpolated precipitation and simulated snowmelt in the closest nearby active model cell. There is a very good correlation between well response and precipitation/snowmelt events, especially during the spring. The summer response is very muted, as might be expected, but the small spikes in water levels correlate well with the larger rainfall events. This indicates that although the data are not perfect and there are substantial distances between the well and the active stations, the interpolated climate data produces reasonable results. 	Clarification provided.	RESOLVED	Clarification was provided with respect to the Provincial Groundwater Monitoring Network well W0005-1. Issue addressed.

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140.	'Although there are gaps, the data provide useful insight into how the wells respond to rainfall events and to seasonal and inter-annual climate variability.' It appears there were no on-site climate data to correlate water levels to climatic events. Reliance on off-site climatic stations and composite climatic records from different climate stations as described in Section 4.1.1, page 76, and water level data gaps, limit correlation between simulated water levels and the range of climatic conditions. Please explain the impact of this on the reliability of the computer model.	See above	See comment 14, 81, 86, 132, 159, 191, 217, and 235.	Climate station question was addressed earlier. We believe that the model matched event based responses well despite the lack of an on-site station.	Earthfx relies upon model calibration to streamflow data using climate data from offsite stations. The implications to reliability of model predictions in light of on-site groundwater data gaps and the lack of an on-site climate station was not addressed.
143.	This figure shows areas of upward and downward vertical hydraulic gradients. Two areas of downward gradients (in blue) are show near the edge of the Niagara Escarpment east of the subject property. These areas are located where there are few or no wells. How were these areas of downward hydraulic gradients determined? Earthfx has acknowledged that: 'While there are some clear patterns of downward gradients near the Escarpment face (shown in blue), the limitations in the MECP water well record data and spatial distribution result in limited usefulness.' (Page 110, Section5.3.2.1) Clarification is required of the information shown on Figure 5.15.	Typo. The blue areas are upward gradients, that is, heads in the deeper system are higher than the shallow. They are likely an artifact of limited data at the Escarpment brow.	Typographical error acknowledged and clarification provided. Assume correction will be made.	RESOLVED	Typographical error acknowledged.
145.	Figure 5.16 presents a hydrograph for monitoring well MW03-30B, which shows typical seasonal water level patterns.' Figure 5.16 shows water levels for the period between November 2018 and August 2019. Does this period represent typical climatic conditions expected for this area? In other words, how typical is this period of time?	The point of the figure was to show that "Groundwater levels show a muted response in the late fall and early winter as the ground freezes, precipitation decreases, and snow accumulates. Peak water levels generally occur in early to mid- April primarily due to recharge from precipitation and snowmelt events after the ground has thawed. Groundwater levels decline through the summer because few infiltration events reach the water table, and most of the water in the soil zone is lost to evapotranspiration. Groundwater levels typically recover in the early fall due to increased precipitation and decreased ET." The period was selected because it is a period of recent continuous data collection. The seasonal pattern is typical of most wells in southern Ontario. 2018 was a year with near average annual rainfall. Inter-annual variation was discussed further on in the section.	Clarification provided.	RESOLVED	Clarification provided.
148.	Wells in close proximity to the quarry (e.g., OW03-15, which is 50 m from the face) exhibit more than 14 m of vertical head difference between the Layer 4 shallow bedrock and Layer 8 deep fracture zone, as illustrated in Figure 5.11'. The above suggests that layer 8 is drained by the adjacent existing quarry and that the horizontal hydraulic conductivity (Kh) is likely much higher that the vertical hydraulic conductivity (Kv) resulting in under draining of the overlying layers. (2nd paragraph) 'With increasing distance from the quarry, the difference in head between the shallow and deep system is reduced. At 300 m from the face, the difference in head has decreased to 10 m (Figure 5.18),' (4th paragraph) 'At 1000 m from the quarry, the spring freshet provides an excess of water to the water table and, with minimal deep system drainage to the quarry, the water levels in the shallow and deep system are nearly identical.' The above observations suggest that the existing quarry has resulted in under draining of the shallow	The question has been answered earlier. In essence, heads differences decrease relatively quickly with distance from the quarry face. The decrease in heads is maintained because local leakage from above (between 0 and 50 m) cannot match the drainage at the lower fracture zone outcrop. Further away from the quarry, the net leakage between the well and the quarry face (0 to 1000 m) balances the lateral outflow and there is no need to further decrease water levels. At that point, the difference between the shallow and deeper bedrock is small, but not zero, since there is still vertical movement to the deeper system due to natural recharge from above. Several points can be made with regards to surface water features: (1) The steep decline is relative to the shallow bedrock heads. Heads in the weathered till, the zone in direct contact with the wetlands that are not perched is largely unaffected; (2) wetlands that are perched are obviously unaffected; (3) the impact on the deep bedrock attenuates rapidly with distance and wetlands beyond 300 m should not have been affected at all by the decrease caused by the approach of the quarry face; (4) although the change occurred in a gap period, the response was likely rapid and a new equilibrium quickly established due to relatively small storage values in the bedrock. The issue of cumulative impact is discussed in Response 3, 15 and 77	Figures 6.22 (West Calibration Section) and Figure 6.23 (East Calibration Section) in the south expansion area, show average simulated water levels within the bedrock model layer 4 (weathered bedrock), model layer 6 (Middle Amabel Fracture Zone) and model layer 8 (Lower Fracture Zone), These figures suggest an area of influence of the existing quarry to include the areas within about 1000m of the existing quarry edge. This appears to have contributed to perched groundwater conditions for wetlands within this area, particularly those closest to the existing quarry. It remains unclear whether this condition has stabilized or is still expanding. It is also unclear what impact this has had on the wetlands within the area of influence of the existing quarry. These conditions are considered 'baseline' conditions for purposes of assessing impact of the proposed quarry expansion, however they clearly represent impacts from the existing quarry which have not been specifically identified. For cumulative effects see comment 15 and 77.	Agree to disagree on the definition of baseline conditions. Baseline represents the current conditions.	Earthfx has taken the current condition to represent baseline conditions for purposes of assessing the impact of the proposed expansion. This seems reasonable for purposes of assessing the impact of the proposed expansion but is considered incomplete with respect to assessing cumulative impacts for purposes of site restoration which proposes to maintain lowered groundwater levels. We remain in disagreement on this issue.

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	bedrock and overburden in proximity to the quarry. It is not clear what impacts the existing quarry has had on the hydroperiod of the nearby wetlands or whether these impacts have stabilized or are expanding. Clarification is required. Earthfx considers the current conditions to represent baseline conditions. The assessed impacts are based upon simulated changes from the proposed quarry expansion compared to current conditions. The simulation of impacts of the quarry expansion do not identify the cumulative impacts of the existing quarry and the proposed expansion. Cumulative impacts including the existing quarry should be identified.				
151.	The actual amount of water consumed at the Burlington Quarry is relatively small. Well over 90% of the water handled is returned to the local watershed.' How is the amount of water consumed at the quarry measured and what does it consist of?	Water enters the quarry primarily as rainfall and groundwater seepage but there is some inflow from ditches along Colling Road to the north. The amount discharged from the two quarry sumps is recorded. Differences between inflows and quarry discharge are due to evaporation and losses to groundwater, primarily beneath the quarry ponds. This mass balance is represented in the model, allowing us to match the quarry discharge in the model rather than specifying it as a measured value. Our match to the actual flows is good and improves in the later years when pumping was done continuously rather than on an as needed basis. This gives the model predictive power to estimate quarry discharge in the impact assessment scenarios.	Clarification provided. It remains unclear how much water is consumed within the quarry including the water removed within the washed aggregate and used for dust control.	There is no washing of aggregate at the Burlington Quarry. Minimal amount of water used for dust control as there is a state-of-the-art wheel wash that recirculates water on-site.	Clarification provided on the amount of water consumed by the quarry. No aggregate washing is said to occur at the Burlington quarry and water used for dust control is described as 'minimal'. No quantity of water used for on-site dust control was provided.
152.	Some discharge from Quarry Sump 0100 is diverted, via gravity flow, to the Burlington Springs Golf course for use as irrigation under a separate permit.' How much water is diverted to the golf course and how much is diverted to the tributary to Willoughby Creek?	There are no measured records of water diversion for golf course irrigation. The Quarry and Golf Course have been collaboratively using water for decades. There is a weir that can be controlled to raise stage in the pond, thereby feeding the golf course ponds. Flow is measured at SW1, but it would be hard to estimate the actual losses from the available data.	Acknowledged that there is a data gap.	No response required.	Earthfx acknowledged that there are no data available on the amount of water diverted from the existing golf course irrigation ponds for golf course irrigation use.
154.	'Of the 156 homes visited, only eleven homeowners indicated that they were interested in participating in the monitoring program. Seven of the eleven private domestic water wells were accessible and, as a result, have been added to the current groundwater monitoring program (Figure 10.1)' A summary of results of the door to door well survey should be included as supporting information in the report. Copies of 26 well forms were provided in a separate information package received September 29, 2020. It is not clear whether these are all of the well survey results.	See response 12	See comment 12	See response to #12.	Not Resolved.
158.	Should the 'Contributing Area' shown on this figure also include the up-gradient areas under Hortonian Surface Runoff and be defined by the up-gradient groundwater table?	The figure is a schematic trying to show the concept of an increasing/decreasing contributing area (as defined by Whitely) to one type of Dunnian flow. This type of Dunnian flow occurs when the water table is near or at surface, often the case in the lowland areas. Two things occur: (1) the groundwater system can discharge to the soil zone creating saturated conditions and possible discharge to the surface; and (2) any rainfall within the "contributing area" will be lost to runoff. The position of the water table relative to land surface controls the rate of Dunnian runoff. You are correct in the sense that the Hortonian runoff shown in the figure would likely cascade downslope and reach the saturated area. At that point it would be added as run-on to the downslope cells. Some or all of that flow would be partitioned and emerge as Hortonian and Dunnian runoff. This is not to say that Dunnian runoff cannot occur in upland areas (i.e., areas with deep water table). Another type of saturation excess can occur in wet periods if sufficient infiltration has occurred and the soil is poorly drained and at saturation. Subsequent rainfall events produce Dunnian runoff.	Clarification provided.	RESOLVED	Clarification provided with respect to 'contributing area'.

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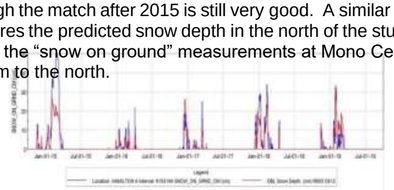
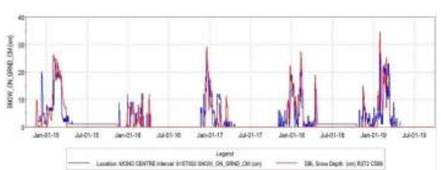
159.	'Analysis of preliminary model results often pointed to gaps in the previous analyses. The gaps were addressed by obtaining additional data or re-evaluating the data analysis and assumptions made in the conceptualization phases.' What is the impact of data gaps on the accuracy/reliability of the integrated model?	See Response 132. We acknowledge that there are gaps in the groundwater observations that Earthfx had no control over. Where we were able to obtain additional data, we did. For example, we went further afield to get precipitation. With regards to the calibration, the hydrologic model was calibrated against gauges with longer term data. The strength of the continuous integrated modelling approach is that the intermittent records available at other stations could still be compared against model output to verify the predictive capability of the model.	The remote locations of the climate stations do not add to the accuracy of defining on- site conditions. The data gaps for on-site monitors would likely pose further limitations to the accuracy of the model predictions. See comment 14, 81, 86, 132, 140, 191, 217, and 235.	The climate station question was addressed earlier. We believe that the model matched event based responses well despite the lack of an on-site station.	See Comment 140.
165.	The hydraulic conductivities shown on this figure are significantly higher than show on table 17.1. It is assumed this represents model layer 1. What impact do the higher hydraulic conductivities have on the model?	Generally, it was assumed that the fine-grained soils would be slightly more permeable than the parent material due to weathering. The values are used in the model to define the maximum amount of water that can infiltrate per day. Variations in hydraulic conductivity values above $3x10^{-7}$ (equivalent to 25.4 mm/d) have little influence on recharge and interflow since it is rare to infiltrate more than that amount on any given day (except along a cascade flow path or during snow melt events). The model is more sensitive to the lower values. Lower values will allow water to remain in the soil zone over several days and subsequent events can saturate the soil leading to Dunnian runoff. More soil water is also available for ET, leading to higher actual ET rates in the summer compared to more permeable soils.	Clarification provided.	RESOLVED	Clarification is provided with respect to surficial hydraulic conductivities shown on Figure 6.10.
166.	'Parameters values were estimated for many of the sub model processes, such as snowpack accumulation, snowmelt, and potential ET (PET) calculation. These were generally estimated from "book values" or the results of previous Earthfx investigations in the Halton/Hamilton area.' What effect does parameter estimation have on the model predictions?	The parameters mainly control the depth of the snowpack and, more importantly, snowmelt timing. There was not a lot of data to calibrate to and we did not do any comparisons for the report. The figure below, however, compares predicted snow depth in the south of the study area versus the "snow on ground" measurements at Hamilton Airport, 23.5 km to the south. The timing of the snowmelt is dead-on. Calibration of snow compaction factors may have produced a better match to the observed depth for the larger snow packs, although the match after 2015 is still very good. A similar figure compares the predicted snow depth in the north of the study area versus the "snow on ground" measurements at Mono Centre, 68.5 km to the north.  	Clarification provided.	RESOLVED	Clarification provided with respect to parameter estimation on model predictions.
171.	'A visual comparison of the observed and simulated values shows that a good match was achieved although, as noted in Section 5.3, there is considerable scatter in the static water level data because of the fractured nature of the bedrock; deviations are less prevalent below the Niagara Escarpment. A good match was also achieved across the model with the key study area groundwater flow patterns.' The 'considerable scatter in the static water level data' suggests local variation in the bedrock hydrogeology. The matching of water levels over the large study area suggests that the model is a good representation of area wide or regional conditions but is lacking in its ability to characterize local variations. See Section 19.5.7 Groundwater Calibration Conclusions, 5th paragraph, page 546. A discussion	The local variations are likely due to proximity (or distance from) discrete vertical and bedding plane fractures. We tried to represent the overall effect of these features, but the exact location and properties of the fractures are unknowable. Overall, our goal was to represent the likely impact of the quarry expansion across the area, including kilometers of streams, wetland complexes, and multiple bedrock and overburden units; we did not attempt to predict the response at individual fracture locations.	The difficulty of predicting response in individual fractures is acknowledged. The impact of this on model predictions should be identified with respect to the reliability and/or the representativeness of the computer model simulations of actual site conditions.	The local response in a single vertical fracture is of less importance than the water level response patterns observed with distance from the quarry face as discussed in detail in our Nov. 2021 JART meetings.	Earthfx attributed the 'scatter' in static water level data to the presence of local fractures. Earthfx acknowledged that *'the exact location and properties of the fractures is unknowable.'* However, Earthfx '*tried to represent the overall effect of these features*'. Earthfx stated that 'the *local response of a single vertical fracture is of less importance than the water level response patterns observed with distance from the quarry face*'. This may be true from a groundwater modelling perspective at a regional scale of analysis. It is my view that, on a site specific basis, the local response of an individual fracture is of paramount importance within an environment dominated by fracture flow. The limitations of the predictive capabilities of the computer model with respect to predictions on individuals down-gradient wells is important to recognize and has not been acknowledged.

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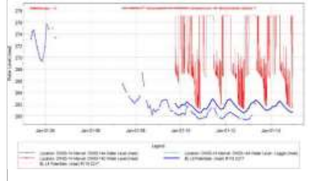
	is required in the report on the significance of the 'considerable scatter in static water level data'.				
175.	'Additional calibration analysis was focused on matching transient responses at individual local wells, and in particular, the observed patterns in water levels between the upper and lower units and their influence on wetlands and water supply wells.' Was this additional calibration analysis extended over the study area or confined to the immediate area of the proposed quarry extensions?	As was noted in earlier answers, the exposure of the lower fracture zone at the quarry face causes a unique condition that enhances the head differences between the shallow and deep system. Matching this local response required modification of hydraulic conductivity values used in early versions of the model and the addition of vertical fracture zones. Away from the quarry face, the head differences are small and various combinations of vertical and horizontal hydraulic conductivity values would produce reasonably similar heads. Matching the head profile with distance from the quarry face illustrates that the model is closely matching the observed and expected effects.	Clarification provided.	RESOLVED	Clarification was provided with respect to additional calibration in the model.
180.	'Numerous additional examples of each of these water level patterns are included in Section 19. The numerical model universally replicates the patterns, indicating an excellent calibration to the observed effect of the existing quarry. The close calibration to these commonly observed patterns confirms that the model can accurately predict the future effects of the quarry extension.' The model appears to generally match the observed hydrograph patterns although the computer simulations often either underestimate or overestimate the water levels compared to observed water levels. See Figure 6.24, page 149. What is the significance of this?	"Excellent" calibration should be taken in context of the difficulty in creating and calibrating an integrated transient model that produced a good representation of shallow surface conditions in a fractured bedrock environment overlain by a variably fractured till using interpolated climate data. We are unaware of any similar level of integrated quarry modelling in Canada.	It would be useful to put into context the limitations of the model simulations.	As far as we are aware, this is the first model in Ontario to replicate the seasonality in the water level response with distance from the quarry face. The match to this complex response is excellent.	Earthfx has described this model 'As *far as we are aware, this is the first model in Ontario to replicate the seasonality in the water level response with distance from the quarry face*'. No limitations of this model were provided in response to the comment.
181.	The predicted water levels in shallow monitors MP16 and MP6 show similar seasonal patterns although there is a time phase shift from the observed water levels. What is the significance of this time shift?	See Response 179	Comment referred to Comment 179 which refers to Schedule D, response to MNRF. It remains unclear where Scheduled D is as it is not labelled as such in the accompanying material to the JART Hydrogeology Table. It is speculated that Schedule D is Wetland Characterization Summaries. Clarification is required.	Correct.	Clarification was provided with respect to Schedule D. Reference to comment 179 by Nelson. JART Table comment number 179 is provided by Conservation Halton. Response to the issue of hydrograph phase shift is provided in 8 MNRF Table Response Section 4 PDF page no 1023, item 7. Clarification has been provided.
183.	'Water levels in this wetland are always higher than the water table (shown as the Layer 2 potentials in Figure 6.33).' Figure 6.33 appears to show hydrographs of measured and simulated water levels of the water table at MP33. Wetland water levels, for comparison, should be shown on this figure.	The potentials in Layer 1 at this location represent the simulated water levels in the shallow MODFLOW lake used to represent the portion of the wetland assumed to have standing water. These levels should be comparable to MP33. The heads in Layer 2 are assumed to represent the water table.	Water levels within MP33 have not been confirmed to represent wetland (pond) water levels. The hydrograph for MP33, as provided in S. McFarland Witness Statement, 2010 (Attachment D.1, pdf page 787) shows water levels in MP33 below ground level. It is therefore presumed that the water levels within MP33 represent the groundwater table. The simulated water levels of Layer 2 on Figure 6.33 representing the water table, do not correlate well with measured water level for MP33. Clarification is required.	As discussed in our MNDMNRF response (March 2021), the minipiezometers are all approximately 1 m deep and therefore straddle the soil zone and weathered till. This is a higher elevation than the center of Layer 1, and will respond differently.	No surface water gauge exists at MP33 to confirm wetland water levels for comparison to simulated MP 33 water levels.
184.	Typographic error, 'MNRF Wetland 1301' should read 'MNRF Wetland 13031'	Comment noted.	Typographical error noted. It is assumed that a correction will be made.	RESOLVED	Typographic error is acknowledged.
185.	'The observed water levels in the wetland pond are nearly 10 m above the measured water table in monitor OW03-19C (Figure 6.34), confirming that this a highly perched wetland'. This location is elevated with an overburden thickness of 9.9 meters which is largely responsible for the perched wetland condition. A discussion is required whether this is typical of the majority of wetlands within the study area.	MNRF Wetlands 13031 and 13032 are a bit unique because they are located in depressions on top of topographic highs associated with the Water down Moraine. Other wetlands are located in the lower lying areas between the ridges. The topography shown in Figures 6.28 and the section through the wetlands (Figure 6.32) were meant to highlight this. An extensive discussion of the shallow wetland response is included in our response to the MNRF comments. Copies are provided in Schedules B, C, and D.	Clarification provided. It is not clear that the wetlands with shallow groundwater instrumentation installed by Tatham are perched as indicated in the Wetland Summaries. Examination of hydrographs of the shallow groundwater monitors installed by Tatham provide evidence contrary to the wetland descriptions as perched and isolated from the groundwater system. Schedules B, C, and D referred to are not labelled in the materials provided with the JART Table. Clarification is required.	The following schedules were noted: Schedule A: MECP response matrix Schedule B: Wetland Characterization Schedule C: Watercourse Characterization Schedule D: Earthfx response to MNDMNRF	Earthfx has acknowledged that '*MNRF Wetlands 13031 and 13032 are a bit unique because they are located in depressions on top of a topographic ridge associated with the Waterdown Moraine. Other wetlands are located in low lying areas between the ridges'.* Earthfx has not acknowledged the Tatham water level data indicating hydraulic connection between the wetlands and the shallow groundwater system. See comment # 13, 14, 99, 197, 204, and 266.
190.	The model was run for a ten-year period (WY2010 to 2019) and calibrated to regional and local observation data collected during this time.' Were there actual measured water level data from the property throughout this period and especially during periods of drought and wet conditions from which simulations were made? Does this baseline analysis incorporate the impacts of the existing quarry? A discussion is required on how appropriate calibration to local and regional water well data may	We have discussed the gaps in data in previous answers. Figure 19.23 presents a typical observation hydrograph with gaps in the measurement periods. The 2017 drought was missed. 	The water well record information spans a large time frame well beyond the period of time that was simulated with the model. Since the model predictions were calibrated against the water well data set, it is important to put the model predictions for the regional characterization in this context with a qualifier regarding the reliability and accuracy of the model predictions.	This question is redundant as it has been asked and answered several times. The steady state calibration demonstrated the model response on a long term regional basis and the level of calibration is consistent with similar models.	Earthfx has stated that *'The steady state calibration demonstrated the model response on a long term regional basis and the level of calibration is consistent with similar models.'* Earthfx has not recognized any limitations to the model predictions due to the inherent variations in the water well data base. Earthfx has not recognized limitations of the model predictions for site specific predictions of impacts on individual down-gradient wells.

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	be for purposes of capturing the impacts of the existing quarry even though the quarry has existed since 1953. Well record data would span this time frame. How would these data be representative of impacts of the existing quarry which was slowly expanding over this period of time? Would the well data be representative of the modeled climatic period of 2010 to 2019?	 Yes, the baseline analysis incorporates the impacts of the existing quarry. We started the model assuming the topography, quarry pond configuration, and water management consistent with current conditions. As noted in earlier responses, the site data and MECP data sets are generally non- overlapping. That said, early on in the study, we tried separating populations of wells by time period to see if any patterns could be discerned. This exercise was generally unsuccessful because (1) general noise in the data (e.g., natural seasonal and inter-annual variation), (2) the lack of sufficient number of wells and good spatial coverage within decadal grouping (see figure) needed to interpolate regional surfaces for comparison.			
191.	'The exceptionally long model run times and model stability challenges required practical model management solutions. In some cases, the long model runs were completed as two simulations spanning the 10-year assessment time period. For example, the first 5 years of the baseline scenario was completed as one continuous simulation, with an emphasis on the assessment of the Golder monitoring data. The second part of the baseline assessment started in October 2014 and covered: the WY2015-WY2016 drought period (including a Level 2 Low Water Advisory), the WY2017 wet period, and finally, The WY2018-WY2019 new data collection period.' What impact does the on-site data gap have on the computer model simulations?	The advantage of our continuous modelling approach, using multi-year simulations with a daily time step, is that we can compare model results with the available streamflow and water level data even if the data cover short periods and there are gaps. Obviously, it would be better to have long, gap-free data, but we can make good use of what we have. The continuous model can be compared to continuous or intermittent manual or logger levels.	The continuous modelling approach cannot compare model results to groundwater data that is missing. What impact does the on-site groundwater data gaps have on the computer model simulations? See comment 14, 81, 86, 132, 140, 159, 217, and 235.	We respectfully agree to disagree. Please refer to comment #20.	Earthfx does not recognize or specifically identify limitations to the modelling resulting for gaps in on-site groundwater data.
193.	'At any location in the vicinity of the quarry a private water well could be drilled to the Layer 8 fracture zone and would have up to 22 m of available drawdown' Available drawdown has been used as a potential measure of possible available groundwater. This does not take into consideration the aquifer yield or water quality. Flow profiling completed by Golder in 2004 indicates that the Amabel aquifer has diminishing flow with depth (See Figure A8 and A9 page 434 and 435 respectively of Earthfx hydrogeological report). This suggests that despite available drawdown, little or no additional groundwater supplies may be available at deeper levels within portions of the Amabel Aquifer. Deepening wells may therefore not be a viable option for restoring water supplies to private wells. Private residences along Cedar Springs Road near the northwest portion of the western extension are located at surface elevations of about 254.0 and 545.0 mASL compared to the base of the proposed quarry excavation of 252.5 mASL which represents the lowermost portions of the Amabel Formation. What impact would this have on available drawdown from the Amabel Formation?	MECP wells are completed across a range of depths indicating that water is broadly available. It is expected that the lower part of the formation will yield groundwater of good quality water and sufficient quantity for domestic supply.	The Earthfx report has not acknowledged evidence which suggests that deepening of private wells in some areas may not necessarily provide significant addition well yields. Water quality information from the lower portions of the Amabel formation and the underlying Reynales and Cabot Head formations is lacking. This is critical in determining suitability of groundwater from these zones for drinking water purposes if deepening of wells is to be considered a viable option for mitigating the impacts of the proposed quarry extension. The Earthfx report has also not acknowledged the fact that a number of wells along Cedar Springs Road are obtaining water from bedrock zones near or below the base of the proposed quarry extension. It is quite possible that a number of these wells are obtaining water from a near surface intervals that rely upon up-gradient water percolating though the bedrock intervals that are to be excavated.	Please refer to response #6.	The recently provided water quality data in Schedule 1 attached to Nelson's response to the JART Hydrogeology Table of comments, suggests poorer groundwater quality occurs at depth near the bottom of the existing quarry elevation and below. See comment #7 and 84 above. Earthfx does not recognize the potential for poor water quality within the lower portions of the Amabel Formation or the potential for lower well yields. This issue remains unresolved.
195.	'The Medad Valley is an interesting setting, for Figure 7.20 shows that there is groundwater discharge to the soil zone along the flanks of the valley, yet the main stream in the centerline of the valley is leaking water to the groundwater system (Figure 7.21). This demonstrates that the incised Medad wetlands and streams are somewhat isolated	Access to the Medad Valley was limited, so there are only flow measurements at the gauges for comparison. The map needs a bit of explanation, since it portrays the average of stream leakage over the simulation period. Areas of dark red on the map tend to exhibit heads that are always higher than stream stage and net leakage is from the aquifer into the stream	Clarification provided.	RESOLVED	Clarification was provided in Nelson's original response by way of explanation of the computer simulations. Clarification was provided regarding the available data as follows: 'Access *to the Medad Valley was limited, so there are only flow measurements at the gauges for comparison.* '

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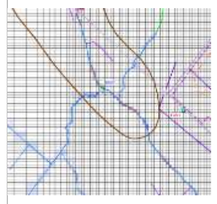
	from, and functionally different than, the streams and wetlands of the upland plateau (where the quarry is located).' What measured field data are there to support the conclusion that the main stream in the Medad Valley is losing water?	(first figure below). Areas of dark blue on the map exhibit heads that are always lower than stream stage and net leakage is from the stream to the aquifer (second figure). Reaches with lighter shades of reds and blues are areas where heads and stage reverse over the simulation period and leakage in or out varies over time (third figure).			
197.	'There are 24 wetlands within the study area (locations are shown in Figure 7.22). Detailed feature- based water budgets were calculated to analyze the inflows and outflows to 22 of these local wetlands.' Of the 22 wetlands within the study area, there appears to be groundwater shallow instrumentation only at five wetlands SW5, SW11, SW12, SW13, and SW16 for purposes of water budget analysis. How were water budgets completed for the remaining wetlands where there was no shallow groundwater instrumentation? Do the water budgets represent average, conditions or were drought and wet conditions considered?	The water budgets were prepared using simulation period averages of all PRMS and MODFLOW inflows and outflows. The flows were averaged over all cells falling within the polygons defined by the wetland area. The purpose was to compare the flow terms under each scenario to see how they change and re-balance under the different conditions. Water budgets for the instrumented wetlands are presented in the Tatham report. Please also refer to Response 5 and 14	See comment 14.	See response to #14.	Water budgets completed for wetlands that were not instrumented by Tatham were simulations. Earthfx does not recognize the shallow groundwater levels measured by Tatham as indicative of groundwater discharge conditions representing hydraulic connection between the shallow groundwater system and the overlying wetlands. Clarification provided regarding water budgets but issue of hydraulic connection between Tatham monitored wetlands and shallow groundwater system remains unresolved. See comment # 13, 14, 99, 185, 204, and 266.
199.	How was the level of detail generated for this figure where there are widely dispersed data control points or monitoring locations?	As noted in the caption these are average <u>simulated</u> values. The model computes stream leakage, surface discharge, overland runoff, and groundwater leakage at every cell in the model grid. The daily cell-by-cell values were averaged over the simulation period. You are probably more used to model results presented as coloured rectangular cell values (see below); we used a new VIEWLOG option to colour the stream segment crossing the cell based on the cell value. 	Clarification provided.	RESOLVED	Earthfx clarified that the details shown on Figure 7.21 were simulations.
201.	The water budget inputs do not appear to match the outputs. Please clarify	The wetland water budgets should nearly close. There are round-off errors due to: Change in storage. The lake or soil zone may have more or less water remaining in it at the end of the assessment period Mass balance error. There can be a small mass balance error (2-3%) over the simulation Precipitation and ET directly in/out of streams calculated but not tabulated here (usually small) The SW and GW models are solved iteratively, with the surface water system solved first and then the GW model, so there is potential for small discrepancies Internal transfers between processes After further investigation, the key problem turns out to be the way the polygon was drawn and the cells selected. For example, the polygon for Wetland 9 missed two cells that the stream touched but were not included in the summation. Hortonian and Interflow to streams was underreported by 10% because of this. This would account for the difference between those terms and stream pickup through the wetland. We tried hard to be careful not to miss any cells (see the selected cells versus the polygons for the two small wetlands (10 and 11) but may have missed some. 	A summary table showing water inputs compared to outputs would be useful in assessing the water budget analysis.	Earthfx feels that the presentation of the water balance parameters was adequately presented.	Earthfx responded that there are roundoff errors in the water budgets due to storage. Earthfx declined to add a table summarizing the inputs and outputs of each water budget to facilitate the peer review.

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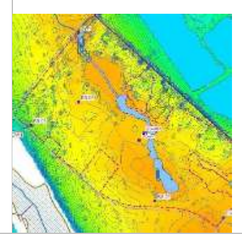
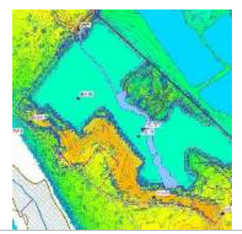
203.	'The Baseline surface water analysis demonstrates that, while there are some interactions between the surface and groundwater systems, they are frequently limited by the regionally extensive, and low permeability, Halton Till.' The Halton Till is recognized as consisting of relatively fine grained materials. However, no consideration has been given to the pump test results completed by Golder (2010) showing a response in the overburden materials presumably consisting of Halton Till to pumping test of the underlying Amabel bedrock. The field program completed for this investigation has not addressed the evidence from the Golder pump test results. An explanation of the Golder data and test results should be provided.	Golder (2006) states that "As shown on Figure 18, no water level response is observed in the shallow overburden sediments and pockets of standing water. This indicates that there is essentially no hydraulic connection between surface water in the wetland and groundwater in the underlying bedrock during the testing period. This assessment is further supported by observed monitoring data from Cluster I and 3 which are presented in Figure C-3 and C-4 respectively in Appendix C. Some of the C series wells responded to the pumping tests. These wells are drilled to top of bedrock and therefore would respond differently than wells screened solely within the overburden. Most of the C wells showed no response. As in the bedrock, there are likely some vertical fractures penetrating the till. This would allow heads to respond to recharge events, but it does not mean that there is significant flow across the unit.	See comments to response 9, 13, 29, 30, and 99.	The reviewer noted in comment #13 that "the lack of response in the wetland water level and shallow mini-piezometers is provided as evidence of hydraulic isolation of the wetland from the underlying bedrock during the pumping tests." The reviewer blames inadequate well construction for the lack of response" Earthfx continues to disagree with the reviewer's position.	Earthfx does not recognize the uncertainty of the hydrograph data related to previous pump tests conducted by Golder in 2004 and 2006. Questions regarding the construction of shallow groundwater monitors used by Golder in the pump tests were not resolved with the completion of new shallow monitors for the pump test completed for the current investigations. Issue remains unresolved.
204.	"None of the wetlands in the immediate vicinity of the quarry receive significant groundwater inflows.' How can this be determined with any certainty without instrumentation and monitoring of both groundwater and surface at each of the wetlands? Only five of the 22 wetlands have groundwater instrumentation installed for this investigation. Clarification is required.	This section is summarizing the results of the simulations which used property information from testing and monitoring at the five instrumented wetlands.	This comment should be qualified to include 'based on the results of computer simulations'.	Comment noted.	It is acknowledged that the conclusion by Earthfx that *'none of the wetlands in the immediate vicinity of the quarry receive significant groundwater inflows'* is based upon simulations. The field data collected by Tatham on selected wetlands suggests the potential for groundwater contribution for those wetlands monitored by Tatham. Earthfx does not acknowledge this potential or provide an explanation of these results with respect to groundwater contributions to the wetlands. See comment # 13, 14, 99, 185 ,197, and 266.
205.	'Near the existing quarry that available drawdown is reduced, but many existing wells are in close proximity to the quarry, and yet have been providing suitable water supply for many years.' Evidence to support the conclusion regarding suitable water supply for wells in close proximity to the existing quarry should be provided.	The observation being made here is simply that adequate water quantity has not been a problem in the quarry vicinity despite ongoing operations at the quarry and climate variability. It is recognized that additional drawdowns will likely occur as a result of the quarry extensions. This is discussed in Chapter 8. Please refer to the well survey discussion for more information on local water supply.	This appears to be anecdotal as opposed to evidence in the form of examples of successful well deepening and/or replacement.	We agree to disagree.	No further supporting information was provided by Earthfx to support their contention that *'Near the existing quarry that available drawdown has been reduced, but many existing wells are in close proximity to the quarry, and yet have been providing suitable water supply for many years.'* This contention by Earthfx is insufficiently supported with field data. The well survey completed in support for this application had very few responses to support this contention by Earthfx.
206.	However, the off-site discharge will continue as per the conditions of Nelson's PTTW and ECA.' There is a recommendation to increase the discharge volume for Sump 100. Tatham page 92 last paragraph. This is contradictory to the above statement. No assessment of the impact of this increase in pumping on downstream areas has been completed to support this increase in pumping. An assessment of the impact of the increase in pumping on downstream areas is required to support this increase in pumping.	The model simulated the discharge volumes for the expanded quarry in a similar manner as the baseline conditions where discharge was triggered based on the elevations of the water in the sumps. Thus, discharge was increased automatically in the model due to expansion of the quarry and the assumed drainage of water (precipitation and groundwater inflow). Accordingly, the assessment of the impact of the increase in pumping on downstream areas has been completed.	The statement in question is misleading as it implies that the sump discharge will continue as in the past.	Please note that the regulatory agency is the MECP and Nelson will be required to obtain MECP approval (amendments to the active PTTW and ECA) prior to increasing pumping rates. The expansion does not require amendments to the existing approvals, but Nelson believes that amendments will improve the pumping conditions of down gradient systems (mimic natural conditions)	Contrary to the statement by Earthfx *'However the off-site discharge will continue as per the conditions of Nelson's PTTW and ECA'*, the recommendation by Tatham (page 92) to increase the off-site discharge through quarry sump 0100 suggests otherwise.
207.	'For the western extraction area, the existing sump (0100) will continue to operate and discharge water to the Collins Road roadside ditch and into the Weir Pond. The existing golf course irrigation ditch and pond will be relocated to an area outside of the extraction area but inside of the license boundary to replicate the artificial groundwater mound they currently create.' Has the groundwater mound beneath the existing irrigation ditch and pond been confirmed with field data or is it only assumed to exist? If the Halton Till limits surface and groundwater interaction as postulated above, the proposed infiltration pond may not provide significant recharge to the underlying aquifer. Please clarify	The baseline simulation indicates that heads would be elevated in the vicinity of the golf course ponds, Under Scenario P3456, the mound would be shifted to underneath the infiltration pond (see figures below). The observation data covered a limited period and wells were not positioned to detect mounding. Seepage out of the infiltration pond is higher because it is excavated to the weathered bedrock. The model simulates higher average seepage by about a factor of 6.  	See comment 94.	See Comment 94.	The infiltration from the irrigation ponds has been simulated. No supporting field data was provided. See also comment 94.

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208.	'The Level 2 Assessment surface and groundwater issues are fully addressed by the integrated model.' The Level 2 assessment has not addressed water quality issues with respect to potential impact of the quarry on water quality discharge as surface water and potentially being recharged back into the aquifer through an infiltration pond(s). The drinking water quality implications of this have not been addressed in the assessment. Potential sources of contamination affecting surface and groundwater quality have also not been addressed in this assessment. The nearby high pressure oil pipeline along the southern side of Collins Road and partially beneath the wetland adjacent to SW1 and the weir to control quarry discharge water, presents a potential water quality risk to the quarry operations. (See Site Plan Sheet 1 of 4 and Explotech Blasting Report page 19). A more complete analysis of water quality issues is required.	Please refer to Response 7 and 8.	See comments to response 7 and 8. The specific issue of a potential high pressure oil pipeline leak into the quarry and the nearby Sump1 has not been addressed.	Any leaks from the oil pipeline is not the responsibility of Nelson. If the sumps contained oil from an oil pipeline leak it would be very evident in the sumps and Nelson would be required to cease pumping. Please consult with the pipeline operator for their emergency response plans.	No details beyond ceasing pumping of the quarry sump 0100 were provided to address the potential for a pipeline leak resulting in contamination of the on-site discharge ponds and the resulting risk to down gradient wells from subsequent sump discharges following such an incident. Earthfx has referred the reviewer to the pipeline operator for their emergency response plan. Concern remains regarding the potential for down gradient impacts on private wells from subsequent quarry sump discharges from a potential pipeline leak into the on-site quarry sump. Questions remain how this will be handled on-site.
210.	Right Hand Column - Level 2 Assessment Needed?, 3rd row 'Limited potential for water quality effects as groundwater dewatering will maintain flow directions into the quarry.' There is no information provided in the hydrogeological report to support the above statement. Clarification is required.	Please refer to Response 7 and 8. Water quality monitoring is discussed in the AMP. As noted, the quarry forms a local groundwater sink and the general direction of flow in the quarry vicinity is inward into the quarry. Accordingly, contaminant spills within the quarry or close to the quarry face will be drawn in to the quarry.	It is acknowledged that the quarry will form a local groundwater sink. It is anticipated that contaminant spills will be contained within the quarry. It is not clear how contaminants from spills or introduced from surface runoff will be prevented from being discharged through the quarry sumps.	The quarry is currently a local groundwater sink. As per the existing ECA, Nelson complies with the Operations Manual (Spill Contingency and Pollution Prevention Plan, revised February 6, 2019) which includes the contingency plans and procedures for dealing with potential spill, bypasses and any other abnormal situations.	Earthfx refers to 'Spill Contingency and Pollution Prevention Plan, revised February 6, 2019. This document was appended to the JART Natural Heritage Table. It remains unclear from this document how contaminants from spills or introduced from surface runoff will be prevented from being discharged through the quarry sumps. See comment 209.
216.	Up to 14 m or more drawdown predicted using equivalent porous media assumptions in model. Pumping tests (west extension area Well BS-07 and BS06) and well flow profiling in south extension area (S. McFarland Witness Statement Sept. 2010 PDF pages 284-286) show significantly different hydraulic conditions within short distances. These results question the reliability of the model to predict local conditions. Please explain how the site variability impacts the model assumptions and the reliability of the model predictions.	The 14 m drawdowns within the quarry footprint are a result of dewatering the P12 quarry extension and are to be expected. The point of the figure is to show how far the drawdowns would extend outside of the quarry footprint. The question has been answered multiple times. There are unknowable local variations in hydraulic conductivity because of the fractured nature of the bedrock. What we did is use a reasonably conservative EPM assumption with mean values to represent he entire study area. We believe that in this way, the model was able to produce reasonably conservative estimates of the likely time-dependent drawdowns across the study area.	It is acknowledged that the model provides estimates of drawdown on local wells. Due to differences between actual site conditions and assumed conditions for purposes of computer modelling, qualifiers should be provided on the accuracy and applicability of the model predictions.	The monitoring and protection of the domestic water wells is regulated by the Ministry of Environment, Conservation and Parks (MECP). As noted, upon licensing a detailed water well survey will be completed to ensure that we have accurate information on the key receptors, such as well location, well depth, historical water issues (quality and quantity), available drawdown, etc. Until residents participate in this survey, additional information cannot be obtained. This work will be a condition of the ARA license as well as a requirement for any future ORWA applications to be submitted and reviewed by the MECP.	Earthfx has acknowledged that *'There are unknowable local variations in hydraulic conductivity because of the fractured nature of the bedrock'* Earthfx believes that *'the model was able to produce reasonably conservative estimates of the likely time dependent drawdowns across the study'* Earthfx has declined to comment on the impact of the site variability on the reliability of drawdown predictions at site specific locations.
217.	'The transient simulations through 2015-2016 provide insight into the effects of P12 during seasonal and interannual variation, including a Level 2 drought.' These simulations lack comparison (calibration) of predicted drawdowns to sites with measured groundwater levels during this time period. What is the impact of the lack of data for calibration of the model and on predictions of the model?	This question has been asked multiple times. The model was calibrated to streamflow, regional groundwater levels, and local response to pump tests and quarry advancement. The transient baseline heads were compared to Golder wells with observation data for earlier time periods. Although there were gaps in the observation data, the results for earlier periods demonstrate the predictive capability of the model. As an example, the figure below shows a hydrograph for Wetland 17 and Golder SG3. There is reasonably good agreement between the monthly staff gauge measurements and the daily stage. (This area is discussed further in Comment 220)	See comment 14, 81, 86, 132, 140, 159, 191, and 235.	Redundancy in questioning. We respectfully agree to disagree. Please refer to comment #20.	The issue of data gaps in on-site groundwater data on the model results was raised in other comments (comments. 14, 81, 86, 132, 140, 159, 191, and 235). This issue has not had a satisfactory resolution.
218.	'Under drought conditions there will, however, continue to be up to 20 m of available drawdown in the Amabel Aquifer. (Figure 8.21)' No consideration is given well productivity in assessing interference potential and groundwater availability. Available drawdown alone does not guarantee adequate water supplies. Well productivity and water quality should be considered in quarry impacts on private wells and the assessment of groundwater availability.	This has been asked multiple times. The point is that there is adequate available drawdown and deeper wells should not be affected. Affected shallow wells could be deepened to address those that go dry due to quarry impacts. There may be individual wells with construction-related issues or areas where well yield proves inadequate. Well operation issues can be mitigated.	See comment 193.	See response to #6 and #193.	See comment 193

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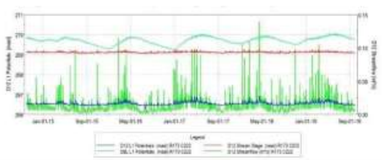
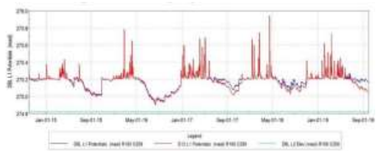
219.	'Figure 8.24 presents the average simulated streamflow loss to groundwater (blue areas) and the areas of groundwater discharge to streams (red areas). Little change is seen compared to the Baseline Conditions (Figure 7.21), except in the small streams in the wetland complex to the west of P12.' What is the explanation for change in stream flow in the small streams in the wetland complex to the west of P12? Has this analysis taken into consideration increased potential loss of water through the Halton Till due to till fracturing?	While most reaches are perched, because of variations in topography, some reaches in the west are gaining under baseline conditions (i.e. heads are higher than stream stage, see light green line in hydrograph near SW6 versus red line). Due to decreases in groundwater levels under P12 (see blue line), these reaches shift to losing reaches, In addition, increased discharge from the quarry raises stream stage in the west streams, thereby increasing leakage out of the perched reaches. 	Clarification provided.	RESOLVED	Clarification provided.
220.	'Under P12 conditions, water levels have declined by up to 5 m under Wetland 17. What is the impact of lowering groundwater levels by 5 meters on the hydroperiod of this wetland?	As discussed in the report, groundwater inflow into Wetland 17 comprises about 1.3% of the overall water budget, on average, under baseline conditions. The reduction in water levels will eliminate this inflow. The hydrograph shows simulated wetland stage during the drought period under baseline and P12 conditions at SG-3 (see Comment 217). The model indicates that wetland stage will drop in the summer in most years as much as 10 cm; however the stage in this wetland cell remains above the wetland base (green line). Each cells within the wetland complex will behave differently, this one is located in the center. The water budget looked at the average response of all cells. 	Clarification provided.	RESOLVED	Clarification provided.
221.	Water budgets were completed to analyze inflows and outflows to 22 local wetlands (locations shown in Figure 7.22).' Only five wetlands have shallow groundwater monitors installed for this study. How can water budgets completed without groundwater monitoring data and surface water monitoring data at each wetland be considered reliable?	This question has been asked multiple times. These are water budgets based on model simulations. Most items in a typical water budget including runoff, infiltration, canopy capture, ET, cannot be measured directly with simple instrumentation such as staff gages and piezometers. Instead, the model was calibrated to match water levels (stage and head) and streamflow and checked against other secondary indicators such as soil moisture. The assumption is that if measurable outputs are matched over a wide range of conditions, the partitioning of flows within the water budget is reasonable. The extension of this assumption is that if reasonable parameter values are used to represent processes in the monitored catchment, they can be used with reasonable confidence in the unmonitored catchments.	See comment 197.	See response to #197.	Same as comment 197.
223.	The baseline conditions are compared to the Phase12 conditions in this figure for layer 2 (Halton Till overburden) and Layer 8 (Lower Fracture Zone). The section line extends in a northwest-southeast direction parallel to a series of wetlands east of the southern extension. The baseline conditions show water levels in layer 2 at or slightly above surface at Wetland #17 with progressively lower levels toward the northwest as one approaches the existing quarry. The layer 8 water levels follow a similar pattern with relatively high groundwater levels at wetland #17 with progressively lower levels to the northwest as one approaches the quarry. The drop in water levels closer to the quarry are likely the result of the existing quarry dewatering. (See Section 5.3.3.2 Quarry Water Level Patterns). Consequently, the current hydrogeologic conditions beneath the wetlands between wetland #17 and the quarry appear to represent altered groundwater conditions. It is also possible that wetland #17 has been impacted by the existing quarry. The current or baseline conditions of these wetlands are being used to measure the impact of the quarry expansion. The simulated Phase12 conditions show a similar	This question has been asked multiple times. The analysis focused on how streamflow, groundwater levels, and wetland stage and related measures would be affected by quarry expansion.	See comment 148.	See response to #148.	See comment 148.

	pattern of decreasing water levels toward the northwest with water levels in both Layer 2 and Layer 8 being lower than baseline conditions. Please explain the appropriateness of using impacted wetland conditions as a baseline for purposes of site rehabilitation.				
224.	The water budget inputs do not appear to match the outputs. It would be useful to illustrate water budget inputs and outputs in a table format for comparison. It is not clear how GW Outflows and Inflows as a percentage of Total outflows were calculated. Please clarify.	See Response 201. In general, the matches between inputs and outputs are close. We recognize some problems where a stream crossed the edge of a wetland cell but was not accounted for. We divided the sum of all the outflows to groundwater by the sum of all the wetland area outflows and multiplied by 100. GW outflow terms included GW recharge, GW discharge to streams, and GW discharge to lakes. The other outflows included Soil ET, streamflow out, lake evaporation, Hortonian runoff out, and interflow/Dunnian runoff out. GW inflow terms included GW discharge (surface leakage), GW inflow from streams, and GW inflow from lakes. The other outflows included Net Precipitation, streamflow in, lake precipitation, Hortonian runoff in, and interflow/Dunnian runoff in.	See comment 201.	See response #201.	See comment 201.
227.	'The wetland water budgets confirm that the wetlands will leak a small amount more to the groundwater system under P12 conditions, but the effect of this change is so small that it cannot be measured in the field and will not change the overall water budget of the wetland.' Leakage of water from the wetlands into the groundwater system can only be confirmed for those wetlands with shallow groundwater monitoring data along with surface water monitors. What effect is this loss of water from the wetlands expected to have on the wetlands?	See Response 220. The response discusses Wetland 17 which is typical of wetlands close to the P12 quarry extension. The responses at all other wetlands were evaluated and formed the basis of our statement.	Comment noted. See comment 220.	RESOLVED	See comment 220.
230.	'Water is currently routinely diverted from the north quarry discharge pond, through golf course ditches, to the golf course ponds. This water is used for irrigation and a portion also likely infiltrates directly to the groundwater system. The proposed infiltration pond is intended to function in a similar manner to the irrigation ditches and golf course ponds, so as to help maintain the current surface and groundwater system patterns. In addition, based on the findings of this report, Tatham (2020), and Savanta (2020), pumping to the north and south (Quarry discharge locations Sump 0100 and 0200), must be maintained.' The infiltration capability of the irrigation pond is assumed and has not been confirmed with field instrumentation. A compelling case for the maintenance of pumping to the north and south (Quarry discharge locations Sump 0100 and 0200) is not supported with the analysis. A more complete analysis of the impact of the rehabilitation scenarios should be completed considering not only individual stream reaches but the sub-watershed as a whole.	Modelling analysis showed that leakage from the infiltration pond, presumed to be in contact with the weathered bedrock, would be much higher than for the golf course ponds. Pumping to the sumps would continue in order to: (1) dewater the existing quarry and the quarry extensions, and (2) to help maintain hydrologic and biologic features that have adapted to the higher flows. Predicted changes in discharge from the sumps were analyzed in each scenario. The comprehensive analysis of the rehabilitation scenarios (RHB1 and RHB2) considered potential impacts to groundwater and streamflow across the entire study area including the Willoughby Creek sub-watershed.	The computer modelling results are based upon a number of assumptions that have not been supported with field data. The results of the computer modelling are questionable and should therefore be considered as approximations and may not be reflective of actual impacts of the proposed quarry expansions. Qualifiers should be provided on the accuracy of the model predictions and the expected variation from local conditions.	We respectfully agree to disagree.	The model results should be considered approximations due to generalized model assumptions. Earthfx disagrees with providing qualifiers on the model results and the limitations of the model predictions. Issue unresolved.
231.	'Figure 8.40 also shows the average simulated change in streamflow. Increases in simulated flow occur at the Northwest sump (and in new quarry floor drains and the conduits carrying flow to the infiltration pond). Decreases in simulated flow occur in the Medad Valley, reaching a maximum of approximately $1.0x10.0^{-3}$ m3/s (1.0 liter/second) in the Medad creek immediately west of the P34 excavation.' What accounts for the decrease in flow to Medad Valley given the increase in flow of quarry discharge and subsequent discharge into the proposed infiltration pond?	The infiltration pond is intended to mitigate the effects of the quarry expansion as best as possible. Small changes in flows, groundwater levels, and groundwater discharge still occur across the study area despite the infiltration pond and are reflected in the small changes in flow in the Medad Valley.	It remains unclear what is responsible for the simulated decrease in flow to Medad Valley.	Please refer to Schedule 2. (Updated model results).	The Earthfx updated model results include further simulations on the performance of the proposed infiltration ponds and the impact on local groundwater and surface water resources. These results are similar to those presented in the Level 1 and Level 2 Hydrogeological and Hydrological Impact Assessment Report by Earthfx 2020. It remains counter intuitive that there will be losses in discharge to the Medad Valley under the Phase 3456 extraction compared to baseline conditions of the proposed quarry west extension when it is anticipated that there will be an increase in discharge to the proposed infiltration ponds compared to the discharge to the existing irrigation ponds.

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233.	Figure 8.42 shows the average simulated heads in Model Layer 6, representing the middle fracture zone in the Amabel aquifer and average simulated streamflow for the same period under Scenario P3456. Figure 8.43 shows the average simulated drawdown in Model Layer 6. The water levels rise rapidly with distance from the excavation, and exhibit less than 2.0 m of drawdown at a distance of 500 m from the active face.' The depth of excavation will extend to 252.5 mASL to near the bottom of Model Layer 7 almost to the top of Model Layer 8. Are the existing quarry sumps excavated into Model Layer 8? Will there be a need for additional sumps into model layer 8 to keep the proposed excavation dry and what impact will this have on groundwater levels in Model Layer 8 and local wells?	The sumps were assumed to be at the elevation of the quarry floor. Water levels will decrease in Layer 8 as well as Layer 6. The drawdowns extend out a bit (< 100 m) further in Layer 8 (red contours) compared to Layer 6. 	If sumps within the existing quarry are constructed with the bottom of the sump coincident with the quarry floor of 252.5 masl, it would be expected that drawdowns resulting from the quarry expansions would extend beyond the excavation limit in a similar fashion to the existing quarry which is shown on the East and West Calibration Sections for the south extension as shown on Figures 6.23 and 6.24 respectively. Figures 8.42 and 8.43 show average simulated heads and drawdown respectively for Layer 6 (Middle Amabel Fracture Zone). There are no hydro stratigraphic sections showing simulated drawdowns for Layer 8 (Lower Fracture Zone) in the area of the west extension. Figures 8.42 and 8.43 suggest that the proposed infiltration ponds are largely responsible for maintaining groundwater levels and mitigating the drawdown effects of the proposed western extension on down gradient private wells. There is no field data such as infiltration field testing to support the computer simulations that the infiltration ponds will provide such mitigation effects. The simulated drawdowns in Layer 6 as shown on Figure 8.43, extend into an area of the Medad Valley in which Layer 6 does not likely occur.	Please refer to the new pond simulations presented in Schedule 2.	The simulations provided in Schedule 2 referred to by Earthfx, do not address the question of the lack of a hydrostratigraphic section for layer 8 and the possible absence of layer 6 in the vicinity of the Medad Valley.
235.	'Wetland 22 is located between the P3456 extraction area and the existing quarry. This wetland had no change in the water budget compared to baseline conditions because it is perched year-round and there was no change in the contributing area.' This wetland is located relatively close to the existing quarry within about 100.0 meters, and appears to be perched, likely due to the impacts of the existing quarry. It is reasonable to assume that the proposed western expansion will not substantially change the conditions beneath Wetland #22 as quarry impacts on the groundwater system have already occurred. There is no water level data from the overburden in this area to confirm shallow groundwater table. The nearest monitors BS-03A and BS-03B are completed into the underlying bedrock. The hydrograph for BS-03A and BS-03B shown on the lower figure on page 395 (no figure no.) indicated very slight downward gradient from data logger data. It is unclear what the red line and red symbol on the hydrograph for BS-03 represents. Is this BS- 03A or BS-03B? Water level data in the wetland and underlying overburden along with the underlying bedrock is required to assess the water budget and potential impact of the proposed expansion.	For a discussion of this specific wetland please refer to the package of interdisciplinary tables integrating wetland and watercourse characterization and analysis has been prepared and provided in Schedules B and C. Additional water level data are being collected at this site.	Field data is lacking for water levels in this wetland and in the directly underlying overburden to support the conclusions of impacts from the proposed western expansion. SW37, was installed by Tatham April 22, 2020. The Tatham Surface Water report was issued in April 2020 and did not include any field data for SW37 located in Earthfx wetland 22 (MNRF Wetland 13200). See comment 14, 81, 86, 132, 140, 159, 191, 217.	Please refer to the updated AMP.	The AMP shows additional monitoring locations in the vicinity of Wetland 13200 (Wetland 22) however no additional monitoring data was provided. It is understood that the monitoring locations proposed in the AMP near this wetland will be monitored after their installation. It is therefore concluded that the water budget completed for this wetland is based upon simulations completed in the absence of site specific wetland data.
236.	It is not clear from water budget figures 8.62 to 8.69, how the percent groundwater outflow and inflow was determined. Please clarify.	We divided the sum of all the outflows to groundwater by the sum of all the wetland area outflows and multiplied by 100. GW outflow terms included GW recharge, GW discharge to streams, and GW discharge to lakes. The other outflows included Soil ET, streamflow out, lake evaporation, Hortonian runoff out, and interflow/Dunnian runoff out. GW inflow terms included GW discharge (surface leakage), GW inflow from streams, and GW inflow from lakes. The other outflows included Net Precipitation, streamflow in, lake precipitation, Hortonian runoff in, and interflow/Dunnian runoff in.	Clarification provided.	RESOLVED	Clarification provided.
237.	'Under P3456 conditions, current levels of quarry discharge will continue to pass through this pond. Diversions for golf course operations will no longer be necessary, however a portion of flow will be diverted to the newly constructed infiltration pond, which will locally support groundwater levels in a similar manner to the current golf course ditch and pond system.' The degree to which the existing irrigation pond is contributing to the groundwater system is questionable since Earthfx has concluded 'while there are some interactions between the surface and groundwater systems, they are frequently limited by the regionally extensive, and low permeability, Halton Till.' What is the impact of low permeability	This question has been asked multiple times. The purpose of the infiltration pond is to replace the golf course ponds that may have contributed to groundwater recharge in the area. It is assumed that the pond will be in good hydraulic contact with the bedrock surface and should provide higher leakage than the natural ponds with their accumulated sediments.	See comments 207, 116, 94, 18 and 6.	Please refer to Schedule 2. (Updated model results).	See comments 207, 116, 94, 18, and 6.

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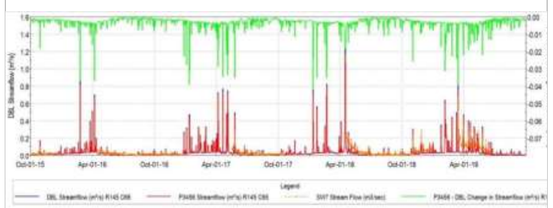
	Halton Till on the proposed infiltration pond? What is the potential for infiltrated water from the proposed infiltration pond to be intercepted by the underlying sand layer and the karst layer, Model Layer 4 and not reach the wells?				
238.	It is not clear from these figures how the percentage of groundwater inflow and out flow were determined. Please clarify	See Response 236	Clarification provided.	RESOLVED	Clarification provided.
240.	'The effects of P3456 development on the Medad Valley is distributed across this elongated feature. Figure 8.70 shows the areas where changes in groundwater discharge to the soil zone (seepage) will occur between the baseline and P3456 scenarios. (Values are presented on a cell-by-cell basis in m3/d). Summing those values from the start-of-flow-of Medad Creek to SW07 yields a net average decrease in seepage of 2.1 L/s at SW07. The hydrograph for SW07 (Figure 8.49) shows that the change is primarily a minor reduction in winter and spring peak flows.' Tatham measured average base flow at SW7 at 4.0 liters/second (Tatham page 10 Monitoring Location SW7, 2nd paragraph, 1st sentence). SW7 is located on Willoughby Creek immediately downstream of the confluence with the unnamed tributary to Willoughby Creek. As per the above, modeled net average decrease in seepage is 2.1 liters/second or just over 50.0% of the average base flow measured at SW7. The significance of this reduction in base flow should be addressed.	It should be noted that, except in 2019, Tatham pulled their loggers in December and replaced them in May, thereby missing much of the high flows. Our model was continuous. As we state, the larger change is in the winter and early spring. There is much less change in the summer flows. 	The projected reduction in base flow would have the most impact during periods of low flow within the summer months as stream flows are generally at their lowest during this period. Comment is required with respect to the significance of reduction in base flow during the seasonally low flow periods.	Please refer to Schedule 2. (Updated model results).	Earthfx has not commented on the significance of the simulated reduction in flow in Willoughby Creek.
241.	'The construction of the west extension has a minor impact on the Medad Valley. No water is diverted away from this natural discharge zone, but some water is discharged slightly to the north via north quarry discharge stream.' Tatham measured average base flow at SW7 as 4.0 liters/second. The reduction in seepage is calculated to be 2.1 liters/second at SW7. This is about 50.0% reduction in average base flow. The significance of this should be addressed.	See Response 240 The effects on this wetland are discussed in more detail in the package of interdisciplinary tables integrating wetland and watercourse characterization and analysis that has been prepared and provided in Schedules B and C.	See comment 240.	Please refer to Schedule 2. (Updated model results).	See comment 240.
242.	'The water levels rise rapidly with distance from the excavation, and exhibit less than 2.0 m of drawdown at a distance of 500 m from the active face.' Most of the homes along Cedar Springs Road directly down-gradient of the proposed quarry expansion are within 300.0 meters of the limit of extraction. What is the risk of interference to these wells from the quarry expansion and what is the potential for deepening wells on these properties to maintain well productivity and water quality? Please address this issue.	As noted, this is a groundwater discharge area and is not significantly sensitive to change.	The computer model does not appear to take into account the stratigraphic intervals providing water to the down gradient wells. Some of these wells appear to be located in areas of groundwater discharge from the lower Amabel. The possibility of deepening these wells and obtaining suitable additional water supplies is questionable. How will loss of water to these wells be addressed?	The protection of domestic water wells falls under the site's PTTW. Any amendments to the PTTW will require the approval of the MECP that no adverse impacts will occur as a result of the quarry operations.	Earthfx has not demonstrated that the private wells down-gradient of the proposed west extension can have their water supplies protected from impacts of the proposed west extension.
243.	'The basal Layer 8 lower fracture will maintain, on average, between 6 and 20 m of available drawdown in the aquifer (Figure 8.75). As a result, private domestic water wells, some of which are partially penetrate the Amabel Formation, could be deepened if necessary. The proposed groundwater monitoring program has been designed to ensure that there are no changes to the quantity or quality of private water supplies (Section 9.3).' What is proposed for existing private wells that do not have 5 meters of available drawdown to support their water supply or for wells that are poorly productive and cannot supply adequate supplies of water? Please address this.	This question has been asked and answered multiple times	See comment 242.	See response #24.2	See comment 242

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244.	'Under baseline conditions, none of the wetlands receive more than 3% of their total inflows from the groundwater system (Table 8.6). Under P3456 conditions, the P12 excavation has been filled with water and the water table has recovered to a new level consistent with the P12 lake. This recovery has restored a degree of groundwater discharge to the wetlands near P12.' How was groundwater inflow determined for wetlands under baseline conditions?	As per Response 236, we divided the sum of all the outflows to groundwater by the sum of all the wetland area outflows and multiplied by 100. GW outflow terms included GW recharge, GW discharge to streams, and GW discharge to lakes. The other outflows included Soil ET, streamflow out, lake evaporation, Hortonian runoff out, and interflow/Dunnian runoff out. GW inflow terms included GW discharge (surface leakage), GW inflow from streams, and GW inflow from lakes. The other outflows included Net Precipitation, streamflow in, lake precipitation, Hortonian runoff in, and interflow/Dunnian runoff in. Specifically, water budgets were conducted using an Earthfx GSFLOW post- processor to analyze the daily flows produced as outputs from the PRMS and MODFLOW models. MODFLOW fluxes were analyzed with an Earthfx version of the USGS Zone Budget tool. It processes all the direct cell-by-cell flow terms (e.g. groundwater recharge or stream leakage). Lateral flows are summed for all cells on the wetland boundary. Direct PRMS flows are also summed on a cell-by cell basis. Overland runoff and interflow required analyzing the cascade flow map to determine which cells have runoff leaving the wetland boundary and which cells receive runoff and interflow from upslope cells. Streams crossing the wetland boundaries were detected by analyzing the SFR2 input to locate stream segments entering and leaving the cells. Lake water budgets were saved on a daily basis and used to determine Lake precipitation, evaporation, and GW and streamflow inputs and outputs. The post-processor output was produced as a CSV file and pasted into an Excel spreadsheet to tabulate and combine flows to create the wetland water budget figures.	Same comment as comment 236.	Please refer to the updated AMP.	See comment 236. Clarification provided.
245.	'The effects of the quarry extension are small and distributed across the long Medad Valley wetland. SW07, in the northern section of the Medad, shows some gains and losses in base flow (Figure 8.43), but the largest change in flows at SW07 are a loss in peak flows, due to the increased buffering effect of the west extension (Figure 8.49). The changes in SW07 flows are so small that they will not be measurable in the field.' Tatham (p.10) measured average base flow at 4 liters/second in Willoughby Creek at SW7. The model predicts a loss of seepage of 2.1 liters/second. This suggest a significant loss of stream base flow. It is reasonable to assume that restoration of groundwater levels would restore most if not all of the loss in base flow. This would be the case with Rehabilitation Scenario 2 (RHB2) whereas Rehabilitation Scenario 1 (RHB1) would continue to maintain lower groundwater levels. Please address this.	See Responses 240 and 241. The loss is on an annual basis. Again, the model showed that flows would be affected mainly in the winter and spring not summer.	How does rehabilitation Scenario RHB1 address the loss of base flow to the Medad Valley? Also see comment 240.	Please refer to Schedule 2. (Updated model results).	See comment 240.
246.	'Scenario RHB1 represents a managed rehabilitation and it is assumed that discharge from the Sump 0100 will be ongoing to maintain dry conditions in the rest of the quarry area and to keep the P5 lake at the specified elevation of 255.5 masl.' How does RHB1 conform to the rehabilitation plan for the adjacent existing quarry?	RHB1 is a plan for the entire quarry and would replace existing rehab plans	No response provided	RESOLVED	Earthfx responded that the rehabilitation Plan RHB1 will replace the approved rehabilitation plan. There was no response regarding conformance of RHB1 with the approved rehabilitation plan.
247.	How does the retained consultant know that the infiltration pond will provide groundwater discharge to the deeper bedrock (Model Layers 6 to 8) and not short circuit groundwater discharge only to the shallow bedrock system (Model Layers 4&5 weathered/fractured Amabel) and Upper Bulk Amabel) before discharging at surface along the Medad Valley? Note the upper bulk Amabel (Model Layer 5) has Kh/Kv of 500:1 as indicated on page 105, which would favor horizontal flow over vertical flow. Has the model adequately accounted for this possibility?	As previously explained, water leaks out of the infiltration pond and forms a groundwater mound. As indicated in the model, heads rise in all layers.	It is implied that there is no preferential flow accounted for in the computer model to address this concern.	Please refer to Schedule 2. (Updated model results).	The model appears to predict a rise in heads of all model layers from the influence of the infiltration ponds. The Earthfx model apparently does not account for preferential flow of water or short circuiting of flow through fractures or certain layers.

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248.	'There are general decreases in flows within the existing quarry footprint and an overall decrease in the discharge from the Northwest sump. Decreases in simulated flow occur in the Medad Valley as a result, reaching a maximum of 5.2x10 -3 m3/s (5.2 L/s) compared to 3.6x10 -3 m3/s under Scenario P3456. Other streams in the east show small decreases in average flow compared to Baseline Conditions. Decreases in streamflow have been moderated compared to Scenario P12 due to the cessation of quarry dewatering at P12.' Why is there a decrease in flow in Medad valley of 5.2 liters/second under RHB1 when decrease in flow at SW7 is 2.1 liters/second under Scenario P3456 extraction? Why is there a larger decrease in flow in the Medad Valley as a result of rehabilitation Scenario 1 (RHB1) after extraction? Are these flows measured at different points?	These were differences in average flows measured at SW7 (Average flows were 0.0423 m^3/s for baseline, 0.0387 for P3456, and 0.0372 for RHB1). The difference between Baseline and RHB1 is 5.1 L/s while the difference between baseline and P3456 is 3.6 L/s. The higher decrease for RHB1 is mainly because there is less quarry discharge under this scenario, therefore less leakage from the unnamed tributary and subsequent pickup in the Medad near SW7, as stated in the report (see next comment).	It seems counter intuitive that there will be decreased flow under RHB1 compared to P3456 as it is proposed to continue pumping from the northwest sump as part of RHB1. An explanation is required why the flows from the northwest sump will be decreased for RHB1 from P3456. What is the anticipated reduction in flow to the unnamed tributary to Willoughby Creek from the Northwest Sump for RHB1? The reported decrease in flow in the Medad Valley of 3.6x10 -3 m3/s (3.6 L/sec) appears to contradict the modelled reduction in flow of 2.1 L/sec. See comment 240. Clarification is required.	Please refer to Schedule 2. (Updated model results).	See comment 240. It remains unclear why flows will be decreased under scenario RHB1 and decreased within the Medad Valley.
249.	'SW07 in the Medad valley shows some gains and losses in base flow, most likely due to changes in discharge from the Northwest sump that recharges the groundwater system as it flows through the karst feature.' SW7 gains and losses. How does this compare to decreases reported in Medad Valley above i.e., maximum 5.2 liters/second.	The 5.2 L/s is an average value. Figure 8.84 shows that there are decreases in the peak flows but base flows actually increase slightly. The small increase is due to the higher head in the RHB1 lake and added leakage to groundwater but the peak flows decrease due to less quarry discharge. This demonstrates why a model is needed because there are a number of opposing factors affecting flow in the Medad and it is impossible to intuit which is likely to dominate.	See comment 248.	Please refer to Schedule 2. (Updated model results).	See comment 248.
250.	'The wetlands are located at various distances from the existing quarry and the extension areas. Wetland 22 is located between the P3456 extraction area and the existing quarry. This wetland had no change in the water budget compared to baseline conditions because it is perched year-round and there was no change in the contributing area. Most of the other wetland areas are slightly more similar to baseline conditions than P3456 because of internal quarry configuration changes.' For wetland 22, the simulated water budget appears to rely upon model calibrations for validity without actual data collected from this wetland. Little is known of Wetland 22 (MNRF wetland #13200) due to a lack of monitoring data. Tatham indicated that surface water monitoring of this wetland will be established in the spring of 2020 with monitoring station SW 37 (Tatham, 2020, Table 39, page 81). No surface water monitoring data for this location are included in the Tatham report. The nearest groundwater monitor to wetland 22 is BS-03 which is about 100.0 meters from this wetland. A similar situation exists for wetland 21 located adjacent the north side of No. 2 Side Road. The nearest groundwater monitor location, BS-04, is about 150.0 meters from wetland 21. Quarterly surface water flow monitoring data was recorded at M33 at wetland 21. How does the lack of monitoring data for wetland 22 affect the reliability of the computer simulations of the water budget?	As previously discussed, the model calibrated model was checked and found to produce reasonable results at instrumented wetlands. Assuming that underlying conditions are similar, the response at the remaining wetlands was felt to be predictable.	The subsurface stratigraphy is shown to be variable and somewhat different in the vicinity of wetland 22 (Wetland 13200). The borehole log for nearby borehole BS-03 shows a sand and gravel layer underlying a surficial silty clay till. The sand and gravel layer is absent in other boreholes completed in the western extension area with the exception of BS-06. The soil stratigraphy of BS-07 in unknown as the drillers log has not been provided. Water level data from wetland 22 and the underlying overburden and bedrock is lacking. The computer simulations therefore rely on data removed from the wetland. The modelling results may therefore not provide a reasonable representation of wetland 22. A comment is required on the degree of reliability of the model predictions for wetland 22	Please refer to the updated AMP.	Earthfx has referred to the updated AMP to address the issue of the lack of data at wetland 22 to support the water budget analysis. No new water level data was presented in the AMP although it does call for additional monitors to be installed at wetland 22 (MNRF wetland 13200).
251.	It is not clear how the percent of groundwater inflow and outflow have been determined. Please clarify.	See Response 244.	See comment 236, and 244.	See response to #244.	See comment 236 and 244. The issue of how the groundwater inflow and outflow was calculated in the wetland water budgets has been clarified.

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252.	'From a groundwater perspective, the differences between P3456 and the RHB1 scenario are minor. Under RHB1, a small rise in the water levels in the modified quarry ponds has a minor but positive effect on the water levels in the vicinity of the private wells near the Medad Valley. Quarry discharge and operations are similar. In summary, the Level 2 analysis of available drawdown and wetland function conclusions, presented for P3456 (Section 8.7.7) is essentially the same for RHB1.' This indicated that the preferred rehabilitation option, RHB1, will have very similar impacts on the groundwater and surface water system as the phase 3 to 6 proposed western quarry extension. This condition is proposed to be maintained in perpetuity. The rational for maintaining pumping and the low groundwater levels is based upon perceived fish habitat impacts on two stream reaches currently artificially maintained by pumping. There is no analysis of overall impact on the local sub-watershed. A broader analysis of the impacts on the sub- watershed should be completed.	This report discusses groundwater conditions. There are a number of factors that make RHB1 a preferred alternative that are not discussed here. From a hydrologic/ecologic point of view, this is the preferred alternative because the flows to the fisheries are maintained. The distributed integrated model fully addresses overall impact on a sub-watershed scale. We specifically assess both local and distant surface water monitoring.	The main rational for maintaining the quarry discharge and pumping appears to be based upon perceived fish habitat benefit. The benefits of restoration of stream base flows to conditions more closely aligned to pre-quarry conditions does not appear to have been given consideration in the comparison of rehabilitation scenarios.	The rationale is based on recommendations from Tatham and GEI. The watershed and associated features have become dependent on water being discharged from the existing quarry and it is recommended that the current pumping regime be maintained.	No comment is provided on the rational provided by Tatham and GEI for continuing pumping after quarry closure. Justification in support of RHB1 has not be adequately provided from a water resource perspective. RHB1 would go contrary to the approved rehabilitation plan and the underlying rationale for the approved rehabilitation plan. RHB1 would maintain an artificially created situation that has not been demonstrated to provide the assumed benefits to the maintenance of groundwater supplies to down gradient private wells. RHB1 is contrary to Halton Region Official Plan policy.
253.	'Figure 8.106 shows the simulated change in average head in Model Layer 6. Only a very small area west of Phase 5 had a drawdown greater than 2 m, which was due to the elimination of quarry discharge and leakage to groundwater. Some residual drawdowns, less than 1.3 m, are noted in the P12 area, due to the flattening of the water table in the vicinity of the P12 lake. Most of the quarry vicinity showed a significant increase in heads ranging from 0 to 12 m, with the 2m rise extending out up to 630 m from the west side of the existing quarry. The predicted increase in groundwater levels should result in restoration of groundwater conditions. The overall impact of this on surface water and on local wells should be assessed and factored into the rehabilitation scenario assessment.'	Yes, from a groundwater perspective, this may be a better alternative. As noted previously, there are concerns related to cessation of pumping at the existing quarry and therefore the preferred alternative was RHB1. We evaluated both scenarios with the integrated model.	The benefits of increasing groundwater levels from RHB2 does not appear to have been considered in relation to the impacts of the existing quarry and the existing approved rehabilitation plan. The rationale for selecting RHB1 appears to be based primarily upon perceived impacts on fish habitat including unconfirmed fish habitat along the tributary to Willoughby Creek. The groundwater benefits and resulting improvements in stream base flow from RHB2 do not appear to have been given appropriate consideration when evaluating alternative rehabilitation scenarios. Clarification is required whether the RHB2 modelled streamflow scenario as shown on Figure 8.106 (PDF page 284) takes into consideration the removal of the weir at SW1 which controls the flow into the tributary to Willoughby Creek as well as the proposal by Tatham to redirect of external drainage from entering the existing quarry from north of the existing quarry to the drainage ditch along Collins Road ultimately feeding the tributary to Willoughby Creek. See comment 252	Nelson will not be removing the weir at SW1.	Earthfx has acknowledged that RHB2 may be a better alternative from a groundwater perspective. It is my view that insufficient consideration has been given to the impacts on groundwater and the restoration of water resource conditions that would more closely resemble pre-quarry conditions compared to RHB1.
254.	'Surface water flow in the upper reaches of a tributary of Willoughby Creek and the West Arm of the West Branch of Mount Nemo Creek will cease when the quarry discharge is discontinued, resulting in an adverse impact to downstream fish habitat compared to baseline conditions (See Savanta, 2020 and Tatham, 2020 for details).' Model simulation results in flows deceasing in upper reaches of Willoughby Creek and the West Arm of the west branch of Mount Nemo Tributary of Grindstone Creek when quarry discharge is discontinued. Model simulation shown on Figure 8.105 (page 283) indicate that stream flows within these stream reaches continues but at a reduced rate compared to baseline conditions as shown on Figure 8.106 (page 284). The model shows an increase in stream flows of most of the other streams in the area (Figure 8.106). The stream flow increases have been quantified in the next two paragraphs on page 285. An overall analysis should be completed weighing the benefits of the stream flow increases against the disadvantages of reduced streamflow in selected areas. (Note: The impact of these changes in streamflow is a fish habitat issue and requires fisheries expert input.)	Typo, you are correct, the text should have said decrease not cease.	Typographical error acknowledged. Assume correction to be made. Suggestion of an analysis of anticipated streamflow changes remains unanswered. See comment 253.	See response #253.	See comment 253. Earthfx acknowledged a typographical error that stated the flow in the Tributary to Willoughby Creek would cease when the quarry discharge is discontinued to state that the flow to the Tributary to Willoughby Creek would decrease when the quarry discharge is discontinued. The suggested analysis of the benefits of the streamflow increases from RHB2 was not responded to.

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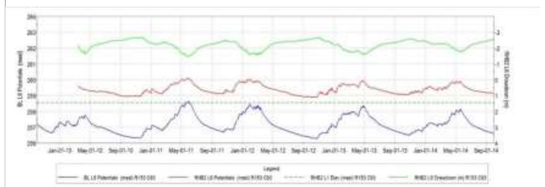
255.	'SW07 in the Medad valley shows very small gains in base flow, most likely due to cessation of discharge from the Northwest Sump that served to recharge the groundwater system as it flowed through the karst feature. Decreases in event flows reach a maximum value of 0.05 m3/s.' The simulated loss of seepage within Willoughby Creek downstream of the western expansion area was simulated to be 2.1 liters/second under the Phase 3456 extraction compared to current baseline conditions. Under RHB2 the quarry dewatering will cease and groundwater levels will increase up to 12.0 meters closest to the excavation. Given the large projected increase or rebound in groundwater levels under RHB2, it is not clear why there would not be a proportional increase or restoration of seepage in the Medad Valley as opposed to 'very small gains in base flow' at SW7 downstream of the proposed western expansion as shown on Figure 8.112, page 288. Please clarify.	This sentence is a bit unclear. With quarry discharge ceasing, there is no inflow into the infiltration pond. The lack of infiltration from the pond though is offset by leakage from the filled quarry lake so overall there is a very small increase in base flow. The event flows decrease because there is no quarry discharge and to SW1 and leakage from the karst feature.	The response suggests that model predictions show that leakage from the filled quarry under RHB2 provide slightly more benefits to groundwater recharge than the predictions of infiltration from the infiltration ponds. See comment 253.	See Schedule 2 for updated pond simulations.	See comment 253
256.	The surface elevation should be shown on each of these hydrograph figures representing each of the eight assessment points.	With the exception of GW1 (below) all heads are below land surface. 	Ground surface elevations on these figures would be helpful in visualizing and understanding the hydrogeological simulations.	Information has been adequately presented.	Earthfx indicated that all heads shown on the hydrographs in question with the exception of GW1 are below ground surface. The suggested editorial change on the hydrographs was not accepted.
257.	'Leakage below the final quarry lake contributes to the groundwater flow system and contributes to the higher heads outside of the quarry.' It is not clear how higher heads will be contributed to by the final quarry lake assuming that the lake levels will be slightly below the surrounding ground surface. As long as the water levels in the lake are maintained below the surrounding ground level, the quarry will act as a groundwater sink lowering groundwater levels in adjacent areas that occur above the lake level. Please clarify.	The comment is unclear from a hydrologic sense. Ground surface has nothing to do with groundwater levels. The quarry lake will be allowed to refill. It will reach an equilibrium where seepage in from the north, precipitation, lake evaporation, runoff in, and seepage to the south will balance. The lake becomes the local high point for the groundwater system across from Cedar Springs Road and heads slope down from the lake to the Medad Valley as per Figure 8.105.	Clarification provided. It is acknowledged that the lake will contribute to maintain groundwater levels down-gradient of the lake. Groundwater levels in up-gradient adjacent areas would likely not be affected by lake levels accept perhaps directly adjacent the lake. This assumes that up-gradient areas of the lake are upland areas contributing groundwater inflow to the quarry lake.	RESOLVED	Clarification is provided regarding the maintenance of groundwater levels from the quarry lake.
258.	'Surface water flow in the upper reaches of a tributary of Willoughby Creek and the West Arm of the West Branch of Mount Nemo Creek will cease when the quarry discharge is discontinued, resulting in an adverse impact to downstream fish habitat compared to baseline conditions (See Savanta, 2020 and Tatham, 2020 for details).' Figure 8.105 shows simulated flows within these stream reaches although reduced flow as shown on Figure 8.106. The model results therefore indicate that these stream reaches will continue to have stream flow albeit reduced flow and not cease totally as suggested in the above statement. It is acknowledged that these stream reaches will likely have periods of no flow during dry periods as was likely the case prior to quarry discharge being directed to these stream reaches. A more detailed assessment of changes to the sub-watershed should be completed to asses changes in the surface and groundwater flow regime and their impacts on natural heritage features and habitats.	Same as Comment 254.	See comment 253 and 254.	We are confident and can defend our assessment of potential impacts as simulated. We do not believe additional simulations are required.	See comment 253 and 254.

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259.	It is unclear how the groundwater outflows and inflows as a percent of total flows were determined from these figures. No wetland water budget was shown for wetland no.19 for comparison to previous scenarios for wetland no. 19. Please clarify.	This has been previously addressed.	See comment 236 and 244.	Clarification has been provided.	See comments 236 and 244.
261.	'The Level 2 impact assessment scenarios present a detailed and exhaustive comparison of the proposed developments to the baseline conditions. All pertinent aspects of the surface water and ground water system have been compared across a wide range of climate conditions.' The assessment scenarios provide a detailed comparison of water quantity issues. They do not address groundwater quality issues and therefore this should not be considered a complete assessment of quarry impacts. Water quality should be addressed in more detail.	A discussion of surface water quality is presented in Response 7 and 8	See comment 7, and 8.	See response #7 and #8	See comment 7 and 8.
262.	The long-term monitoring (including the monitoring of the 2005-2019 advancement of the south extraction face) provides a clear groundwater response that has been accurately simulated by the transient integrated model. The detailed field investigations, together with the simulation of this large-scale response, provides significant confidence in the assessment.' Although ground water monitoring data have been collected in the vicinity of the southern expansion area there are significant data gaps in the groundwater monitoring data. There is limited groundwater monitoring data for the western expansion area since boreholes were drilled between June 2016 and May 2019 and monitors installed between January 2019 and August 2019. Groundwater thresholds (i.e., quantity and quality) have not been established or discussed due to insufficient monitoring data to establish baseline conditions (see Page 315, Section 9.6.3 Groundwater Thresholds, 1st paragraph). The existing off-site irrigation ponds are thought to infiltrate water that originates to a large extent from the existing quarry discharge from the existing sump no. 100 and result in a groundwater mound beneath the ponds. There is no field data to support this conclusion. The feasibility of the proposed recharge pond should be confirmed with supporting field data.	This point has been raised multiple times and answered. There was a substantial effort to collect data in the vicinity of the proposed western and southern extensions. The southern extension benefitted from historic data collected as part of a previous quarry expansion study. We took advantage of the data to develop a very detailed model of the study area. The lack of a long period of record in the west does not detract the understanding of baseline conditions developed for the site. The infiltration ponds are discussed in numerous comments, above.	Acknowledged data gaps.	RESOLVED	Data gaps and the functioning of the infiltration ponds are discussed in various comments above.
263.	'Similarly, the extensive record of stream flow and wetland monitoring produces an unprecedented level of understanding of the shallow surface water and ground water system.' Although there are several years of monitoring data for surface water features including wetlands in the vicinity of the southern expansion area, wetlands near and within the western expansion area were not monitored for this analysis. Two wetlands in the area of the western extension MNRF wetland no. 13201 (Earthfx wetland no. 21), and MNRF wetland no. 13200 (Earthfx wetland no. 21) are proposed to be monitored in future as monitoring locations SW36 and SW 37 respectively). Karst springs in the area have been identified but have very limited monitoring data. For example, there is only one recorded flow for these springs taken in late March and early April 2006. There remains uncertainty with respect to the hydraulic conductivity of the overburden deposits and the interconnectivity of surface water and groundwater within the study area. Conflicting	An extensive package of interdisciplinary tables integrating wetland and watercourse characterization and analysis has been prepared and provided in Schedules B and C. Wetland monitoring is discussed in Response 14	Inconsistencies and conflicting data persist and remain unresolved. See comment 14 and 262.	We respectfully agree to disagree.	Conflicting field data and the lack of monitoring data in the Western Extension Lands remain concerns with respect to the accuracy of the model predictions.

	information regarding the hydraulic interconnectivity of the overburden and bedrock from pump tests completed by Golder Associates in 2004 and 2006 in the southern expansion area has not been resolved. In addition, only five of the 22 wetlands in the area have been instrumented for this assessment with both surface water and groundwater monitors to support water budget analysis. Additional field investigations are required to address the above noted data gaps to confirm site conditions.				
264.	'The 2.0 m drawdown cone associated with P3456 extends 330 m to 450 m from the excavation. P3456 is next to a locally significant groundwater discharge area, so water levels are relatively stable and less subject to drought, seasonal fluctuations and the effects of excavation.' There are a number of private wells along Cedar Springs Road that are within 330m and directly down gradient of the proposed west expansion area excavation limit. Private wells along Cedar Springs Road are therefore considered to be at high risk of impacts from the proposed quarry expansion. The proposed west Extension area will be removed along with the underlying aquifer that contributes to the maintenance of private wells along Cedar Springs Road. Threshold values should be established for these wells especially those with less than 5.0 meters of assumed available drawdown.	The point is raised here and in a number of previous and succeeding comments. We recognized that drawdowns due to dewatering the west expansion could impact private wells on Cedar Springs Road. This was the main point of adding an infiltration pond is to replace the golf course ponds that may have contributed to groundwater recharge in the area. It is assumed that the infiltration pond will be in good hydraulic contact with the bedrock surface and should provide higher leakage than the natural ponds with their accumulated sediments. Some of the water will be picked up in the expanded excavation area and recirculated, but the main effect is to recharge the groundwater west of the quarry and maintain higher heads and prevent the private wells from going dry. Other provisions for the private wells are discussed in the report.	Concerns remain with respect to impacts on down-gradient private wells. Insufficient information is available to support proposed mitigation measures for private wells. See comment 293, 285, 242, and 243.	See response #6.	See comment 242, 243, 285, and 293.
265.	'The analysis confirms that there is between 5 and 23 m of available drawdown across the study area, confirming that there is ample groundwater available for current and future private water supply use.' According to the model analysis (Figure 8-75, Average available drawdown under P3456 conditions) a number of wells along Cedar Springs Road west of the western extension have simulated available drawdowns of 10m or less during phase 3456. A number of these have less than 5.0 meters of available drawdown. The analysis has not considered evidence provided in previous studies by Golder that deepening of wells completed within the Amabel Formation may not be a viable option for increasing well yields. A number of wells along Cedar Springs Road may in fact be completed into bedrock units below the Amabel Formation due to their low elevation. These lower bedrock units are not recognized as significant aquifers. Please clarify how private wells with less than 5.0 meters of projected available drawdown will be treated with respect to quarry impacts and how wells occurring near or below the bottom of the Amabel Formation will have their water supply protected with respect to quantity and quality.	This has been previously addressed.	See comment 264	See response to #6.	See comment 264
266.	'The wide distribution of low permeability Halton Till in and round the quarry is the dominant feature controlling surface and groundwater interaction. The wetlands and streams are generally perched above the water table and isolated from the groundwater system by the low permeability till. None of the wetlands receive significant groundwater inflow, and are thus isolated from any changes in the water table due to quarry development.' MNRF wetland no. 13027 (Earthfx wetland no. 17) has shown ground water levels at or above surface and this wetland, at least seasonally, does not exhibit perched groundwater conditions. A number of other wetlands closer to the existing quarry occur within areas that have been influenced by historical	Yes, Wetland 17 was noted to have higher rates of groundwater inflows than the other features under current conditions. Pre-development conditions may have been altered over the 70 year life of the existing quarry. However, the scope of this work was to analyze the likely impact of quarry expansion. The effects on this wetland are discussed in more detail in the package of interdisciplinary tables integrating wetland and watercourse characterization and analysis that has been prepared and is provided in Schedules B and C.	Hydrographs provided by Tatham for wetland 13027 (SW11B), wetland 13022 (SW12B), wetland 13016 (SW13B), wetland 13031 (SW5B) and wetland 13037 (SW16B) all show seasonally high shallow groundwater levels above ground surface. This indicates that these wetlands are not perched above the shallow groundwater table. These wetlands therefore would potentially receive groundwater inputs on a seasonal basis and would be potentially impacted by changes and lowering of groundwater levels from quarry operations.	Inputs are less than 3% as presented in the water balances. We stand by the assessment that indicates that wetlands are surface driven features.	Earthfx does not acknowledge that the Tatham wetland monitoring data suggests hydraulic connection between the wetland and the shallow groundwater table. The Tatham hydrographs suggest that these wetlands are seasonally connected to the shallow groundwater table and are not perched during these periods. Issue remains unresolved. See comments 13, 14, 99, 185, 197, and 204.

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	dewatering of the existing quarry and as such have altered hydrogeological conditions which historically may have not exhibited perched conditions beneath the wetlands. It has not been demonstrated with certainty that none of the wetlands receive significant groundwater inflow. Please clarify.				
269.	'The intent of the groundwater monitoring program is to serve four (4) primary purposes: These are listed as: 1. to determine the background quality and seasonal groundwater level fluctuations in the vicinity of the extraction activities; 2. to assess and characterize the quality and seasonal groundwater level fluctuations throughout the quarry operations and upon closure of the Burlington Quarry; 3. to evaluate whether unforeseen changes within the groundwater regime is occurring from the extraction of aggregate and quarry dewatering; and if they are 4. To determine the presence of, and risk to, private well receptors of the unforeseen changes and if the implementation of mitigation measures is required to off-set the unexpected changes in the groundwater regime.' The above objectives do not address potential for water quality impacts of quarry operations and impacts on water uses. Water quality objectives should be clearly stated and threshold levels and mitigation measures should be identified.	A detailed discussion of the monitoring program and AMP is presented in our response to comments from the MECP (see Schedule A). We will take this comment under consideration as the monitoring program and AMP are finalized. Additional water quality data and discussions are presented in our response to the MECP comments.	Water quality objectives remain absent from the documentation. The water quality information presented in the Earthfx report completed by Azimuth Environmental Consulting Inc. (Azimuth) was focused upon determining the water quality type with the perspective of determining the origin of the water and differentiation between surface water and groundwater. No groundwater quality targets were provided in the Earthfx report or the response to MECP attached to this table. Water quality limits were provided in the Environmental Certificate of Approval (ECA) for sump discharges for the existing quarry. It was proposed to maintain those limits with the proposed rehabilitation Scenario RHB1 where sump discharge would continue as part of the rehabilitation plan. Water quality limits stipulated within the existing ECA include only three parameters including Total Suspended Solids, Oil and Grease and PH. No reference is made to drinking water quality limits as the discharge water is proposed to be infiltrated by proposed infiltration ponds to maintain groundwater levels in down-gradient private wells.	This has been addressed several times. Please refer to the updated AMP.	Additional water quality data was provided in Schedule 1 to the JART Table response by Earthfx. Comparison of groundwater quality to Ontario Drinking Water Objectives was provided. Earthfx concluded that *'In general the natural groundwater quality is good except for elevated levels of hardness and total dissolved solids. Some domestic wells near roads appear to have been impacted by road salt.'* As noted, some wells with elevated sodium and chloride levels are attributed to road salt activities. Examination of the sodium and chloride levels measured in may of 2019 at BS01 and BS 02 suggest that the source of these parameters is at depth and not from the surface. This is reflected in the fact that the level of these parameters decreases toward the surface. If road salt is the source of these elevated parameters, the opposite would be expected with increasing levels nearer the source. These results suggest that deepening wells as a mitigation measure may risk encountering poorer quality groundwater. It should be noted that there is a health advisory level recommended for sodium at 20 mg/L in addition to the aesthetic level of 200 mg/L. Elevated sodium levels of 43 and 47 mg/L are reported in the Northwest Sump. Elevated sodium levels of 38 and 37 mg/L are reported in the Golf Course Ponds. These exceed the health advisory level of 20 mg/L for sodium. Elevated chloride levels are evident in the Northwest Sump and the Golf Course ponds. The chloride levels for Northwest Sump are 80.7 and 86 mg/L (May12/21 and March 16/21 respectively). The chloride levels for the golf course ponds are 70 and 64.9 mg/L (May 12/21 and Mar 16/21 respectively). These values contrast with the down gradient private well DW1 sodium and chloride levels which are reported at 8.7 mg/L and 16.2 mg/L (March 16/21) respectively. If the existing golf course ponds have been effectively infiltrating quarry discharge water over the past decades of their operation as suggested by Earthfx, it is expected that the water quality in down gradient wells would be similar to that of the discharge water quality and the golf course pond water quality. The water quality data presented shows a sharp contrast in certain indicator parameters such as sodium and chloride. This suggests that there is limited infiltration of discharge water from the golf course ponds. Should the level of infiltration be enhanced, as proposed by the construction of the infiltration ponds, it is expected that the water quality of down gradient wells would begin to take on the characteristics of the quarry discharge water. This is expected to result in elevated sodium and chloride levels over existing conditions in down gradient private wells. The elevated sodium levels would constitute a health concern for down gradient private wells. Earthfx has reported that *'The elevated arsenic, just above the ODWO limit is a common, naturally occurring*

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					problem in this area.' Table 2 in Schedule 1 has incomplete analysis and is missing arsenic levels in the Northwest Sump, the Golf Course Ponds, and a number of private wells. As this is considered to be a local problem, more complete analysis for arsenic is required. Water quality thresholds for critical parameters are missing in the AMP. See comment 7, and 84.
270.	'Based on the findings of the impact assessment, key sentry groundwater monitoring wells have been selected and incorporated into the long-term groundwater monitoring program. The groundwater monitoring program consists of water level and water quality monitoring. Water levels will be collected manually on a monthly basis as well as continuously with automatic water level transducers. The manual measurements are used to calibrate the continuous data, which allows for a comprehensive assessment of the water level responses and trends.' Threshold levels should be identified for water quality in addition to water levels and should include monitoring stations for all phases of quarry expansion.	A detailed discussion of the monitoring program and AMP is presented in our response to comments from MECP (see Schedule A). We will take this comment under consideration as the monitoring program and AMP are finalized.	See comment 269.	See response #269.	See Comment 269.
271.	Typographical errors in this paragraph: W03-1A should be MW03-1A and M03-1B should be MW03-1B.	Comment noted.	Typographical error noted. Assume this will be corrected.	RESOLVED	Typographical error acknowledged.
272.	'Water quality sampling will be completed on a semi-annual basis. Parameters will include general water quality parameters, metals, major and minor ions and cations, and hydrocarbons (F1-F4 and VOCs).' It is not clear what the rationale for water quality monitoring is in the absence of threshold levels and a spills management plan. Given that the operations plan relies upon recharge of quarry discharge water into a recharge pond, it is not clear that semi-annual water quality monitoring will be adequate to ensure protection of down-gradient private well water quality. Site Plan Drawing 2 of 4, Site Plan Note O, Report Recommendations, and 7B Natural Environment, there is reference to 'the Burlington Quarry Spills Prevention and Response Plan (2020).' This document has not been made available for this review and should be provided.	A detailed discussion of the monitoring program and AMP is presented in our response to comments from MECP (see Schedule A). We will take this comment under consideration as the monitoring program and AMP are finalized. Additional discussions of the water quality are presented in our response to the MECP comments (see Schedule A).	See comment 269. Spill Contingency and Pollution Prevention Plan, revised February 6, 2019 is Attachment 3 to the Natural Heritage JART Comment Summary Table. This document provides a description of the mechanics of spill reporting and cleanup, also outlining roles and responsibilities of individuals with respect to spill detection, reporting and cleanup. Absent from this document are monitoring requirements to determine effectiveness of spill cleanup and measures to protect the quarry sumps from discharging contaminants in the sump discharge.	This plan was developed in consultation with MECP as part of the ECA. The document is complete and meets MECP requirements.	Absent from the Spill Contingency and Pollution Prevention Plan, Revised February 6, 2019 are details regarding monitoring requirements to determine the effectiveness of a spill cleanup as well as measures to prevent contaminants being discharged through the quarry sumps. As it is proposed to use quarry sump discharge water to recharge the down gradient aquifer to maintain private well water supplies, it is critical to ensure that the quality of water being recharged into the aquifer down gradient does not pose a threat to down gradient water supplies.
274.	'The Level 1 and 2 Hydrogeological Assessment must identify potential receptors, outline the compliance monitoring program, as well as identify threshold values to assess and mitigate the potential impact to those receptors that may be impacted by the quarry development.' There are no threshold levels for groundwater quality. These should be identified for all monitoring stations.	A detailed discussion of the monitoring program and AMP is presented in our response to comments from MECP (see Schedule A). We will take this comment under consideration as the monitoring program and AMP are finalized. Our response to MECP Comment 7 discusses the use of data trends as part of the AMP.	See comment 269.	Please refer to the updated AMP.	The AMP does not include threshold levels for water quality parameters for quarry discharge water used for the proposed infiltration ponds for protection of down gradient drinking water supplies. Issue unresolved. See comment 269.
275.	'The impact assessment methodology has been developed for the initial five (5) years of quarry operation. During these five (5) years, Nelson will have only operated in the south extension and will have completed extraction from Phase 1 and will have partially extracted Phase 2. The area surrounding the south extension area has been monitored extensively for over seven (7) years. As a result, the awareness of how the groundwater regime behaves is enough to develop the assessment tools, such as threshold values and threshold trend analysis for the south extension.' The Phase 12 area has been monitored for the past 7	A detailed discussion of the monitoring program and AMP is presented in our response to comments from MECP (see Schedule A). We will take this comment under consideration as the monitoring program and AMP are finalized. Our response to MECP Comment 7 discusses the use of data trends as part of the AMP.	The impacts of the existing quarry are not recognized in the computer modelling. The existing quarry impact appears to be in flux. It has not been demonstrated that these conditions present a stable baseline of conditions from which to evaluate the impact of the proposed quarry expansion.	We agree to disagree.	The computer model does not recognize existing quarry impacts which are included as part of baseline conditions. Existing quarry impacts should be established for purposes of evaluating rehabilitation scenarios.

	years. Over this period of time extraction has continued in the existing quarry and has resulted in increased drawdowns in monitoring wells over this period indicating that groundwater conditions have been in flux over this period of time and are probably still changing in response into the quarry operations. The threshold values based upon simulated water levels of drought conditions in 2016 do not fully account for the progressively changing conditions within this area from existing quarry operations since the model assessment points are located some distance away for the areas of greatest flux in groundwater conditions. The analysis also does not address the cumulative impacts of the existing quarry particularly as it relates to the evaluation of rehabilitation scenarios. The model simulations include quarry conditions at the time of full excavation of the various Phases of the quarry operations described in Table 8.3 and illustrated in Figures 8.3 (P12), 8.38 (P34) and 8.41 (P3456). These model scenarios do not represent the initial five years of quarry operation. Please clarify.				
276.	'The impact assessment methodology proposed for the Burlington Quarry extension involves both an evidence-based and a predicted-based approach to ensure that the complexity of fractured rock hydrogeology is addressed. The evidence-based approach requires a comprehensive understanding of the natural variability of groundwater elevations at key monitoring locations. This understanding requires several years of monitoring data that shows the groundwater systems natural response to varying climatic conditions, including how the aquifer responds during and following dry/drought conditions. The baseline conditions allow for an improved ability to identify unforeseen trends in water level data, which could be a result of the quarry operations.' The groundwater monitoring data available for the southern extension has data gaps that occur between 2004 and 2007 and again between 2013 and 2018 (Earthfx Section 5.3.1.2, Transient Water Level Data, page 109). The missing data included the drought period of 2015-2016 as well as 2017 the wet period (Earthfx, section 7.2.2 Scenario Summary and Nomenclature, page 166). Calibration of the model against actual on-site water level conditions during this period of time was therefore not possible. Please clarify the validity of the computer model calibration against extreme wet and dry conditions.	The close calibration to seasonal fluctuations in water levels (that vary, in the near vicinity to the quarry, by more than 7 m) suggests that the model is able to replicate and respond to significant climate variation.	The computer model calibrate is limited due to the absence of on-site data between 2013 and 2019 which described by Earthfx Section 7.2.2, includes a wet period (2017) and a drought period (2015-2016). The model therefore relies upon projections. This provides uncertainty with respect to the model's ability to simulate varying climatic conditions. The impact of data gaps/limitations on model predictions should be clarified.	We agree to disagree. The ARA only requires 1 year of monitoring and Earthfx has calibrated to an extensive water level database that spans several years. The purpose of a model is to project.	Data gaps. See comment 262
277.	'A key component of the evidence-based groundwater monitoring program is the availability of background water level data that reports the natural conditions during quarry extraction.' The analysis has not considered the cumulative effect of the existing quarry and the proposed expansion in establishing background water level data. Cumulative impacts of the existing quarry should be included in the impact assessment.	Please refer to Response 3, 15 and 78 for a discussion of cumulative impact	Earthfx has incorporated the 'existing impacts' into the impact analysis as 'baseline conditions' and had not acknowledged existing conditions as including impacts from the existing quarry. The proposed preferred rehabilitation option RHB1appears to enshrine the impacts of the existing quarry and the proposed expansion in perpetuity. Site restoration implications of the proposed site rehabilitation plan with respect to mitigation of the impacts of the existing quarry should be identified. See comment 15, 77, 78,148, and 223.	We respectfully agree to disagree.	Cumulative Impacts. See comment 15, 77, 78, 148, 223 and 275,
280.	'To assist in the evaluation of the water levels measured as part of the groundwater monitoring program, a background monitoring well has been incorporated to the program. The background monitoring well is a domestic water well located north of the existing quarry at 2377 Collins Road (referred to as DW2; Figure 9.1). The purpose of this background monitoring well is to document the natural variability of the groundwater elevation fluctuations and trends under various future climatic conditions. This background monitoring well has	Historical air photos show that the north quarry face wall has been largely remediated (with sloping backfill) since 1979. MP35, located in Wetland 3 near DW2, has shown a consistent seasonal water level pattern in data recorded since 2010. Please refer to our MNRF Comment Response (Earthfx Section 4.3) for maps and hydrographs.	It is apparent that the hydrograph (Figure 34) for MP35 located about 50m from the quarry face is similar to the hydrograph for MP9 (Figure 35) located 820m from the quarry face. The hydrographs extend over a period between May 2010 and September 2013. This suggests that the water levels have not dropped perceptively over this relatively short time period in both of these monitors. It is not clear whether Wetland 3 at MP35 has received surface water inputs that would contribute to the maintenance of water levels within the wetland at MP 35. In the absence of long term groundwater level trends within the shallow and deep groundwater systems northwest of the	Please refer to the updated AMP.	The AMP has proposed to construct a new background monitoring well located up gradient of the existing Quarry at least 500 m from the edge of the existing quarry. It should be confirmed that this location is beyond the area of influence of the quarry operations.

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	shown to have no drawdown from the proposed quarry extension.' Please provide evidence to support the conclusion that background monitor DW-2 has no drawdown impacts from the proposed quarry. Is this from computer simulations or actual measurements over time? Has this monitoring well been impacted from the existing quarry?		existing quarry there remains doubt on the suitability of DW2 as a background groundwater monitor.		
281.	'Trigger values set based on the traditional approach have caused numerous false positive trigger exceedances. The reasons for these exceedances include the oversimplification of the methodology to setting trigger values in a fractured rock environment (fundamental principles of how aquifers respond to abstraction), and more importantly the neglect to account for the full impact of climate change. Seasonal variability in groundwater level as well as season creep, which refers to observed changes in the timing of the seasons, have been widely observed in Ontario.' The influence of climate on groundwater levels is acknowledged, however the analysis relies upon remote climatic stations for data. Given the importance of climate, why is there no recommendation for an on-site climate station for purposes of monitoring and evaluating groundwater levels?	A detailed discussion of the monitoring program and AMP is presented in our response to comments from MECP (see Schedule A). Our response to MECP Comment 7 discusses the use of data trends as part of the AMP. There are a number of climate stations in the area. Our calibration match to numerous minipiezometers, presented in our response to MNRF comments, illustrates that the model is very closely matching local soil moisture conditions. This indicates that the climate data available for the calibration is more than adequate.	It is commonly acknowledged that weather systems can provide dramatically different conditions locally from the same weather system. For example, some local areas can experience significantly different amount of rainfall than nearby adjacent areas. Local impacts of climate are therefore not likely to be recorded by climate stations that are located kilometers away. Although the existing climate stations may be suitable for establishing average conditions for purposes of calibrating computer modelling, they are considered to be inadequate for purposes of monitoring local groundwater conditions especially in areas with contrasting landforms such as Mount Nemo. An on-site climate station should be part of the surface and groundwater monitoring system for the proposed quarry extensions.	The Burlington Quarry has a weather station (recently installed). Please refer to the updated AMP.	The AMP refers to an-on-site climate station (page 12, last paragraph). Details are missing regarding the installation of this climate monitoring station, its location, the climate parameters being monitored, the frequency of data collected, and how these data will be used to evaluate the changing groundwater and surface water conditions at the quarry site.
283.	'The Seasonal Mann-Kendall Test considers the seasonality of the data series. This means that for monthly data with seasonality of 12 months, one will not try to find a trend in the overall series, but a trend from one of January to another, and from one February and another, and so on.' The Mann-Kendall test may be useful in assessing natural groundwater level trends but are limited in assessing quarry impacts without taking into account variations in on-site climatic conditions. How does the Mann-Kendall test compare season data from different years and relate that to a trend analysis? How will climatic factors be considered in this analysis without on-site climatic data?	Interannual fluctuations in climate could be compared to the variability observed in the 10 year model simulations. Additional refinement of the AMP approach is open to discussion. Fortunately, the site has an extensive network and history of monitoring, and a proven and highly advanced predictive tool (the GSFLOW Model) that are available for monitoring and analysis.	See comment 281.	Please refer to the updated AMP.	See comment 281. The updated AMP refers to an on-site climate station but details are missing.
284.	'The proposed thresholds have been calculated from the simulated water level elevations from the difference between the simulated average baseline water levels and the simulated drought water levels with Phase 1 and 2 extracted during a drought period. If the 0th percentile equals the minimum water level simulated, the 10th and 5th percentile values will be relied upon for the threshold values. Level 1 Threshold conditions occur when the measured water level falls below the Threshold 1 value (10th percentile) for a 15-day period. Level 2 conditions occur when the water level falls below the Threshold 2 value (5th percentile) for a 15-day period. This statistical approach to reviewing and assessing the impacts associated with the quarry development meets the objectives of the AMP, which is to implement a system that allows for a comprehensive evaluation of how the groundwater regime behaves with quarry development and to identify unforeseen changes in this system that provides time to implement appropriate mitigation strategies to protect local water use.' Method for calculating thresholds requires clarification. The simulated average baseline and simulated drought water levels represent a discrete and limited time interval, a portion of which has no monitoring data for model calibration purposes. Average and drought conditions are expected to	Additional refinement of the AMP approach is open to discussion. Fortunately, the site has an extensive network and history of monitoring, and a proven and highly advanced predictive tool (the GSFLOW Model) that are available for monitoring and analysis.	Issues remain unaddressed. See comment 14, 81, 86, 132, 140, 159, 191. 217, and 235 regarding data gaps.	Please refer to the updated AMP.	Groundwater level thresholds to be determined by statistical methods (Mann-Kendall and Theil-Sen test). These methods are complex requiring technical expertise in statistical methods and are not suitable for general quarry site operations staff. Average and drought conditions are expected to change with increasing record of climatic conditions. It is presumed that these determinations will be completed by qualified professionals. The mechanism and timing of these analyses should be provided. Clarification is required with respect to the selection of threshold water levels due to changing climatic conditions. The AMP lists the groundwater monitors to be monitored and monitoring locations that will be submitted to a trend analysis and the selection of threshold water levels which may impact site operations. This includes both deep and shallow groundwater monitors. Threshold groundwater levels are to be determined for the Western Extension area as there is an insufficient period of monitoring data available to determine thresholds at this time. No threshold groundwater levels have been determined for the Southern Extension area as these are subject to a trend analysis. It is not clear when this will occur and how the effects of the quarry operations will be separated from normal climatic responses in the groundwater levels. The Mann Kendall approach suggests that a number of

	change with an increasing record of data, rather than the limited discrete time interval and climatic conditions represented in the model simulations. How are existing climatic conditions factored into the threshold determination? Does the threshold level need to be met consistently over a 15 day period for any action to be taken? There is uncertainty whether the method proposed will provide early warning of quarry impacts where worst case drought conditions compared against average baseline conditions are used to define threshold levels. No thresholds exist for intermediate and shallow depth monitoring wells. Threshold levels for the intermediate and shallow depth monitoring wells should be identified.				years will be required to have sufficient data from the same season to complete a trend analysis and analysis of impact from the quarry. It appears as though monitoring data from the same month of successive years will be compared to asses a trend upon which to base an opinion on whether a threshold level can be established for purposes of directing quarry operations. Clarification is required with respect to implementing the suggested statistical approach to establishing threshold groundwater levels. The suggested approach to groundwater monitoring appears to have value in predicting when threshold groundwater levels will be reached. This approach required multi-year groundwater level data and it does not appear to be well suited to establishing short term impacts from quarry operations. Also see comments4, 81, 86, 132, 140, 159, 191, 217, and 235.
285.	'A key finding of the Level 1 and 2 Hydrogeological Assessment and Numerical Modelling (Earthfx et. al., 2020), is that the drawdown associated with the extension of the Burlington Quarry does not adversely impact the available drawdown in the regional bedrock aquifer found at an elevation beneath 252 masl (elevation of the quarry floor) It is generally accepted that 5 m of available drawdown is a safe available drawdown for domestic water wells constructed in bedrock aquifers.' It is assumed that available drawdown estimates in each private well was determined from static water level recorded on the well record at the time of well completion. This is not a reliable measure of the available drawdown as the accuracy of these measurements is questionable. What is the source of this generally accepted available drawdown of 5.0 meters as a 'safe available drawdown'? It is not clear what is meant as a 'safe available drawdown'. This does not take into consideration the productivity of the well or water quality considerations.	The overall available drawdown at each well was calculated using the simulated water levels and the elevation of the base of the Amabel. Wells may be deepened and operationally treated and restored as necessary.	Issues remain unaddressed. See comment 193, 242, 243, 264, 285, and 293.	We respectfully agree to disagree.	The issue of available drawdown as a measure of adequacy of water supply remains unresolved.
287.	'Data collected from existing domestic water wells along No. 2 Side road, which are within 80 m of the quarry, show that wells constructed in the hydro stratigraphy layer beneath the quarry floor (Layer 8) can meet peak domestic water demands with between 2 and 5 m of available drawdown. Please provide data from existing domestic wells in this area to support this assertion?'	Long term monitoring data from the private wells is not available, but no well complaints or issues have been noted in this area. The extensive network of monitors in the P12 extension area demonstrates that water levels recover quickly with distance from the existing quarry.	Water levels within the bedrock have been lowered significantly by the existing quarry operations. It has not been demonstrated that deepening of private wells alone has been sufficient to provide adequate water supplies to affected private wells.	This has been addressed several times. We agree to disagree.	Earthfx has not demonstrated that deepening wells is a feasible option in all cases for maintaining groundwater supplies especially for wells already completed to near the bottom of the Amabel aquifer or below the Amabel aquifer. Issue remains unresolved.
288.	'Nelson will commence with planning the required compensation if unforeseen trends suggest off-site impacts will be greater than predicted and threaten the available drawdown in private wells. Compensation must be acceptable to the homeowner and the quarry operator and could include all or part of the costs associated with drilling of a new well, deepening a well, and abandonment of the old well.' What contingencies are proposed if well replacement /deepening are not adequate? It is not clear how 'Nelson will commence planning the required compensation' will be implemented. Please clarify.	Additional refinement of the AMP response is open to discussion. Given the long history of compatible coexistence between the quarry and the home owners and the extensive and productive Amabel aquifer, it is highly unlikely that the proposed solution will not be sufficient.	See comment 287.	Please refer to the updated AMP.	No contingencies have been proposed in the event that well deepening does not restore water supplies. Issue unresolved.

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289.	'Upon completion of the well construction, a comprehensive water quality analysis will be completed to characterize the water supply. If it is shown that the water quality has deteriorated from intercepting poor water quality at depth (for example increased chlorides and sulphates), the appropriate water treatment system will be purchased and installed.' Although not stated, it is assumed that water quality sampling and analysis will be completed within the well in question prior to deepening or replacing the well. Please confirm. Who pays for the maintenance of the water treatment system? There is no discussion of potential for water quality impacts on private wells and monitoring data necessary to establish baseline water quality data and thresholds for specific water quality parameters. Water quality thresholds should be identified for monitoring stations.	Additional refinement of the AMP approach is open to discussion.	Issues remain unresolved.	Please refer to the updated AMP.	The question of water quality sampling of a private well prior to replacement as well as after replacement and who will be responsible for the installation and operational and maintenance costs of a water treatment system, if necessary, remain unresolved.
290.	'The integrated surface water/groundwater model results predict groundwater mounding beneath the existing irrigation ponds in the West Extension. --- To replicate the existing artificial groundwater mounding produced by the irrigation ponds, a pond will be constructed outside the extraction area within the license boundary between the extraction limit and Cedar Springs Road. To replicate the existing artificial groundwater mounding produced by the irrigation ponds, a pond will be constructed outside the extraction area within the license boundary between the extraction limit and Cedar Springs Road' The report concludes that the regionally extensive and low permeability Halton Till limits interaction between surface water and groundwater systems (Page 190, Section 7.3, 2nd paragraph). This brings into question the effectiveness of the existing irrigation ponds and the proposed infiltration pond in maintaining groundwater levels. Please provide field data to confirm the recharge capability of the existing irrigation ponds and the proposed recharge pond.	Please refer to Response 116	The effectiveness of the proposed infiltration ponds is based upon assumptions and not supported by field data. See comment 116 and 94.	Please refer to Schedule 2 (model of infiltration ponds).	The effectiveness of the existing irrigation ponds remains unresolved. See comment 94, 116, and 269.
291.	'Interference will be in part masked or, coupled by local climatic conditions. Key groundwater monitoring locations that have over 7 years of water level data have been selected to act as the long-term sentry wells to ensure the influence on the groundwater regime is consistent with the predicted influence from quarry operations (Figure 9.2). The monitoring locations, well construction details, and predicted drawdown conditions during a drought period (expressed as water level elevation, simulated drawdown, and simulated available drawdown), are provided on Table 9.1.' Climatic conditions are acknowledged to play a role in masking interference by quarry operations. It is not clear how the method for identifying threshold levels will take into account ongoing on-site climatic conditions. There is a need to monitor climatic data on-site to effectively evaluate quarry impacts versus climatic impacts on groundwater levels. Please clarify.	Please refer to Response 284.	See comment 140, 281, 283, and 284.	Please refer to the updated AMP.	The AMP makes reference to on-on-site climatic station but no details are provided on its location, monitoring parameters, and how the climate data will be utilized to assess impacts of the quarry on the groundwater system. See comment 281.
292.	Typographical errors; M03-9 and M03-14 should be MW03-9 and MW03-14.	Comment noted.	Typographical error noted. Assume error will be corrected.	RESOLVED	Typographical error noted by Earthfx. It is assumed that a correction will be issued.

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293.	'The closest receptor (private water well) is located approximately 120 m to the west of MW03-15, and currently has 4.6 m of available drawdown.' Will existing private wells that currently have less than 5 meters of available drawdown receive mitigation measures? A number of wells having less than 5.0 meters of available drawdown are shown on Figure 9.3 and 9.5, (Minimum available drawdown in Layer 8, P12, Drought Conditions, page 312 and minimum available drawdown in Layer 8, P3456, Drought Conditions, Page 317).	Nelson is committed to addressing water supply issues as outlined in the AMP. The model has been comprehensively used to identify both average and the minimum available drawdown (under drought conditions) which demonstrates a commitment to understanding of the full range of response.	The proposed percentile statistical method for establishing groundwater level thresholds as outlined in the AMP requires sufficient monitoring data to include a drought period as the drought related groundwater levels are taken to represent the 0th percentile water level. Groundwater level monitoring may not be possible in all nearby private wells due to restricted access. It is not clear how this method will be useful in evaluating water well complaints in nearby private wells where access to the well not possible. Nelson proposes to investigate each water well complaint by engaging a licensed water well technician to perform an investigation on any wells within one kilometer of the quarry where a change has been reported. No guidance is provided with regard to this investigation especially where no background data exists on the well in question. It is not clear whether existing wells that have less than 5 m of available drawdown will be provided with mitigation measures to ensure adequate water supplies.	Please refer to the updated AMP.	It remains unclear how well owners with wells having less than 5 meters of drawdown will be treated or how their loss of water due to quarry operations will be assessed. Issue unresolved
295.	'The response to a Level 1 Threshold condition, would prompt Nelson to: - mail out a letter to all residents located within 1 km of the southern extension lands informing them of the low water levels; notify the SLC, MECP and MNR in writing; and post a notice on the Nelson website.' 'The process will be repeated if a Level 2 Threshold condition is met. In addition to a second mail out letter, Nelson will attempt to notify the residents in person; and post a notification of the local groundwater conditions in the local news outlets. Instructions to contact Nelson if anyone has experienced any issues with their water supply within 1 km of the quarry will be outlined.' Apart from informational purposes, it appears as though the threshold levels have limited usefulness. Threshold levels are intended to act as an early warning system of low water levels. Achieving threshold water levels at specific monitoring locations, will result in actions as proposed by Earthfx that are primarily of an educational nature and will not result in any mitigation actions on private wells. It is not clear how useful these notifications will be when there are no specific actions required. No information will be provided to assist the individual well owners or proactive measures taken to avoid excessive use of water and aggravate low water conditions. Actions to address well issues will only be undertaken when a complaint is registered by the well owner. During drought conditions, it is expected that increased water use will result to compensate for drought conditions. This will include such items as lawn and garden watering. Will this disqualify private homeowners from compensation should threshold levels be met? Threshold levels should be established for intermediate depth ('B' series) monitoring wells, shallow depth ('C' Series) monitoring wells, and private wells.	The purpose to the thresholds is to actively monitor the system before action is required. That makes them useful. The commitments to mitigation are clearly defined. is what	Details are lacking on how the well complaint investigations are to be conducted especially where access to wells for monitoring purposes is not possible and background data on private wells is not available. See comment 293.	Please refer to the updated AMP.	Details remain missing on how the well complaint investigation will be undertaken especially where access to wells for monitoring purposes is not possible and background data on private wells is not available. Questions remain regarding changes in private well use during drought conditions and how these will impact the well complaint investigation. The usefulness of the proposed response by Nelson to meeting threshold groundwater levels is questioned as no concrete actions apart from informational purposes will be provided by Nelson. No actions will be implemented until a complaint arises. Proactive measures to assist well owners could be beneficial in avoiding well complaints during times of drought.

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296.	'The extraction of the proposed West Extension (Phase 3 through to 6) is scheduled to commence approximately 10-years following the issuance of the ARA license. No groundwater thresholds are proposed until enough groundwater monitoring data is collected to establish baseline conditions.' What are baseline conditions to represent? In the case of phases 3, 4, 5 and 6, the conditions forming baseline are defined during the active excavation of Phase 12. How much groundwater monitoring data is considered enough to establish groundwater thresholds? Does this include water quality thresholds? How can a valid baseline be established from an ongoing changing quarry operation condition (i.e. selected from a period of time during which Phase 1/2 is ongoing)?	The site already has an extensive network and history of monitoring, and a proven and highly advanced predictive tool (the GSFLOW Model) could be used for further assessment. The 10 year period of monitoring will provide an excellent extension to the baseline data already available.	It is questionable how representative the (water level) thresholds will be of background or baseline conditions. It is proposed that monitoring data will be collected during a 10 year period of transient conditions resulting from the excavation of Phase 12. Thresholds should be established prior to commencement of extraction until enough groundwater monitoring data is collected to establish stable baseline conditions.	Please refer to the updated AMP.	Baseline conditions for the Western Extension are to be established from monitoring data collected during the Phase 12 excavation in the South Extension. It remains unclear how representative these data will be in representing baseline conditions as they will be collected during a period of transient groundwater levels resulting from the excavation of Phase 12.
298.	Groundwater quality parameters should include parameters related to site operations including dust suppressants, explosives, fuels, any on-site stored materials, and any identified potential sources of contamination from on-site or directly adjacent areas. There is no discussion of water quality thresholds or mitigation required in the event of water quality impacts either through normal operations or an on-site spill. Note that surface water drainage areas which direct external surface water onto the property and into the sump discharges may contain potential contaminant sources. Water quality analysis should be included with threshold levels and mitigation measures.	Further information on the monitoring program and AMP is presented in our response to comments from MECP (see Schedule A). We will take this comment under consideration as the monitoring program and AMP are finalized. A discussion of water quality is presented in Response 7 and 8	Identification of possible source of contamination to the quarry sumps should be identified. Water quality threshold levels should be established for potential contaminants from on-site and off-site sources. Groundwater quality monitoring should be expanded to include potential sources of contamination. Mitigation and contaminant containment/treatment measures should address all potential contaminants entering the quarry sumps.	Please refer to the updated AMP.	Groundwater quality threshold levels are absent from the AMP. Off-site potential sources of contamination should be identified as well as on-site potential sources of contamination. Spill or contaminant response measures should be tailored to address specific contaminant sources whether through a spill or through non-point sources of contaminants in surface runoff that is directed onto the site and into the on-site storage ponds.
299.	There are no groundwater monitoring locations upgradient and to the north of the quarry operations to monitor impacts of the quarry expansion and rehabilitation scenarios. The only exception to this is one private well DW-2. Monitoring data should be presented to demonstrate that DW-2 has not been impacted by the existing quarry. It would be useful to have a corresponding figure for AMP surface water monitoring stations.	The north discharge has been shown to support (recharge) the shallow water levels. This will be ongoing, in the future so no impacts are expected.	No data has been provided for the north discharge to demonstrate that it supports shallow groundwater levels. Earthfx contends that an extensive layer of Halton Till acts to isolate wetlands from the groundwater system. See comment 280.	Please refer to the updated AMP.	The updated AMP has identified a background monitor located at least 500m to the north of the existing quarry. It should be confirmed that the proposed background monitoring location is beyond the influence of the existing quarry operation in order to represent background groundwater conditions. Same as comment 280.
300.	'The Private Well Monitoring Program includes the collection of water quality samples and water levels, like the on-site monitoring program outlined in Section 10.1.1. Similarly, the impact assessment on each well will include a trend analysis and threshold value.' This suggests that the trend analysis and threshold values will be established for both groundwater levels and groundwater quality for private wells. No water quality thresholds have been established for the on- site groundwater monitoring program. Semi-annual and annual water quality monitoring is suggested in Table 10.1, page 319. It is not clear that this is sufficient to protect groundwater quality of down gradient wells. Water quality thresholds should be identified along with mitigation measures.	Further information on the monitoring program and AMP is presented in our response to comments from MECP (see Schedule A). We will take this comment under consideration as the monitoring program and AMP are finalized. A discussion of water quality is presented in Response 7 and 8.	The proposed water quality monitoring and mitigation measures are not considered sufficiently thorough to protect private wells. See comment 7, 8, and 298.	Please refer to the updated AMP.	The updated AMP does not provide for groundwater quality threshold levels. Surface water quality monitoring should also include the Northwest Sump, the proposed infiltration ponds and the South Sump. Since the proposed infiltration pond will be used to augment the groundwater system to sustain down gradient domestic wells, additional water quality monitoring should be implemented from the perspective of this water being used as a drinking water source. The existing ECA does not appear to recognize the quarry discharge water as being used for drinking water purposes. See comment 298.

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304.	'The numerical simulations confirm that the majority of the wetlands and streams are isolated from the water table by the low permeability Halton Till. A total of 5 of the 22 mapped wetlands in and around the quarry receive groundwater upwelling in the spring, however groundwater is in every case a very small percentage (less than 3%) of the overall inflows into the wetland.' The Tatham surface water investigation instrumented only five wetlands with shallow groundwater monitors in addition to surface water monitoring for water budget purposes. For the remaining wetlands the analysis relied upon simulated groundwater conditions without the benefit of having actual groundwater level data to confirm groundwater upwelling. Field data including groundwater levels for all identified wetlands should be provided to support the computer simulations.	As noted, our wetland characterization tables and response to MNRF comments provide extensive additional information for each wetland. Earthfx Section 2.2.1 in that document provides details on over 62 minipiezometers, soil core boreholes, and Guelph Permeameter test locations. Table 13 lists twelve of the key wetlands that have one or more minipiezometer, including MNRF Wetland 13033, which has 5 minipiezometers. The key larger wetlands, Wetland 17 in particular, were instrumented. Matching the dynamics of these features gave us confidence in our ability to represent the remaining ones.	It is agreed that a number of wetlands have both surface water and groundwater instrumentation. Most of which were previously installed for studies completed by Golder Associates within and adjacent to the proposed southern expansion area. These monitors have data gaps that extend over a number of years between the completion of the Golder studies and the current investigations. The western expansion area was instrumented more recently by Azimuth for the Earthfx investigation and computer modelling. The western extension has limited monitoring data upon which to base the computer model projections. A number of wetlands are lacking key instrumentation required for the water budget purposes. Only five wetlands have recent instrumentation installed by Tatham for establishing a water budget analysis. Without groundwater and surface water monitoring data the model predictions cannot be verified for specific locations through a calibration process for those wetlands lacking adequate monitoring data. In the absence of data at a particular wetland, calibration must be made with the available data from surrounding areas. In this way local variations in site conditions cannot be detected. This suggests a degree of uncertainty with respect to model predictions for those wetlands. The uncertainties associated with the model predictions should be quantified.	The number of monitors and period of record is exceptionally large, considering only 1 year of monitoring is necessary for an ARA license application. The transient integrated simulation and comparison to the large monitoring network provides the reader with a detailed view of the model response across a range of climate and groundwater stress conditions both near and far from the existing site. This is far superior to a traditional steady state simulation with sensitivity bracketing, because we are actually simulating all of the processes and their interactions.	The lack of recent water level data for purposes of wetland water budget analysis requires reliance on site condition assumptions, simulations, and extrapolations of data collected at previous times or at similar locations. Calibration of these water budget simulations are limited to site assumptions which may or may not be representative of current conditions. It is unclear to what extent this results in uncertainty of the model predictions and water budget calculations. The AMP proposes to incorporate additional monitoring locations at wetlands although these monitors were not available for the water budget analyses.
305.	'The Level 2 impact assessment scenarios present a detailed and exhaustive comparison of the proposed developments to the baseline conditions. All pertinent aspects of the surface water and ground water system have been compared across a wide range of climate conditions. The integrated approach ensures that surface and groundwater functions and water budgets are fully reconciled.' It may be appropriate to consider existing conditions for purposes of assessing impact of the proposed expansions. The cumulative impacts of the existing quarry and the proposed expansion have not been addressed. A map showing the existing cone of influence and drawdown of the existing quarry should be provided as part of the impact assessment. The impact assessment scenarios should also address groundwater quality.	This has been previously addressed.	See comment 15, 77, 78, 148, 223, and 277 regarding baseline conditions and cumulative impacts. See comment 7, 8, 18, 193, 208, 269, and 298 for water quality.	We respectfully agree to disagree.	See comments 15, 77, 78, 148, 277 with respect to baseline conditions and cumulative effects, and comment 7, 8, 18, 193, 208, 269, and 298 with respect to water quality.
308.	'The private wells in the vicinity of the West Extension will see a decline of approximately 2 m in available drawdown, however the majority of the wells have between 10 and 16 m of Amabel Aquifer drawdown after excavation, so deepening a well is a viable mitigation measure. Near the intersection of Colling Road and Cedar Springs Road there are a few wells that will have between 5 and 10 m of available drawdown, however these are in a significant discharge area so it is likely that there will be sufficient flow to meet their private supply needs.' Numerous residences along Cedar Springs Road are located 200.0 to 300.0 meters from proposed limit of extraction. Some properties at the northwest portion of the proposed western extension are between 100.0 and 200.0 meters from the proposed limit of extraction. Wells along Cedar Springs Road are directly down gradient of the existing quarry and proposed expansion. The existing quarry has intercepted groundwater that would have flowed towards these wells under natural gradients. The groundwater seepage into the quarry as well as surface runoff from precipitation events is converted to surface water discharge via the existing quarry sumps. These wells are likely already impacted by the existing quarry and may depend to some extent upon infiltrating discharge water via a series of irrigation ponds on the upgradient golf course property much of which is to be removed through the western quarry expansion and replaced with an	Please see Response 285 and 293.	See comment 193, 242, 243, 264. 285 and 293 for issues relating to down gradient wells.	This question has been asked and addressed several times. Please note responses regarding the MECP and their requirements under future PTTW and ECA amendments as well as the AMP.	See comment 193, 242, 243, 264, 285, and 293 with respect to down gradient wells.

	infiltration pond. Data provided by Golder, 2010 as well as pump tests completed in the proposed western expansion area indicate that groundwater conditions vary considerably between groundwater monitors and test wells. Available drawdown by itself is therefore not a reliable indicator of water availability for wells. The productivity of the aquifer at each well location will also be a significant determining factor of water availability. Flow profiling results (Figure A8 and A9, pages 434 and 435 respectively of the Earthfx hydrogeological Assessment Report) completed by Golder, 2004 indicate diminishing water flow with depth in existing monitoring wells in the southern extension area. This suggests that deepening wells may not be a viable solution to addressing well interference issues. A detailed analysis of this information and the implications to proposed mitigation measures should be completed and included in the report.				
309.	'Furthermore, surface water flow in the upper reaches of a tributary of Willoughby Creek and the West Arm of the West Branch of Mount Nemo Creek will cease when the quarry discharge is discontinued resulting in an adverse impact to downstream fish habitat compared to baseline conditions (See Savanta, 2020 and Tatham, 2020 for details).' The analysis of impact of discontinuing quarry discharge does not appear to be complete. Anticipated increased seepage from higher water levels under rehabilitation scenario 2 (RHB2) and the overall benefit of this to the sub-watershed does not appear to have been given consideration in this analysis. A detailed analysis of the impacts of cessation of pumping to the sub-watershed should be completed.	We have analyzed the likely flows in Willoughby Creek and its tributaries under RHB2 conditions. These results were transmitted to other team members to analyze potential impact on hydrologic and natural heritage features.	See comment 230, 245, 252, and 253.	See responses to #230, 245, 252, and 253.	See comments230, 245, 252, and 253 with respect to rehabilitation scenario analysis.
310.	'The final rehabilitation plan will preserve the form and function of the upper reaches of a tributary of Willoughby Creek and the West Arm of the West Branch of Mount Nemo Creek as quarry discharge will continue.' The current conditions within the unnamed tributary of Willoughby Creek and the upper reaches of the West Arm of the West Branch of Mount Nemo Creek have been altered by quarry pump discharge. Is it appropriate to preserve an artificial condition that has altered a natural system? (This requires input from a natural heritage and fisheries habitat perspective.)	We have analyzed the likely flows in Willoughby Creek and its tributaries under RHB1 conditions. These results were transmitted to other team members to analyze potential impact on hydrologic and natural heritage features. We recognize that quarry discharge has modified the pre-development conditions, but there may now be ecological features (e.g., fish populations) that developed over the 70 years of operations that have adapted to or require these flow conditions.	It appears as though the hydrological benefits of scenario RHB2 have not been given sufficient consideration. See comment 230, 245, 252, and 253.	We agree to disagree.	Same as comment 309
311.	'The quality and quantity of groundwater needed for the natural environment and wells will be protected,' It has not been demonstrated how water quality will be protected. Clarification is required how this will be accomplished.	A discussion of water quality is presented in Response 7 and 8 and discussed in our response to the MECP AMP questions (see Schedule A).	The documentation is missing a discussion of the necessity of meeting drinking water quality standards for the infiltration ponds and the establishment of groundwater quality thresholds for the protection of down gradient private wells. See comment 7, 8, 18, 193, 208, 269, and 298.	This comment is redundant and has been addressed. See responses #8, 18, 193, 208, 269, and 298.	See comment 7, 8, 18, 193, 208, 269, and 298 with respect to water quality
312.	'Incorporate the mitigation and monitoring requirements as outlined in this report into the Adaptive Management Plan (Earthfx and Tatham, April 2020) for the site; as outlined in Sections 9 and 10 of this report.' This report does not address potential water quality impacts from the proposed quarry extension with the identification of threshold levels and mitigation measures. This report is missing a recommendation for monitoring of climate data on-site for the duration of the proposed quarry extension and monitoring period following cessation of quarry operations. Consequently, these have not been	A discussion of water quality is presented in Response 7 and 8 and discussed in our response to the MECP AMP questions (see Schedule A).	See comment 311.	See response #311	See comment 311 with respect to water quality.

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	included in the Adaptive Management Plan. Additions are required to the Adaptive Management Plan for completeness				
313.	Typographical Error; Worthington 2019 should be Worthington 2020	Comment noted.	Typographical error noted. Assume error will be corrected.	RESOLVED	Typographical error acknowledged and assumed to be corrected.
315.	'The Keith Lang boreholes were drilled to supplement the original HQ boreholes and expand the geological and hydrogeological coverage of the Western Lands. These boreholes are 6-inch in diameter and were constructed using a conventional rotary water well rig. As such, no core was recovered in these boreholes.' Borehole/well logs for the Keith Lang holes drilled are not included in report. These should be provided as background information within the report.	See response to Comment 11. It should be noted that the Keith Lang boreholes are BS-04 to BS-07 and data have been provided for these wells in the report. The original MECP drillers logs are provided in Schedule E	It would be helpful if the corresponding assigned borehole numbers are indicated on the MECP drillers log provided in Schedule E. It is not possible to correlate with certainty, the MECP driller's record with the assigned borehole numbers. See comment 317.	Keith Lang records were requested and provided.	Borehole logs were provided as requested. Issue resolved.
316.	'Finally, two additional overburden monitoring wells were constructed in November 2019 at the southeast corner of the Southern Lands (MW18-1 and MW18-2).' The location of MW18-1 and MW18-2 should be shown on report figures.	Well construction and location data are provided below. Slug test data for the wells are provided in Schedule E. Well locations are shown below.  	It is not clear for what the purpose monitor MW-18-1 and MW-18-2 were installed.	To monitor water levels in the overburden at the property boundary.	Clarification provided regarding monitors MW18-1 and 18-2. Issue resolved
317.	Selected borehole logs are presented with a number of borehole logs missing. In addition, a table showing monitoring construction details is missing. Monitor details were provided in a separate submission received September 29, 2020 for the shallow groundwater monitors installed in the five wetlands noted by Tatham. No soil descriptions were included. In addition, no monitoring details or soil/bedrock descriptions were provided for test wells BS-06 and BS-07 completed by Azimuth. Monitoring details should be provided in a table format within the report and borehole logs for BS-06 and BS-07 should also be included in the report.	As per the response to Comment 11 and 315, driller's logs for BS-06 and 07 are provided in Schedule E. As indicated in the report: *"The Keith Lang boreholes* [including BS-06 and BS-07] *were drilled to supplement the original HQ boreholes and expand the geological and hydrogeological coverage of the Western Lands. These boreholes are 6-inch in diameter and were constructed using a conventional rotary water well rig. As such, no core was recovered in these boreholes".* Spinner logs were recorded in BS-06 and BS-07 and these are also included in Schedule E. For additional details refer to Borehole Log BS-03, (Earthfx, 2020, Page 361) which is less than 10 m from BS-06. The borehole log for BS-03 shows that the water table was at the bedrock surface contact at the time of drilling so no monitor was installed above the water table.	MECP drillers records were provided for the Lang monitoring wells BS-06 (Tag no. A235621) along with Tag no. A235624, assumed to be BS-04 and Tag no. A235628 assumed to be BS-05. Azimuth provided borehole logs with their report for BS-01, BS-02, BS-03, BS-04, BS-05, BH18-1 and BH18-2. The borehole and/or drillers log for BS-07 appears to be missing. Soil descriptions for the Tatham boreholes are also missing. It is noted that ground elevation is missing for BS-04, BS-05, BS-06 and BS-07.	Noted.	Information missing from borehole logs was noted by Earthfx.
319.	In addition to reporting elevations of the packer testing zones, the corresponding bedrock or model layer zones for the reported packer test results should be identified.	A spreadsheet with pack test data has been provided in Schedule E. The packer test depth intervals are listed in the table. The information has also been presented in a table in a MS-Word document. Figures showing the packer test locations are also provided.	Comment noted. Model layers corresponding to packer test intervals on the provided tables would be helpful for peer review purposes.	RESOLVED	Packer test information was provided but corresponding model layers were not identified as suggested.
320.	Typographic error; 1615 Cedar Springs Road should be 5161 Cedar Springs Road as referenced in text at top of page 371.	Comment noted.	Typographical error noted. Assume error will be corrected.	RESOLVED	Typographical error noted by Earthfx.

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321.	'In fact, BS-07 was to originally be used as the pumped well. However, the water level in this well drew down too quickly and therefore the test was abandoned and the pump moved to the BS- 06 well which proved to be more conductive than BS- 07.' What is the significance of the difference in hydraulic response between BS-07 and BS-06 within the bedrock? How has this variability been accounted for in the computer model?	As demonstrated by these two close wells, some locations will be proximal to a well- connected fracture, some locations will not. There distribution of fracture connectivity is likely random and not mappable. Reasonable EPM aquifer properties were adopted in the model, but there will not be a match to K variation at specific locations.	Clarification provided.	RESOLVED	Clarification provided regarding difference in hydraulic response from pump tests in adjacent wells BS-06 and BS-07. Variations in bedrock fracturing is attributed to difference in hydraulic response.
322.	'The test response for the Westerns Lands is unique in terms of the unconfined response and is attributed to the local setting at the pumping well. This is stated since the bedrock profile at the pumping well is overridden by a thickness of sand which has not been seen elsewhere on the Western Lands and the Southern Lands. This delayed response (i.e., late-time unconfined response) is attributed to the overlying sand sequence as opposed to the larger interconnected fractured rock network. This also accounts for the fact that the same response was not observed during the former Golder pumping test sequences (Golder, 2006). The clay till overburden evident over the regional setting has no capacity to yield any significant response. ' The pump test was able to assess the hydraulic conductivity of the bedrock aquifer. No borehole logs of the test wells BS-06 and BS-07 were provided to confirm the bedrock intervals that were tested. The lack of groundwater monitors within the overburden shallow water table prevented an assessment of the degree of leakage from surface and the degree of interconnection between surface water features such as wetlands and the underlying bedrock. Pumping test of the bedrock should include a groundwater monitor completed within the overburden to assess the interconnection between the overburden and bedrock. Monitoring of nearby surface water features should also be conducted during the pumping test. The pumping test should be of sufficient length to determine the degree to which there is hydraulic connection between the overburden and bedrock.	As per the response to Comment 11 and 315, driller's logs for BS-06 and 07 are provided in Schedule E. As indicated in the report: "The Keith Lang boreholes [including BS-06 and BS-07] were drilled to supplement the original HQ boreholes and expand the geological and hydrogeological coverage of the Western Lands. These boreholes are 6-inch in diameter and were constructed using a conventional rotary water well rig. As such, no core was recovered in these boreholes". Spinner logs were recorded in BS-06 and BS-07 and these are also included in Schedule E. For additional details refer to Borehole Log BS-03, (Earthfx, 2020, Page 361) which is less than 10 m from BS-06. The borehole log for BS-03 shows that the water table was at the bedrock surface contact at the time of drilling so no monitor was installed above the water table.	Borehole logs were provided as per comment 11. Confirmation of the unsaturated overburden with the construction of a groundwater monitor within the overburden would have been helpful in assessing the interconnectivity between the overburden and the bedrock. The lack of water within the overburden may have been due to the conventional rotary drilling techniques used to drill the borehole. A bentonite mud is typically used in conventional rotary drilling techniques to lubricate the drill bit while completing the borehole. This may also create a temporary barrier to formation water entering the borehole. Water levels measured within the underlying bedrock zones as shown on the borehole log for BS-03 would support the conclusion of unsaturated conditions within the overlying overburden at this location although this is not conclusive without instrumenting the overburden for groundwater level measurements.	Please refer to the updated AMP.	The lack of an overburden monitor near BS06 and BS07 would provide confirmation of overburden saturation and would be valuable in assessing the interconnectivity of the shallow and deep groundwater system during the pump tests. The degree of interconnectivity remains unclear.
323.	'For the three HQ (4-inch diameter) boreholes (BS-01, BS-02, & BS-03), the borehole diameter limited the installation of two formal monitoring well instrumentations, both of which were standard one-inch (25 mm) diameter PVC construction, while BS-01 and BS-02 had the upper part of the boreholes left open such that they targeted the upper saturated fractures and could be monitored and sampled similar to the deeper well constructions. The larger diameter 6-inch water wells (BS-04 & BS-05) were able to have three formal monitoring well installations with 1.25- inch (32 mm) diameter PVC construction. All these wells were constructed with either a 1.5 m or 3 m machine slotted well screen with standard monitoring well sand pack. The intervening borehole spacing was sealed with bentonite hole plug to ensure proper vertical sealing between monitoring wells within each borehole.' How can be sure the bentonite seals between the multi-level monitors within one borehole were not leaking to explain the similar water level response in each monitor?	Monitors were constructed by experienced staff so there should be little chance of interconnection. BS-01 to BS-05 contain multi-level monitors. Similar water levels between screened aquifer units were expected at these wells due to the findings presented by Golder on the south lands (MW03-04, MW03-28, and MW03-32) along with the aquifer testing results on the western expansion land wells. There is also a constant supply of recharge water from the golf course irrigation ponds which influence the aquifer systems. The vertical gradients are also discussed in Section 5.3.3.2 where it is noted that that with increasing distance from the quarry, the difference in head between the shallow and deep system is reduced and when the quarry no longer influences the lower system, the water levels in the shallow and deep system are nearly identical.	It is acknowledged that testing the integrity of bentonite seals may be problematic. Slug testing with the removal from or adding of water to one monitor while measuring water level response in the other monitors within the same borehole could provide evidence of the integrity of the bentonite seals within the same borehole. Completion of separate boreholes with individual monitors in each borehole would greatly reduce uncertainty regarding leakage through bentonite seals within the borehole.	Your preferred way to construct monitoring wells is noted however we are confident that the multi-level monitors within each borehole have adequate seals.	The method of construction of the multi level monitors provides a degree of uncertainty regarding leakage between bentonite seals. There is a higher degree of confidence in the integrity of bentonite seals and the hydraulic response in multi level monitors completed in separate boreholes.

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327.	In total, 100 monitoring wells were monitored at 39 locations (nested locations) with data loggers targeting 34 monitoring wells for at least part of the monitoring period of November 2018 to October 2019. It is also noted that a single domestic well located at 5161 Cedar Springs Road was also included in this monitoring program and had a data logger installed for continuous monitoring.' Need a figure to show which monitors were monitored. Were manual water level readings taken and available drawdown assessed in these wells? If so, these data should be provided as background information to the report. Shallow overburden wells need to be monitored to assess impacts to wetlands. Note that water level data was subsequently provided in a excel spreadsheet in a separate information package received September 29, 2020. The data was transcribed from the original files into a computer input file for computer model purposes and was of limited usefulness for peer review purposes.	As noted in Comment 325, a spreadsheet providing data for of all monitoring wells is provided in Schedule E. The data is also presented in an MS-Word table along with figures showing well locations. Average water levels are provided in the table along with ground surface and monitor top and bottom elevations so that depth to water and available drawdown can be determined.	Monitoring well water level data provided.	RESOLVED	
331.	'During the field program completed by Azimuth in 2019, 24 ground water samples were collected from 13 locations, while eight additional samples were collected from the Southern Lands to complement the previous geochemical sampling completed by Golder in 2003. This previous sampling of the Southern Lands included 22 water quality samples collected from 21 locations.' Laboratory results should be provided as background information to the report. Copies of laboratory data results were provided in a separate information package received September 29, 2020. A summary and analysis of these data with respect to water quality characterization has not been provided and should be included in the assessment report.	Additional water quality information has been compiled and supplied in the response to the MECP comments and AMP discussion included in Schedule A.	Some additional water quality data was provided for the Goodchild well in the response to MECP Table comment 4. It is not clear whether the water quality data presented represents average water quality. It is also not clear when or how the well water samples were taken. Water quality data is provided from the sump discharges as part of the 2019 and 2020 Groundwater and Surface Water Compliance Reports, provided as attachments to the JART Natural Heritage Summary Table. Water quality laboratory data sheets are included in these reports but are missing for groundwater data collected by Azimuth. A discussion is lacking regarding the potential for water quality impacts on the groundwater system and down-gradient wells from the proposed infiltration ponds. As it is proposed to infiltrate quarry sump discharge, a water quality analysis of the sump discharge with respect to the Ontario Drinking Water Standards is required.	This has been asked and answered. Therefore we can agree to disagree.	
332.	'Of the 156 homes visited, only eleven (11) homeowners indicated that they were interested in participating in the monitoring program. Seven (7) of the eleven (11) private domestic water wells were accessible and, as a result, have been added to the current groundwater monitoring program A summary of the well survey results should be provided as background to the report and there should be a discussion of findings from the well survey. All of the locations included in the well survey should be identified on a figure. Copies of 26 well forms were provided in a separate information package received September 29, 2020. It is not clear whether these are all of the well survey results and the remainder of the156 homes visited as part of the well survey did not have a response. Threshold levels should be established for the private wells.	Additional details about the well survey are included in the AMP document (together with a map showing the locations that responded). The AMP also states that a follow-up well survey will be completed at a later date due to again invite well owners to participate. The seven wells to which access was provided in the first survey did not provide significant insight beyond the publicly available well record. Additional documentation could be provided now, however the AMP states that Nelson's website will have a page dedicated to Private Well Monitoring details once the second survey is complete.	All wells/residences included in the survey, whether responding or not, should be indicated on a map. Having private well information is important to providing an effective assessment of potential well interference complaints.	All wells within 1 km were surveyed however resident participation was limited. As noted, upon licensing a detailed water well survey will be completed again to ensure that we have accurate information on the key receptors, such as well location, well depth, historical water issues (quality and quantity), available drawdown, etc. Until residents participate in this survey, additional information cannot be obtained. This work will be a condition of the ARA license as well as a requirement for any future ORWA applications to be submitted and reviewed by the MECP.	

NIAGARA ESCARPMENT COMMISSION COMMENTS

Proposed Burlington Quarry Expansion
Interim JART COMMENT SUMMARY TABLE – Hydrogeology

Please accept the following as interim feedback from the Burlington Quarry Joint Agency Review Team (JART). Fully addressing each comment below will help expedite the potential for resolutions of the consolidated JART objections and individual agency objections. **These interim comments will be finalized following the breakout meetings between JART and Nelson and any changes will be marked using "track changes". Additional, new comments may be provided once a response has been prepared to the comments raised below and additional information provided**.

	JART Comments (February 2021)	Applicant Response	Interim JART Response (February 2022)	Applicant Response June 2022	JART Response (June 2023)
3.	The report lacks discussion on the realized impact of the existing extraction operation on groundwater in the area throughout its lifespan. (Part 2.2.1 & 2.9.3 (g)). Discussion on cumulative impacts and the objective of minimizing negative impact on surrounding land uses would benefit from the inclusion of such information.	The report does in fact, clearly delineate the "cumulative effects" of all existing and proposed excavations in the water level maps and hydrographs presented for each development scenario phase. The results were presented in terms of absolute water levels and streamflow's, not just in terms of change, so the cumulative impacts were fully taken into consideration. We also present incremental drawdowns from a fully transient 10-year baseline, and both average and minimum remaining available drawdown in the aquifers. As part of the report, extensive use of observations of change in groundwater levels due to excavation within the quarry footprint was utilized (See Section 6.11.3). This information was extremely useful for the transient calibration and for developing an understanding of the magnitude of the likely future changes due to quarry expansion. This work resulted in a recommendation to revise the rehabilitation plan for the existing quarry to mitigate impacts from the existing approved quarry. As JART is aware the existing approved rehabilitation plan for the Burlington Quarry requires dewatering to stop and the site to naturally flood to a lake with no off-site discharge. As part of the Burlington Quarry Extension application, Nelson has agreed to modify the existing quarry rehabilitation plan to maintain off-site pumping to improve conditions for surrounding lands compared to existing approvals and maximize land area for future after uses. We did not attempt to recreate pre-1950s conditions, as this would have limited relevance to assessing the impact of future expansion, which was the focus of this study. Pre-1950's data is extremely limited, so attempts to estimate flows and levels at that time would be of little value.	Not addressed. Restoration and enhancement with regard to development that has occurred or may occur is not predicated on recreation of pre-1950s conditions but can refer to historical data available for surface conditions, and this report details that absent perpetual pumping the resulting lake will be at a level conforming to the water table. Potential "long-term" impacts to the downstream fish habitats are relative, given the life of the existing quarry and pumping regime versus the age of the overall landscape.	As we noted, the model analyses and report looked at the cumulative impacts of all activities in an 83 km2 area surrounding the quarry site during the excavation periods of the proposed quarry expansion and post-rehabilitation. The analyses assumed that the current quarry footprint represented the maximum for the existing site and no further impacts from current conditions were expected. The rehabilitation analyses included rehabilitation for both the existing quarry and expansion areas. This covers the lifespan of the proposed excavation, as required, with the added analysis of the existing site under current and future (rehabilitated) conditions. The response raised a second issue related to potential "long-term" impacts to downstream fish habitat. As we noted in discussions with MNDMNRF, fish habitat has been significantly altered due to factors other than quarry discharge including construction of a dam at the confluence of Willoughby and Bronte Creek (SW2) and numerous in line ponds between SW7 and SW2. There is no fish habitat in the Medad Valley upstream of SW7.	Not addressed as analysis encompassing pre-quarry conditions without perpetual pumping is not considered or provided.
4.	Review of rehabilitation scenarios should better reflect the requirements of the NEP (2017). Currently there is no concrete evidence that the natural and hydrological features of either expansion sites are being restored or enhanced. Scenario 1 describes that "the overall hydrogeologic and hydrologic conditions will be similar to the final extraction "phase". Please consider Part 2.9.11 (a) & (b) of the NEP. Scenario 1 will require perpetual pumping of the site to ensure appropriate water levels. More detail on how this would support other public water management needs should be provided. NEC Staff interpret this to mean supporting existing water management needs, not as a mitigation measure to achieve a proposed after-use. (Part 2.9.11 (j)). Scenario 2 describes that the whole quarry will be allowed to fill and become a lake. Additionally, groundwater levels will be impacted as will stream segments (key hydrologic features). Please consider 2.9.11 (a) & (b) of the NEP.	The rehabilitation objectives and designs are discussed in further detail in the other companion reports (i.e. MHBC 2020). Considerable thought and analysis went into the preparation of the design and it reflected factors including the requirements of the NEP (2017). The integrated modelling rehabilitation analysis indicates that the proposed scenarios will preserve and restore streamflow, groundwater levels, wetland stage, and wetland hydroperiod to conditions similar to those currently observed at the site. The phrase "the overall hydrogeologic and hydrologic conditions will be similar to the final extraction phase" was referring to the groundwater levels and water management features from a modelling context. Considerable site rehabilitation will be done to create and enhance recreational features and enhance natural features on the site. Pumping will be required in Scenario RHB1 to manage groundwater inflows into the site, maintain the recreational features and enhanced natural features on site. Discharge from the site will have the added benefit of helping maintain current flows in the tributaries to Willoughby and Mount Nemo Creeks and to sustain the fisheries that have adapted to these long established rates of flow. Future operations will no longer be driven by golf course irrigation needs and can be optimized for ecological and fisheries benefits as there is considerable water storage in the quarry. The proposed infiltration pond in RHB1 is both larger than the current golf course pond system and closer to the Medad Valley and can also be operated in a manner beneficial to the natural features of the valley. Scenario 2 allows the groundwater levels within the excavated areas to recover. This will also allow groundwater levels outside the	Partially addressed. As with comment 3, the "long established" quarry discharge rates of flow to the Willoughby and Mount Nemo Creeks tributaries are relatively brief given the life of the quarry vs. the extant landscape. Estimates of quarry discharge contributions in proportion to overall flow where fish habitat occurs in these watersheds would be informative, in addition to background information on whether fish habitat was present prior to establishment of the quarry operations.	As we noted in our response, two scenarios were investigated: RHB1 which required ongoing pumping to continue to provide water to off-site features; and RHB2 which allows the groundwater levels within the excavated areas to recover but would result in decreased discharge, with flows at more natural (pre-dewatering) levels. The response raised other questions related to fish habitat. As noted above, fish habitat has been significantly altered due to factors other than quarry discharge including construction of a dam at the confluence of Willoughby and Bronte Creek (SW2) and numerous in line ponds between SW7 and SW2. With regards to historic flows, existing quarry operations started in the 1950s and pre-date the start of monitoring in 2003. Data on flow conditions and habitat prior to that time are unavailable. The Bronte Creek Watershed Study (Conservation Halton, 2002), notes that fish habitat has been significantly altered due the dam at the confluence of Willoughby and Bronte Creek (SW2) and more than 12 private in line ponds (visible in new LIDAR data) between the quarry and SW2. Significant additional insight, including new LIDAR data detailing Willoughby Creek and the Medad Valley, is provided in Earthfx Schedule 1 and 2.	Remains partially addressed, as pre- or early-quarry conditions and metrics overlap with early conservation authority jurisdictions and records, and do not preclude estimation of pre-quarry baseline conditions.

NIAGARA ESCARPMENT COMMISSION COMMENTS

		site to recover. Flows in the tributaries to Willoughby and Mt Nemo Creeks will decrease because of the cessation of pumping, but a new, more natural equilibrium would be restored with increased groundwater discharge to the Medad Valley. Taking into consideration both rehabilitation scenarios, the water resources and natural environment team recommend rehabilitation scenario RHB1.			
5.	Better integration between the findings of Hydrogeological report and the Natural Environment Technical report should be considered. • Hydro report suggests that the effects of a 3.0% loss to the inflow of groundwater to 5 of 22 wetlands is so small that “it cannot be measured in the field”. What type of effects are being measured? How does even a 3.0% loss of groundwater inflow to these key hydrologic features achieve Parts 2.6.3, 2.7.6, 2.9.3 (d & e) of the NEP (2017)?	A package of interdisciplinary tables integrating wetland and watercourse characterization and analysis has been prepared and provided in Schedules B and C. Included in those tables are additional hydrographs illustrating the timing and volume of groundwater seepage change that is predicted to occur. The simulations are consistent with long term observations at Wetland 10 and 3 which demonstrate that nearby quarry excavations have no measurable effects on the perched wetlands (see companion MNRF response and discussion). There are wetlands close to 120 m from the proposed extraction areas. Most of the wetlands are perched and thus receive no groundwater inflow. Lowering the water table in the vicinity of these features will not have an impact on the features. Other wetlands receive groundwater inflows for all or part of the year when the water table rises above the base of the wetland. The amount of groundwater exchanged between the aquifer and the wetland at these times strongly depends on the hydraulic conductivity of the material beneath the wetland. The wetlands in the site vicinity are underlain by Halton Till, which has been found to have generally low hydraulic conductivity, thereby limiting the volumes of water exchanged. Groundwater inflow into these wetlands forms a small part of their water budget, therefore, decreases in these volumes are expected to have limited negative impact on the hydrologic function of the feature, water quantity and quality, natural streams or drainage pattern, and the overall water budget for the watershed.	Partially addressed. The review may be better informed by more granular data presentation and analysis. Confirmation that some wetlands receive groundwater flows for all or part of the year indicates that a 3% loss of inflow is acknowledged and evaluation of cumulative impacts based on a short sampling span is limited in scope.	Our study has been highly integrated, both during the original work and in formulating responses to the review comments. The lack of monthly water budgets in the original report is not a reflection on the level of integration. In fact, hydrographs and tables of daily flows, stage, and groundwater levels and other water budget components were provided to the other team members during the course of the project as aids in their analyses. These daily data were as granular as possible with the integrated model and showed the seasonality and year-to-year variation in wetland behavior. Additional granular results, integrated with new LIDAR data detailing Willoughby Creek and the Medad Valley, is provided in Earthfx Schedule 1 and 2. As noted, monthly water budgets are inferior to our submission of annual summaries and graphs of daily components. Monthly average water budgets smear the effects of wetland function because of changes in the timing of the arrival of the spring freshet and lagged changes in surface and groundwater storage. For example, the spring freshet may occur entirely in one month, or span a month boundary. Further, surface water and groundwater storage response is also lagged.	Remains partially addressed.
302.	Permanent and intermittent streams as well as seepage areas and springs are considered key hydrologic features by the NEP. Section 11.3 of the report lacks detailed discussion on the effects on these features specifically on the western expansion lands where streams and ponds are proposed to be entirely relocated to a proposed discharge pond	Section 11 is a summary of the findings. There are detailed discussions on predicted changes in the groundwater levels, streamflow, and wetland stage for each scenario. In particular, Section 8.5 and 8.6 discuss the effects of P12 excavation and refilling on western streams and wetlands.	Partially addressed. 8.5 details extraction of areas 1A, 1B and 2 (south extension). 8.6 and 8.7 provide information on extraction of areas 3, 4, 5 and 6 (west extension). These further details are acknowledged, but impacts on NEP key hydrological features are confirmed in this analysis.	Correct, sections 8.6 and 8.7 provide the detailed discussions on predicted changes in the groundwater levels, streamflow, and wetland stage for the effects of P3456 excavation and P12 refilling on the western streams and wetlands. The streams and ponds to be redirected under that scenario, mentioned in the original comment, are artificially created golf course ponds and the interconnecting channels (originally drainage ditches) that are fed by quarry discharge. These will be removed. An infiltration pond, discussed in the report, is intended to replace the groundwater recharge function, of the removed golf course ponds. For additional information please refer to Schedule 1 and 2.	Remains partially addressed: these further details are acknowledged, but impacts on NEP key hydrological features are confirmed in this analysis.

Proposed Burlington Quarry Expansion
JART COMMENT SUMMARY TABLE – Natural Environment

Please accept the following as feedback from the Burlington Quarry Joint Agency Review Team (JART). Fully addressing each comment below will help expedite the potential for resolutions of the consolidated JART objections and individual agency objections. **Additional, new comments may be provided once a response has been prepared to the comments raised below and additional information provided**.

	JART Comments (February 2021)	Reference	Source of Comment	Applicant Response (July 2021)	Interim JART Response (February 2022)	Nelson GEI/Savanta Response (June 2022)	JART Response (June 2023)
Report/Date: Level 1 and Level 2 Natural Environment Technical Report, April 2020				**Author: Savanta**			
1.	Confirmation of the existence and extent of critical fish habitat within 240.0 meters of any identified key hydrologic feature should be provided though DFO (NEP, Part 2.7.5 & 2.7.6 (d))	General	Niagara Escarpment Commission	DFO has confirmed in the Letter of Advice dated June 23, 2021, and their accompanying email that the constructed golf course ponds and interconnecting channels are not considered to be fish habitat.	Partially addressed. DFO's support of Nelson's position re: the golf course ponds and interconnecting channels in their email of June 23, 2021 is acknowledged, but we note that the formal letter does recognize the presence of Largemouth Bass, and how they are to be protected in preparation for extraction activities, and so implicitly acknowledges fish habitat in these ponds. As a result, the presence of fish habitat within 240 meters of any key hydrological feature on or adjacent to the subject property is not refuted. The Savanta's letter of August 14, 202, is appreciated for its provision of pre-golf- course (and quarry aerial photographs, but lacks documentation of the same for the south extension, and does not include pre-golf-course (and quarry) national topographic series mapping. All of this documentation would be useful in documenting pre-existing drainage patterns to guide mitigation during extraction and rehabilitation post-extraction.	Given that the Niagara Escarpment Plan definition of fish habitat is based on the Fisheries Act definition, our opinion remains consistent with DFO in that the drainage features on the golf course should not be considered "fish habitat" for regulatory purposes, regardless of the presence of fish and any requirements for mitigation associated with fish removal prior to feature decommissioning. DFO's guidance is clear that not all features that contain fish are considered "fish habitat". The sole intention of the August 14, 2020 letter was to provide DFO with information on the drainage features on the golf course so they could determine if those features are considered to be fish habitat.	The DFO definition of fish habitat was rescinded in 2012. These areas meet the definition of fish habitat in the NEP, so only partially addressed.
2.	Further clarification should be provided related to assessed significant woodlands on the western expansion site (golf course). The technical report identifies woodlands 'D' & 'M' on the golf course lands as significant; with woodlands 'A' on the opposite side of Colling Road also being significant. • If the technical report identifies these areas as significant woodlands, Part 2.7.3 of the NEP (2017) must be considered in the context of the future health of the feature. Currently the extraction plan proposes to isolate significant woodlands 'D' from surrounding features; NEC Staff are of the opinion this would not maintain or enhance the feature, or associated features	General	Niagara Escarpment Commission	As summarized in section 6.2.1, woodland D is relatively isolated and located on the golf course, adjacent to the existing quarry. While a portion of this woodland is native, the cultural woodland area is non-native, with an abundance of Black Locust, an undesirable tree species, and the FOD5/DIST area contains only a canopy layer, along with turf grass and paved golf cart paths in the ground layer (sub- canopy and understory vegetation are absent). There is high potential to enhance this woodland both in species diversity and composition. The proposed rehabilitation plans will create a system that is better connected and functional than	Not addressed. Woodland D will be fully isolated by the proposed extraction activity: hedgerows provide connectivity between KNHF, so acquiring baseline data through survey is justified to evaluate impacts of the resulting Woodland D isolation. Hedgerows are also a component of the Open Landscape Character comprising the rural environment of the NEP, and so their conservation is warranted.	During extraction Phases 1 and 2, Woodland D is connected to the overall landscape and NHS. During Phase 3, the hedgerow that runs south from Woodland D to No. 2 Side road will be removed as extraction progresses from the existing license into the golf course. As extraction occurs in Phases 3 and 4, Woodland D will remain connected along the west (area of Phase 6), as well as to the north and west (area of Phase 5). During extraction in Phase 5, rehabilitation in Phases 3 and 4 will be on-going, and the connectivity from Woodland D to Woodland M, south of Phases 3 and 4, will be restored as shown on Page 3 of 4 of	Not addressed. Connections provided during operations and by the rehabilitation plan should be demonstrably adequate to maintain a long-term linkage function.

	through extraction. • The impact of this isolation should be discussed in the report and should take into consideration the wording of Part 2.7.6 (d) & 2.9.3 (e). • Hedgerows are identified in the ELC mapping; typically, hedgerows will be included in the connectivity/wildlife corridor considerations. Please include assessment of hedgerows within the scope of maintenance and enhancement of key natural heritage features and wildlife habitat. • Amphibian movement corridors are considered an important function of significant wildlife habitat, they have been identified as being present impacts/mitigation should be considered in relation to SWH.			what currently exists in the golf course and adjacent quarry. Further details are provided in response #9 below. Hedgerows are not a component of woodlands or SWH and are not a KNHF; therefore, survey effort is not recommended. The amphibian movement corridor will remain untouched. No direct impacts are anticipated due to its location outside of the Study Area at the far edge of the 120 m adjacent lands. Potential hydrological impacts and associated mitigation measures are provided in detail in the Wetland Characterization Summaries – wetland 13203 – appended to this response submission.		the Site Plans. During this time, Woodland D will remain connected to the surrounding landscape since extraction in Phase 6 will not have commenced. During extraction of Phase 6, side sloping of Phase 3 area will be completed, and progressive rehabilitation will continue in Phases 4 and 5, re-establishing the open landscape to the north of Woodland D. Therefore, Woodland D will not be isolated during the extraction phasing and will continue to have access to the adjacent landscape and NHS. The extraction phasing and active rehabilitation commitments have been designed to avoid the isolation of this feature.	
3.	In some areas buffers to significant woodlands have been proposed <30.0 meters in width despite lands being available to achieve 30.0 meters. 30.0 meters is a generally accepted standard for protection from an extraction use, please provide further justification for these reductions (relevance to significant woodlands and wetlands) (Part 2.7.6 (c) & 2.7.7) • Reduced setbacks to the FOD7-4 community is of specific concern.	General	Niagara Escarpment Commission	With the exception of the buffer area adjacent to the pine plantation along the east side of the south extension, the buffers in areas that are less than 30 m will be revised on the site plans. In the West Extension, there will be a 30 m setback from the edge of the Weir Pond to the edge of the berm and a 30 m buffer from the edge of the FOD7-4 to the proposed limit of extraction and/or the edge of the berm. In the South Extension, there will be a 30 m setback from the FOD7-4 to the edge of the berm.	Partially addressed. Please provide justification for the exception <30m buffer adjacent to the pine plantation on the east side of the south extension.	A 30 m buffer has not been applied to the pine and spruce plantations (located along the east side of the South Extension, Woodland P) based on the ecological form and function of the feature. The Ecological Land Classification (ELC) ecosites that are adjacent to the proposed license and extraction boundaries consist of two types of coniferous plantations: White Spruce (CUP3-13*) and White Pine (CUP3-2). Thorough field surveys did not identify any significant wildlife habitat or species at risk individuals or habitat within these plantations. These plantations are, however, considered significant woodland based on size and proximity to Regulated SAR habit located further east, outside of the 120 m adjacent lands. These plantations are not considered suitable SAR habitat and therefore are not Regulated Jefferson Salamander habitat. These details were discussed with the NDMNRF. It was agreed that the adjacent pine and spruce plantations are not considered sensitive ecosites within the overall significant woodland, and therefore, a smaller buffer could be justified due to the limited feature sensitivity and the proposed adjacent land use.	Remains partially addressed, as the NEP does not differentiate mature plantations from significant woodlands overall.

						Furthermore, it is understood that JART's natural heritage technical reviewer does not have any concerns with the 15 m extraction setback proposed adjacent to the plantation.	
4.	Fulsome assessment of potential endangered species habitat on the golf course lands has not been completed. Golf course ponds were not surveyed for presence of Jefferson salamander. Connectivity between these ponds, and potential salamander corridors are in scope for the study. The presence of predatory fish in the northernmost pond does not justify excluding the more southern ponds from assessment (Part 2.7.6 (d)).	General	Niagara Escarpment Commission	We respectfully disagree with the comment that a fulsome assessment of potential endangered species habitat on the golf course lands has not been completed. All potential salamander breeding habitat was assessed and trapped as required. Discussions with the MECP confirm that the golf course irrigation ponds are not habitat for Jefferson Salamander and did not need to be surveyed. We are continuing to work with MECP for all SAR related matters and are adhering to their survey recommendations and protocols. As a point of clarification to the presence of predatory fish, Largemouth Bass was visually observed in all golf course irrigation ponds in September 2019, not just the northernmost one.	Partially addressed. In light of comment 84, notwithstanding the argument made that Largemouth Bass occupy the ponds that are not fish habitat, survey for Jefferson and other salamander species centered around these ponds and the related drainage channel(s) may provide supporting evidence for the MECP and proponent position on this matter. As with other forms of potential modeling, not surveying in areas identified as being of low resource potential does not test but reinforces the model used. Can the applicant share the MECP correspondence and confirmation that the golf course irrigation ponds are not habitat for Jefferson Salamander? As per comment 25, we recommend that surveying for Jefferson Salamanders is justified here.	MECP has provided verbal confirmation on several occasions, as well as in comment responses that the golf course ponds do not provide habitat for Jefferson Salamanders or the Jefferson-dependent Unisexuals (email correspondence December 3, 2021 – See attached **Tab 1**). In keeping with MECPs direction, the golf course irrigation ponds are not considered Jefferson Salamander habitat and survey efforts are not warranted. Further to this, the MECP confirmed that no impacts to habitat for Jefferson Salamander and Jefferson-dependent unisexuals are anticipated (email correspondence March 14, 2022 - See attached **Tab 2**).	Response is acknowledged, but remains partially addressed as outcomes anticipated by policy are not confirmed by ground-truthing with field surveys.
5.	Only one Turtle basking station was implemented on the southern expansion lands. Clarification sought as to why wet areas farther south were not included in the turtle assessment.	General	Niagara Escarpment Commission	Turtle basking surveys are used to help determine the presence of turtle overwintering habitat. The extent of the Study Area was surveyed for presence of deeper, pooling water wetland characteristics, and where these features were identified, they were further assessed by completing turtle basking surveys. Such features were limited to just the one on the Adjacent Lands of the South Extension.	Addressed.	Resolved - thank you	

6.	Amphibian assessment is noted in close proximity to wetland 13200; clarification is sought as to why no amphibian call station was implemented in the feature.	General	Niagara Escarpment Commission	Wetland 13200 did not contain water and therefore was not considered a suitable feature to survey for amphibian breeding.	Partially addressed. It is understood that further monitoring data is being collected to assist in the development of the AMP, given the ca. one year of water level monitoring in wetland 13200. Additional data would be useful to determine whether the absence of surface water at Wetland 13200 is its normal state, and can be an important component in impact assessment, not solely deferred to the AMP.	Wetland 13200 continues to be dry, as determined through the 2019, 2020 and 2021 salamander surveys with MECP. The wetlands have been instrumented, as of April 2020 and further details, including impact assessment and mitigation measures, have been included in the updated Wetland Characterization Summary Reports (2021). NDMNRF is satisfied with the impact assessment and monitoring and treating the feature as an assumed significant wetland for the purposes of this application.	Remains partially addressed, noting the relatively short time-span and that a call station could confirm with survey data.
7.	Overall impacts on the hydro period for the assessed wetlands should be further assessed taking into account various phases of quarry operation and rehabilitation.	General	Niagara Escarpment Commission	More details are provided in the attached Wetland Characterization Summaries.	Partially addressed. As further assessment of overall impacts on the hydro period was requested, more detail than annual summary data is required (such as monthly averages), to make a determination of any variation of values through the year, and provide for more detailed analysis and assessment and subsequent minimization of any ecological impact(s).	These details have been discussed and addressed with the NDMNRF hydrogeologist and ecologist. Additional monitoring and further details are provided in the updated AMP.	Partially addressed. While not an SME, all of the monthly metric and threshold tables in the second AMP submitted have “TBD” values in the cells.
8.	It is identified that wetlands 13200 & 13201 will likely be impacted due to a change in catchment area resulting from extraction. • A broader review of impacts should be provided that considers the connectivity of these wetlands (and 13202) as well as the cumulative impact on key natural and hydrologic features demonstrating connectivity within 240.0 meters. (Part 2.2.1, 2.7.3, 2.7.6 (d), 2.9.3(d&e)). • Outlets for these areas should be confirmed. • Maintenance and enhancement of key hydrologic features considered through this report, including wetlands, should be incorporated into the proposed rehabilitation and after-use plans (Part 2.9.3 & 2.9.11 (b)).	General	Niagara Escarpment Commission	More details are provided in the attached Wetland Characterization Summaries.	Not addressed. In conjunction with comment 92. While more data are provided in the attached wetland characterization studies, no further comprehensive review or analysis of the connectivity of wetlands 13200 and 13201 (and 13202), nor discussion of cumulative impacts on and rehabilitation of key natural and hydrological features, are provided.	Please see responses to comments #24, #34 and #37.	Not addressed, as per JART responses for #24, #34, #37, #92.

9.	Broadly, the report needs to discuss the impacts of fragmentation on the significant woodlands and wetlands in more depth, and should discuss how this fragmentation may, or may not be addressed through mitigation or rehabilitation. • Scope of consideration for impacts to key natural heritage and hydrologic features extends to connected features within 240.0 meters of the individual feature being assessed. A landscape approach within the site as well as broader capture and discussion of connected features off-site should be incorporated into the report. (Part 2.7.6 (d)).	General	Niagara Escarpment Commission	The proposed Extension Areas are sited within an active golf course and agricultural area. There is a Regional and Provincial NHS that runs north south; however, the area of the proposed expansion does not appear to negatively affect the redundancy of these smaller branches of the RNHS. The major areas of the NHS run along the Medad Valley, which is west of the proposed West Extension, as well as along the Mount Nemo Plateau and Grindstone Creek Complex, located east of the proposed South Extension. The proposed Extension areas are located between these two RNHS branches and are not impeding or removing any of the features that make up these two branches; the Extension areas are well outside of these two large systems. Based on the Region's NHS mapping, there are some smaller systems that lie parallel to, and between, these two major systems; however, these smaller systems do not connect to the larger NHS, north of the Study Area. These smaller branches of the overall NHS do not provide connectivity to begin with, and therefore, the removal or disturbance of golf course features and their potential for enhancement and future connectivity opportunities can only add to the limited contribution being made to the smaller NHS.	Partially addressed. The proposed isolation of features such as Woodland D and Wetland 13200 does have an impact on the overall connectivity of these smaller natural heritage features which should be considered in the context of mitigation and rehabilitation. The smaller scale of NHS systems between the two major systems does not negate their value, and their smaller scale if anything emphasizes their sensitivity to project impacts, and the need for more nuanced mitigation and rehabilitation methodology.	Please see response to comment #2.	Not addressed. Connections provided during operations and by the rehabilitation plan should be demonstrably adequate to maintain a long-term linkage function.
10.	An acknowledgement/assessment of Section 2.2 of the PPS (2020) – Water, does not appear in Section 2.1.1 of the Report. NEC Staff are of the opinion that Section 2.2 of the PPS contains a number of policies linked to natural heritage that should be assessed and incorporate findings from the Hydrologic and Surface Water reports.	General	Niagara Escarpment Commission	Section 2.2 of the PPS identifies the following water- related policies: "Planning authorities shall protect, improve or restore the *quality and quantity of water* by: a) using the *watershed* as the ecologically meaningful scale for integrated and long- term planning, which can be a foundation for considering cumulative impacts of development; b) minimizing potential *negative impacts*, including cross-jurisdictional and cross-*watershed* impacts; c)evaluating and preparing for the	The Planning Justification Report cites only Section 2.2.2 of the 2020 PPS, asserting that no sensitive surface or ground water features are present. Section 2.2.1 of the 2020 PPS is not addressed in the above report, as referenced in the applicant's response to comment 10, notably: "Planning authorities shall protect, improve or restore the quality and quantity of water by: a) using the watershed as the ecologically meaningful scale for integrated and long-term planning, which can be a foundation for	Section 2.2.1 was not specifically referenced in the Planning report since the policy relates to what "Planning authorities" are to do. The elements of each of these items are addressed throughout the planning report and other technical reports. In summary: The technical reports took into consideration the sub-watershed study completed for the area; The water reports took into consideration the potential for watershed impacts and included recommendations to enhance the watershed compared to existing	Not addressed, and reflects the subject silo approach that could be ameliorated by reference to companion reports.

				impacts of a changing climate to water resource systems at the watershed level; d)identifying water resource systems consisting of *ground water features*, *hydrologic functions*, *natural heritage features and areas*, and *surface water features* including shoreline areas, which are necessary for the ecological and hydrological integrity of the *watershed*; e)maintaining linkages and related functions among *ground water features*, *hydrologic functions*, *natural heritage features and areas*, and *surface water features* including shoreline areas; f) implementing necessary restrictions on *development* and *site alteration* to: 1. protect all municipal drinking water supplies and *designated vulnerable areas*; and 2.protect, improve or restore *vulnerable* surface and ground water, *sensitive surface water features* and *sensitive ground water features*, and their *hydrologic functions*; g) planning for efficient and sustainable use of water resources, through practices for water conservation and sustaining water quality; ensuring consideration of environmental lake capacity, where applicable; and i) Ensuring storm water management practices minimize storm water volumes and contaminant loads, and maintain or increase the extent of vegetative and pervious surfaces. *Development* and *site alteration* shall be restricted in or near *sensitive surface water features* and *sensitive ground water features* such that these features and their related *hydrologic functions* will be protected, improved or restored. Mitigative measures and/or alternative development approaches may be required in order to protect, improve or restore *sensitive surface water features*, *sensitive ground water features*, and their *hydrologic functions*."	considering cumulative impacts of development; b) minimizing potential negative impacts, including cross-jurisdictional and cross-watershed impacts; c) evaluating and preparing for the impacts of a changing climate to water resource systems at the watershed level; d) identifying water resource systems consisting of ground water features, hydrologic functions, natural heritage features and areas, and surface water features including shoreline areas, which are necessary for the ecological and hydrological integrity of the watershed; e) maintaining linkages and related functions among ground water features, hydrologic functions, natural heritage features and areas, and surface water features including shoreline areas; f) implementing necessary restrictions on development and site alteration to: • Protect all municipal drinking water supplies and designated vulnerable areas; and. • Protect, improve or restore vulnerable surface and ground water, sensitive surface water features and sensitive ground water features, and their hydrologic functions. A detailed response to PPS (2020) is warranted here, given the explicit policy directives identifying linkages and related functions between ground and surface water and natural heritage. PPS section 2.2 overall should also be addressed in the Planning Justification Report, and in more detail than an assertion that these policies are being met.	approvals; The water report and planning report took into account climate change; The natural environment and water reports assessed linkages between features; There are no municipal drinking water supplies in the area; The water resources report took into consideration designated vulnerable areas; and The water report and AMP included recommendations to protect, improve or restore sensitive surface water and sensitive ground water features and their hydrologic features.	

				The water policies that are relevant to natural heritage are indirectly addressed throughout the NETR, specifically in the sections regarding fish and fish habitat, given the importance of water quality and quantity to maintaining fish and fish habitat. Relevant water policies are also indirectly addressed in other technical reports (i.e., Surface Water Assessment and Hydrogeological and Hydrological Impact Assessment Report)." g) The overall policy analysis is found in the Planning Report, which includes a review of Section 2.2 of the PPS.			
11.	Additional assessment of downstream impacts to Brook Trout populations related to Willoughby creek is being requested due to the proposed change in water levels and the proposal to utilize perpetual pumping as a mitigation measure to maintain water levels in key hydrologic features.	General	Niagara Escarpment Commission	DFO has reviewed the documentation and issued a Letter of Advice, dated June 23, 2021. One of the requirements is to "maintain an appropriate depth and flow (i.e., base flow and seasonal flow of water) for the protection of fish and fish habitat. This will be addressed though the provisions of the AMP to ensure the pumping regime maintains base flow and seasonal flow of water. More details are provided in the attached Watercourse Characterization Summaries. DFO's guidance and conditions were provided after the Summary tables were prepared and circulated. Nelson is happy to work through the tables with JART to ensure that all DFO conditions and mitigation measures are included in the AMP and that all threshold and trigger values are updated, if needed, based on DFO recommendations.	Not addressed. Comparative modeling and analysis of impact to downstream cold-water fish habitat, between perpetual pumping and no pumping rehabilitation alternatives, including respective surface and ground water contributions, and their impacts on depth, base flow and seasonal flow, is not provided but warranted. Specifically, while surface water provided by a continued pumping regime would help to maintain volume in the downstream, Brook Trout habitat is characterized in part by cold-water provided through groundwater upwelling that is not provided by surface water.	The updated AMP includes flow and temperature mitigation and monitoring requirements within watercourses to ensure no harmful, alteration, disruption or destruction to fish habitat in accordance with DFO letter of advice.	Not addressed as comparative modeling and surface/ground water contributions are not discussed.
12.	The Level 1 and Level 2 NETR describes the current fisheries inventories conducted within the existing quarry (Burlington Quarry) and proposed expansion lands and provides an assessment based on the proposed changes associated with extraction and future operations on those lands. Discussion is limited to within 120.0 meters of the proposed quarry expansion lands. Supporting studies, such as the Surface Water Assessment, as well as hydrogeology submitted as part of the application discuss potential	General	Matrix Solutions Inc.	The application includes protection of surface water features beyond 120 m which also protects any associated fish habitat. DFO is the regulatory authority and is satisfied that application will not result in HADD subject to its Letter of Advice, dated June 23, 2021. More details are provided in the attached Watercourse Characterization Summaries. DFO's guidance and conditions were	1) The statement from DFO's Letter of Advice is contingent upon the successful implementation of mitigation measures by the applicant. The applicant will need to demonstrate that it is following mitigation recommendations provided in the Letter of Advice. Upon implementation of mitigation measures, the DFO letter states that this is not likely to result in a HADD. Evidence is needed from the applicant to demonstrate that all DFO conditions and mitigations are reflected in the revised	The updated AMP includes flow and temperature mitigation and monitoring requirements within watercourses to ensure no harmful, alteration, disruption or destruction to fish habitat in accordance with DFO letter of advice.	The applicant proposes to address fish habitat impacts beyond 120m through the submission of an updated Adaptive Management Plan (AMP) report, which integrates findings from the surface water assessment and hydrogeology. The applicant received a DFO Letter of Advice which stated that the impacts to fish habitat are unlikely to occur if mitigation measures, such as maintaining an appropriate depth of

	fisheries impacts to surrounding areas beyond 120.0 meters. The aquatic impacts provided in the 2020 NETR do not appear to be integrated with surface and groundwater reports and impacts to fisheries from these studies are not well understood.			provided after the Summary tables were prepared and circulated. Nelson is happy to work through the tables with JART to ensure that all DFO conditions and mitigation measures are included in the AMP and that all threshold and trigger values are updated, if needed, based on DFO recommendations.	AMP. We look forward to further explanations in this AMP reflecting how these recommendations are fulfilled. 2) Beyond 120m, it is anticipated that there would be groundwater impacts extending 1 km from the edge of the West Extension Quarry footprint. Interpretation of how this affects fish production in Willoughby Creek should be included as groundwater input is necessary to maintain the cold water character of this creek.		flow, and monitoring measures are applied to fish habitat. The updated AMP has been reviewed and it appears to be integrated with surface and water quality reductions and contains measures for maintaining flows and monitoring requirements with respect to downstream fish habitat. This comment has now been addressed, provided that the AMP is implemented.
13.	The inventories presented in the NETR describe the existing fisheries as consisting primarily of warm water species such as Largemouth Bass, which are commonly stocked in warm water ponds, as well as tolerant warm water fish communities typically found in intermittent tributaries. Given that the existing land uses consisted of a golf course and quarry operations, these results are not surprising for the most part, as the golf course has been in operation since the early 1960s and the lands have undergone ongoing disturbances. Since the existing quarry has been in operation, fisheries impacts have existed due to changes in drainage patterns from extraction activities. As the initial placement of the quarry has irreversibly changed the fish habitat conditions within the headwaters, it is more relevant to focus on the effect of the proposed new quarry expansions on the surrounding fish habitat. The 2020 NETR does not include discussion of the cumulative impacts to the surrounding water bodies that have been described in historical studies as being important. The cumulative effect on the surrounding aquatic habitats from the incremental quarry footprint expansion should be included in the discussion.	General	Matrix Solutions Inc.	We agree that the existing land uses in the study area (e.g., quarry, golf course, residential, transportation) have irreversibly changed the natural pre- existing fish and fish habitat conditions. We also agree that the NETR should focus on the effects of the proposed new quarry on surrounding fish habitat. We interpret the second paragraph of this comment to be similar to other comments regarding the request to expand the discussion regarding potential impacts to Willoughby Creek, which has been done in other rows in this table. Additional information on flows in Willoughby Creek will be provided in the AMP. The water resources report does, in fact, clearly delineate the “cumulative effects” of all existing and proposed excavations in the water level maps and hydrographs presented for each development scenario phase. The results were presented in terms of absolute water levels and streamflow’s, not just in terms of change, so the cumulative impacts were fully taken into consideration. The water resources report presents incremental drawdowns from a fully transient 10-year baseline, and both average and minimum remaining available drawdown in the aquifers. As part of the report, extensive use of observations of change in groundwater levels due to excavation within the quarry footprint was utilized (See Section 6.11.3).	The need to understand the past history of the quarry’s impact to fish habitat allows for the determination of the representative fisheries baseline conditions. Over the course of time, we know that we are dealing already with watercourses that have been already been impacted and future quarry expansions will need to be assessed against this impacted condition. It would be good to know what the incremental effect on the fisheries would be from the additional proposed quarry expansion. As fisheries inventories included in the NETR has been limited to within 120m of the quarry footprint, historical records (2004, 2006) were used to establish what these conditions are like. The applicant’s consultant asserts that those historical conditions would be similar to present day conditions. However, this is unlikely as there has been some drought events that have occurred as well as further development in the area that may have affected the current fishery. Due to constraints such as private property, our understanding of fisheries within 120m of the proposed quarry expansion is limited to areas where the applicant’s consultant has been able to sample. The NETR suggests that those water features within the existing quarry footprint are not fish habitat. Within the proposed west expansion footprint, the NETR suggests that the water features associated with the golf course are also not fish habitat as they contain an artificial fishery of Largemouth Bass and tolerant warm water fish.	The updated AMP includes flow and temperature mitigation and monitoring requirements within watercourses to ensure no harmful, alteration, disruption or destruction to fish habitat in accordance with DFO letter of advice.	The applicant acknowledges that fish habitat has been historically impacted through the placement of the Burlington Quarry. The applicant’s updated AMP includes discussion of groundwater and surface water impacts to date and proposes to maintain flow regimes associated with current quarrying activities. Furthermore, the updated AMP proposes the creation of an infiltration pond to mitigate the loss of groundwater contribution associated with the West Extension of the quarry. As the AMP for the quarry expansion incorporates impacts associated with the fisheries habitats associated with surface and groundwater, the updated AMP satisfies this comment. The applicant maintains that irrigation ponds and watercourses are not considered fish habitat. The explanation should be supported by policy definition by DFO.

				This work resulted in a recommendation to revise the rehabilitation plan for the existing quarry to mitigate impacts from the existing approved quarry. As JART is aware the existing approved rehabilitation plan for the Burlington Quarry requires dewatering to stop and the site to naturally flood to a lake with no off- site discharge. As part of the Burlington Quarry Extension application, Nelson has agreed to modify the existing quarry rehabilitation plan to maintain off- site pumping to maintain existing conditions for off- site fish habitat and other water based key natural heritage features which rely on water being discharged from the existing quarry.	The Willoughby Creek system has been defined as an area of active groundwater discharge. The discharge of surface water from the quarry footprint maintains flow but may not supplement the groundwater discharge reductions. If modelling predictions indicate a reduction in groundwater flow into the Willoughby system, is it possible that infiltration of groundwater at the quarry footprint be better at maintaining this cold-water system downstream? Loss of groundwater discharge to the Willoughby system remains a concern.		
14.	The Level 1 and 2 NETR also states that although that ponds and drainage features within the existing quarry and proposed expansion lands contain fish, these systems are not really fish habitat due to their anthropogenic origin and their isolation from other features, and as a result support no recreational fishery. Given the extent of quarrying, the fish community within the quarry footprint is expected to consist of species that can persist within the changing aquatic habitat conditions that are artificially maintained. The NETR describes the ponds and drainage features as having a hydrologic connection to fish bearing waters in the surrounding watercourses immediately outside of the proposed quarry extension lands. As there are linkages to fish habitat downstream of these areas, it is not clear where does fish habitat begin and end, and if alterations within the quarry in terms of flow, thermal regime, water quality or quantity will affect the downstream fish bearing waters. A table describing the rationale for fish habitat designations, supported by *Fisheries Act* definitions for these habitats should be included. Consistency with the application of fish habitat designations should be demonstrated in this table.	General	Matrix Solutions Inc.	Contrary to this comment, the NETR does not indicate that ponds and drainage features within the existing quarry contain fish habitat. Our interpretation of the limit of what does and does not constitute fish habitat is as follows, as discussed in Section 6.6 of the NETR: • The portion of the Unnamed Tributary of Willoughby Creek between the existing quarry discharge from Sump 0100 and the Colling Road culvert is indirect fish habitat, given that no fish were captured during sampling in this reach in 2019, with exception of Largemouth Bass that were captured in the Weir Pond. It is our opinion that Largemouth Bass are only present in this area as a result of the construction of the golf course drainage feature and therefore, the presence of bass in the Weir Pond, which is part of the commercially constructed golf course water feature, does not constitute direct fish habitat. This reach along Colling Road does provide important functions that contribute to downstream fish bearing waters, including flow conveyance (from the quarry discharge) and organic material inputs. • The constructed golf course	We are interested in determining how the fish habitat classifications are derived from the DFO definition of fish habitat. This is to ensure that these definitions are consistent in its application. Fish habitat is defined in subsection 2(1) of the Fisheries Act to include “all waters frequented by fish and any other areas upon which fish depend directly or indirectly to carry out their life processes. The types of areas that can directly or indirectly support life processes include but are not limited to “spawning grounds and nursery, rearing, food supply and migration areas.” Under this definition, clarification is requested to justify the distinction to distinguish the artificial fishery created with man-made ponds are not fish habitat even though they support fish. The applicant is requested to provide DFO policy that supports this distinction. There is an outflow from the irrigation pond which becomes classified as fish habitat. It is unclear how the outflow becomes fish habitat once it leaves beyond the Nelson Quarry properties. The DFO letter recommends protection of downstream waters and places requirements on the outflow quality and quantity. If the outflows are not controlled in terms of water quality and quantity, they can result in HADD to fisheries habitat. Aquaculture facilities that are entirely self- contained are defined as not fish	As previously noted in our original response, DFO has confirmed in their email of June 23, 2021, that they do not consider the drainage features on the golf course to be fish habitat. As the regulatory authority on what should be considered fish habitat, we are relying on DFO’s decision on this matter. Although we provided DFO with information regarding the golf course drainage features (in our letter dated August 14, 2020), we were not a part of their decision-making process and cannot speak for them in this regard.	The applicant’s interpretation of fish habitat classification outside of quarry is reasonable. The applicant is reliant on an email cover statement that “DFO does not consider commercial ponds (such as golf course ponds), roadside drainage ditches, quarries/aggregate pits, and irrigation ponds and channels as fish habitat”. The explanation provided does not appear in the *Fisheries Act policy*. Should this explanation be supported by the *Fisheries Act* policy definition, then this comment will be addressed.

				drainage features (ponds and interconnecting channels) are not considered to be fish habitat for the reasons outlined in section 6.6.1 of the NETR, as confirmed by DFO in their June 23, 2021, letter. • The reach of the Unnamed Tributary of Willoughby Creek downstream from Colling Road has assumed to be direct fish habitat (i.e., could support direct use by fish), given that no studies have been completed on private property to confirm the presence of fish. • The West Arm of the West Branch of the Mount Nemo Tributary is direct fish habitat downstream from Side road 2. • The East Arm of the West Branch of the Mount Nemo Tributary is indirect fish habitat upstream from the buried karst reach and direct habitat downstream from that point. • H2 is indirect fish habitat. DFO has confirmed in letter dated June 23, 2021, that the constructed golf course ponds and interconnecting channels are not considered to be fish habitat.	habitat. Clarification is requested in how waterbodies with an outflow to existing fish habitat are exempt from being defined as fish habitat. The statement from DFO is contingent upon the successful implementation of mitigation measures (and not intended to be an overall statement) • The definitions for fish habitat seem reasonable but is there DFO policy that supports those definitions? The DFO letter seems to imply the above but does not clearly define what are Canadian fisheries waters. Interpretation using Fisheries Act policy definitions is requested to clarify which watercourses are fish habitat. This explanation appears to be lacking.		
15.	Drainage and surface outflows of the existing quarry operations extend beyond the quarry footprints and are maintained through pumping operations, which are recommended to continue in perpetuity, long after the license for extraction has been surrendered. As long-term plans for the quarry contemplates changes to drainage conditions, along with the changes associated with climate change, understanding the effects on the surrounding fisheries habitat within the Niagara Escarpment is a key consideration in the proposed quarry expansion. The rationale for continued pumping operations should be supported by more detailed information on how fish habitats and linkages are to be maintained. Discussion on the existing flow regime and the form and function of watercourses and linkages should be included to determine how future changes with pumping and drainage will impact these watercourses. Hydrograph information and hydro periods in relation to the surrounding fish habitat should also be	General	Matrix Solutions Inc.	Continued pumping after the operational period has ceased has been identified in the NETR as a key mitigation measure to prevent long term impacts on fish and fish habitat in Willoughby Creek and the West Arm of the West Branch of the Mount Nemo Tributary of Grindstone Creek (as well as further downstream reaches). Pumping from the existing quarry sumps 0100 and 0200 has been occurring since construction of the original quarry and fish communities in these watercourses, as well as the habitat within the watercourses (i.e., stream form and associated function, such as channel size and biophysical processes such as erosion and sedimentation) are expected to be accustomed to, and reliant upon, the pumped discharge. Elimination of pumped discharge would be expected to have negative impacts on the form and function of these watercourses as they revert back	Although the continuance of drainage flows to the Willoughby Tributary through perpetual pumping may be good option for maintaining a continuous flow of water to the tributary, the pre- quarry conditions indicate that this system was groundwater fed (although likely having reduced flows). The pumping scenario provides flow but maintains a warm/cool water fish community (i.e. Blacknose Dace dominated, with occasional salmonid species according to historical records). Pumping of surface water to the Willoughby Tributary does not compensate for the loss of groundwater upwelling that may be lost through the construction of the West Quarry Extension. An understanding of the enhanced groundwater infiltration within the Willoughby system is requested to determine if this can benefit	Groundwater mitigation is proposed in the form of the infiltration pond adjacent to the west extension. Through discussions with the Ministry of Northern Developments, Mines, Natural Resources and Forestry (MNDMNRF), a revision to the integrated model was completed and remodeling of the effects of this mitigation has been completed by Earth FX. See attached **Tab 3** for a copy of the presentation and technical memo prepared by Earthfx. The updated AMP includes flow and temperature mitigation and monitoring requirements within watercourses to ensure no harmful, alteration, disruption or destruction to fish habitat in accordance with DFO letter of advice.	The applicant's updated AMP includes discussion of groundwater and surface water impacts associated with the quarry expansion and proposes to maintain flow regimes associated with current quarrying activities. Furthermore, the updated AMP proposes the creation of an infiltration pond to mitigate the loss of groundwater contribution associated with the West Extension quarry. As these measures will be maintained moving forward, the updated AMP satisfies this comment.

	included in the discussion.			to pre-quarry pumping hydrological regime (recognizing that the rehabilitated quarry will be remaining), which, in the case of the West Arm of the West Branch, would be intermittent and in the case of Willoughby Creek, would involve substantially less flow downstream from the current discharge outlet at the mouth of the Unnamed Tributary. The comment has requested more detailed information on “how fish habitats and linkages are to be maintained”. Essentially, the proposed pumping regime will continue the current flow rates supplied by pumping indefinitely to avoid the substantial change in hydrology that would occur if pumping were to cease after operations are done (as permitted by the current approvals for the existing quarry). Pumping will continue indefinitely to the current outlet locations and at the same general discharge rate regime as currently occurring and will be occurring through the operational scenario. This has been modelled in Rehabilitation Scenario 1 in the integrated stream flow model in the Hydrogeological and Hydrologic Impact Assessment Report. Hydrological changes in Willoughby Creek and the West Arm of the West Branch are predicted to be minimal relative to existing conditions. Further, the predicted impacts on stream flows outlined in Rehabilitation Scenario 2 depict much more substantial changes in flow relative to current conditions and would be expected to have substantial impacts on fish and fish habitat in these watercourses.	downstream fish habitat conditions, in addition to pumping. To allow for a better understanding of pros and cons of maintaining the pumping operations in Willoughby Creek, the NETR should include discussion of the fish habitat and fish community under both scenarios of pumping vs. not pumping. If the “no pumping “situation was initially approved, do we have information on what that scenario would be in terms of the downstream fishery in Willoughby Creek?		
16.	With respect to the quarry expansion application, the applicant has assessed the fisheries habitat within 120.0 meters of the proposed expansion area. Other studies that relate to fish habitat that are submitted as part of the quarry application discuss impacts beyond 120.0 meters of the proposed quarry expansion area. To have a better understanding of the impacts to fisheries resources, the applicant needs to integrate the 2020	General	Matrix Solutions Inc.	Comment noted. Responses are provided to subsequent comments in the rows below.	The study areas differ in the surface and groundwater studies- i.e. the surface and groundwater impacts appear to be larger than 120m. Subsequent discussion with JART groundwater experts reveals groundwater impacts associated with the West Extension can be up to 1.0 km from the proposed quarry footprint. The corresponding effects on fisheries in areas where those surface and groundwater impacts are predicted	The updated AMP includes flow and temperature mitigation and monitoring requirements within watercourses to ensure no harmful, alteration, disruption or destruction to fish habitat in accordance with DFO letter of advice.	The applicant’s updated AMP includes discussion of groundwater and surface water impacts and proposes to maintain flow regimes associated with current quarrying activities. As these measures will be maintained moving forward, the updated AMP satisfies this comment.

	NETR with surface and groundwater studies which extend beyond 120.0 meters. Impacts to fisheries resources needs to be described in relation to future drainage scenarios associated with the changing nature of the quarrying activities over time, as well as the ultimate rehabilitation scenarios involving the creation of landforms, lakes, and changes associated with climate. The following provides a summary of the issues and concerns as they relate to fisheries.				should be included in the discussion.		
17.	The fish information available in the downstream reaches such as in Willoughby Creek are based on older baseline data (2006) and no further recent information regarding the fish communities in these areas have been made available. The paucity of recent fish data is reflected by the limited study area, no sampling or surveys in private property, and of active sampling gear such as seining, electrofishing methods and visual observations.	General	Matrix Solutions Inc.	Comment noted. The assessment of impacts on fish and fish habitat is based on the predictions of stream flow and groundwater discharge from the integrated model (as documented in detail in the supporting surface water and groundwater technical reports) with knowledge of the fish species that have been confirmed in Willoughby Creek in past studies. Although changes in relative abundance and biomass of fish within watercourses are expected to change over time in natural scenarios, it is reasonable to assume that generally the same species are present, as have been confirmed during previous studies, given the lack of available access to complete current fish community studies on Willoughby Creek which is predominantly held in private property. Habitat life history requirements of the species known to be present are well documented in the literature and from those requirements, an assessment of potential impacts on fish and fish habitat can be completed based on the predicted changes in habitat (e.g., stream flow and groundwater discharge). It is not necessary to have recent fish community data to complete an impact assessment based on the minor changes in streamflow that are predicted to occur, particularly when the assessment is primarily based on the presence of Brook Trout and associated habitat, as this species is predicted to be the most sensitive to environmental change of those species known to be present in Willoughby Creek.	There is a pretty large gap in time between older data in 2003/2006 and 2021 in terms of actual fish sampling. The 2006 historical reports rely mainly on data from 2003. Given the climate related changes and ongoing development, would it reasonable to assume that the fish community has changed (i.e. more tolerant fish may have become established) during the past 18 years. Evidence of severe droughts occurring during the interim time period have been noted. If we are to assess the impacts from the new application, how do we know that self-sustaining Brook Trout population is still present and is in fact reproducing in the Willoughby Creek system? Brook trout is a short-lived salmonid species and its existence would be dependent on groundwater discharge and cold- water conditions.	We acknowledge the lack of current baseline data regarding the fish community in Willoughby Creek as a result of lack of access to private property. However, in our opinion, mitigating water quality and flow assuming that the requirement is to maintain existing conditions as closely as possible will address potential effects to fish and fish habitat, regardless of the composition of the fish community. Furthermore, DFO is satisfied that maintaining existing flow regimes will protect fish habitat. See updated AMP for the proposed mitigation and monitoring approach to protect surrounding watercourses and associated fish habitat.	The applicant's response is that regardless of fish habitat composition in the downstream waters, maintaining quarry discharge flow conditions as close to the existing will address potential impacts to fish habitat. While this statement is valid, the objective of having more recent baseline information on downstream fish composition is to be able to monitor the changes to the fish community composition over time. The applicant is assuming that fish data from 2004/2006 is representative- Given that is now more than 15 years ago, it is considered old information for future monitoring purposes. The updated AMP does not include monitoring of downstream fish communities. Any changes to the fish community that is noted in the future would need to be based on older information. The comment still stands as there are NHIC records of Redside Dace within the reaches of Willoughby Creek just upstream of the quarry discharge confluence, and impacts to their habitat remains a concern.

				Section 2.2.9 of the NETR included a summary of Conservation Halton's fish sampling data from stations on Willoughby Creek in 2012. In addition, data collected in support of the original quarry expansion application, as documented in the 2004 Level II Natural Environment Technical Report remains a relevant component of the background knowledge that has supported the impact assessment.			
18.	Predicted impacts to downstream watercourses are discerned from the surface water report which can only be based on older baseline data by collected by others, such as records from 2006. As the data has been collected over 14 years ago, changes that have occurred over time regarding the fish community and habitat changes are not accounted for in predictions related to surface water impacts.	General	Matrix Solutions Inc.	Predicted impacts can be assessed based on the fish species that have previously been confirmed in the watercourse (i.e., through previous studies conducted for the original quarry application or by Conservation Halton as part of their Long- term Environmental Monitoring Program) and the known habitat preferences of those species. Also, of key importance is the minimal actual predicted change in habitat (as documented through the surface and groundwater assessment reports and further analysis of changes in water depth, wetted cross-sectional area, wetted width). Based on the minimal habitat change predicted, Savanta is of the opinion that more recent fish community data for Willoughby Creek would not change the assessment of potential impacts. In our opinion, the general composition of the fish community (in terms of species present) is unlikely to have undergone any substantial change over time that would change how the impact assessment is completed.	The point here to note is that baseline data for fisheries will be based on 2006 reports (which cite 2003 fish sampling data, for the most part). Although that applicant may think there will be no need for further fish sampling, a lot of changes have occurred over time that may have resulted in loss to the fish community assemblage or current fish populations. Without knowledge of the present fish populations, it is difficult to assess whether negative changes that have occurred could be attributed to the West Extension. Predicted changes from the application moving forward would be based on 2003, whereupon changes have to the environment (which could be unrelated to quarry operations).	Please see response to comment #17.	Response is the same as #17 above. Fish inventory information within 120m of the new quarry extension is lacking due to the applicant not being able to access private property. The comment still stands as there are NHIC records of Redside Dace within the reaches of Willoughby Creek just upstream of the quarry discharge confluence, and impacts to their habitat remains a concern.
19.	The 2020 NETR discusses what is impacted within the existing quarry and extension footprints, it does not provide a more fulsome picture of what happens to the downstream watercourses and particularly the Willoughby Creek system. The applicant should provide more discussion on specific effects to fish habitat as it relates to the receiving waters affected by future drainage and alterations to hydrology and hydrogeology from future expansion. The surface water assessment report provides statements which affirms the sensitivity of Willoughby Creek to changes in base flow, and the primary concern is that this feature, as well as the other watercourse will be maintained	General	Matrix Solutions Inc.	See response to Comments 15, 17 and 18. If the agencies are concerned that any potential impacts of continued pumping outweigh the impacts of ceasing pumping once quarry operations are completed (which is permitted by the current quarry approvals) then the proponent is willing to consider this approach.	The scenario of pumping and no pumping approach should be explained in terms of fishery. This would provide further explanation of potential effects should pumping where to suddenly be shut down due to unexpected failure. There are also some outstanding questions that remain such as allocation of pumping during lake creation.	The updated AMP includes flow and temperature mitigation and monitoring requirements within watercourses to ensure no harmful, alteration, disruption or destruction to fish habitat in accordance with DFO letter of advice.	The applicant's updated AMP does include discussion of predicted groundwater and surface water impacts to the Willoughby Creek system. Although perpetual pumping will be required for the future phases of the quarry expansion, the AMP is committed to maintaining the flow regime moving forward and would be required to continue pumping in case of pump breakdown. This The original comment is aimed at understanding the pros and cons of pumping. All of the explanation provided so far is how the AMP

	through pumping. Should pumping be subjected to unexpected shutdowns or malfunctions, it is unclear what these effects would manifest to fish habitat. For example, if fish populations are reliant on this flow to successfully spawn and rear their young, what happens during the coldest winters and summer drought conditions is of concern as a sudden withdrawal of flow in the upper reaches may result in fish mortality.						would maintain flow downstream of the quarry discharge point and the addition of an infiltration pond to mimic the reduction of groundwater input upstream of the quarry discharge point. Although the AMP proposes mitigation for any forcecasted changes in flow, it is difficult to understand how the system is to operate in the absence of field information.
20.	As extraction proceeds to its later stages and progressive rehabilitation takes place, it is unclear how this impacts fish habitat. It is not fully explained how the quality and quantity of discharge water will be maintained. It is anticipated that there will be a lowering of local groundwater and surface water levels from quarry operations and quarry dewatering. It would be good to understand how water quantities will be balanced and water quality will be maintained at various stages during blasting and quarry operations. Furthermore, it is uncertain if ground water conduit flow paths will be interrupted during quarrying operations.	General	Matrix Solutions Inc.	Changes in water quantity through the P3456 and Rehabilitation scenarios have been assessed in the integrated flow model. This has accounted for the predicted lowering of localized groundwater table in vicinity of the quarry as well as predicted increases in some phases as a result of shifting the groundwater volume to the surface water level (i.e., through discharge of intercepted groundwater through sump 0100 into the Unnamed Tributary of Willoughby Creek). Discharge of water will be consistent with current operations and potential impacts to water quantity and quality will be addressed through the provisions of the AMP and MECP approvals. More details are provided in the attached Watercourse Characterization Summaries.	It is anticipated that the updated AMP will contain further details regarding the water quality and quantity through different phases of extraction.	Comment noted. See updated AMP.	Response is the same as #19 above
21.	There may be contaminants introduced into water bodies from blasting and quarry operations that can affect fish habitat. As blasting will be used for extraction, what is the potential for contaminants to be released or the event of a pipeline rupture from blasting (from the Enbridge Pipeline in Colling Road)?	General	Matrix Solutions Inc.	There will be no difference in the potential for changes in water quality as a result of blasting the quarry extension than there has been for the life of the existing quarry. Appropriate mitigation to prevent impacts on the pipeline will be in place during all quarry blasting activities as per the Blast Impact Analysis (Explotech 2020). This report also recommends monitoring when blasting is occurring in proximity to the pipeline.	Is there monitoring to ensure that the water quality is to remain consistent? - I.e. the water quality throughout the process is maintained. We anticipate that this will be reflected in the revised AMP.	Surface water quality monitoring will be outlined in the AMP. See updated AMP.	The applicant's blasting consultant has indicated appropriate mitigation measures are in place to ensure that blasting impacts do not impact fish habitat. The applicant's updated AMP does include discussion of water quality monitoring commitments. This comment has been addressed.

22.	Effects from pumping and lake creation, including shutdown of the pumps, malfunctions or spills at the quarry should be included in the discussion. Furthermore, temperature impacts from the creation of the lake, and other potential effects such as exotic species invasion/blue green algae should also be included in the discussion.	General	Matrix Solutions Inc.	The AMP includes appropriate mitigation and monitoring measures to ensure the effects from pumping and lake creation will not negatively impact the surrounding environment. The AMP includes monitoring, mitigation and reporting requirements during operations and lake filling. If there are additional requirements that the agencies would like included in the AMP please provide these for Nelson's consideration.	Yes- the following should be included in the AMP discussion: Thermal impacts Backup systems and contingency pumping Maintenance of discharge water quality Invasive species control and prevention Infiltration effects to groundwater discharge to the Willoughby Tributary	The AMP discusses mitigation, monitoring and adaptive management associated with quarrying operations for potential surface water and groundwater related impacts. See updated AMP.	The applicant's updated AMP includes general discussion of pumping and lake creation but does not provide further detail regarding the effects associated with lake creation. Although it is understood that this is further into the future, these are items that should be considered due to the sensitivity of the downstream receiving waters. The updated AMP partially addresses this comment.
23.	Future Gaps to be Addressed: The setting for the quarry extension takes place within the Niagara Escarpment Protection Area where the management focus is directed to maintaining the key natural heritage features and key hydrologic features for the movement of native plants and animals across the landscape. The natural feature of concern is in Willoughby Creek, where a remnant Brook Trout population exists. This remnant population presumably still occurs within a short distance within the Willoughby Creek Tributary kept separated from Bronte Creek through a dam from more aggressive migratory salmonid species. This current population is dependent on the existence of base flows and groundwater discharges that occur in Willoughby Creek. During the previous quarry submission, the Joint Agency Review Team (JART) had requested that discussion of each watercourse should include a detailed description of each of the following: • Locations of groundwater upwelling's (and their significance to fisheries), species composition, distribution, relative abundance, and life history of the fish inhabiting the creek. • JART also requested identification of critical or sensitive habitat with reference to species distributions.	General	Matrix Solutions Inc.	DFO has issued a Letter of Advice, dated June 23, 2021, identifying those measures required to prevent the harmful alteration, disruption or destruction of fish habitat. One of the requirements is to "maintain an appropriate depth and flow (i.e., base flow and seasonal flow of water) for the protection of fish and fish habitat. This will be addressed though the provisions of the AMP to ensure the pumping regime maintains base flow and seasonal flow of water. DFO's guidance and conditions were provided after the Summary tables were prepared and circulated. Nelson is happy to work through the tables with JART to ensure that all DFO conditions and mitigation measures are included in the AMP and that all threshold and trigger values are updated, if needed, based on DFO recommendations. More details are provided in the attached Watercourse Characterization Summaries.	The predictions from water quality modelling provided shows a reduction in groundwater inputs- there is a known dependency on this groundwater input to maintain Brook Trout reproduction. AMP needs to show that the loss of groundwater contribution is effectively offset by the outflow discharges. Outflow discharges maintain flow to the creek but does not maintain groundwater upwelling's that allow for trout reproduction and development. There is a need to understand the Willoughby system through more recent data collection so there is baseline data that is more current prior to expansion (i.e. 2003/2006 data may not reflect today's conditions as there has been some warming trends/droughts). Yes, working through the DFO conditions within the tables would be helpful. This discussion should be reflected in the AMP.	The updated AMP includes flow and temperature mitigation and monitoring requirements within watercourses to ensure no harmful, alteration, disruption or destruction to fish habitat in accordance with DFO letter of advice. Please see response to comment # 17.	The applicant's updated AMP addresses items related to surface flows and groundwater contributions but relies on historical information and data collected by other agencies to describe the fish community outside of the proposed quarry extension footprints. The applicant maintains the position that flows will be maintained as in the existing quarry, such that no changes to the fish community composition in the downstream receiving waters is anticipated. The updated AMP also includes proposed additional biological monitoring of the Medad Valley for vegetation communities within the seepage areas affected by the proposed West Extension. To determine the effect of the Burlington Quarry Extension moving forward, future impacts can be measured by changes to the fish community (ie. Fish community diversity, sentinel species composition, SAR species occurrences). This type of study is recommended within the AMP, to determine if the water quality and quantity measures being recommended moving forward are working as intended with regards to fish habitat. The comment still stands.

	• Considering the pumping which will be used to maintain the current base flows to the Willoughby Creek and other tributaries, this strategy needs to be further understood with respect to future risks to the fish habitat downstream. For example, if a passive means of supplying water to these downstream systems is possible, this may be a safer alternative rather than relying on pumps that may be susceptible to mechanical failure and regular monitoring to ensure proper function. • Some of the information requirements that are relevant to the understanding of the potential impacts of the proposed extension raised by JART include: • predicted flow rates for groundwater discharge for the tributaries • effects of groundwater and surface water changes on the fisheries in each tributary • groundwater disruptions may have a very large effect on fisheries and the effects should be further quantified • threshold flows and predicted effects on fisheries habitat • impact of shortened periods of groundwater contribution on fish productive capacity in intermittent streams • the relative contributions/effects to groundwater should be summarized in a table for each watercourse • potential thermal impacts on the watercourse and whether the quality of groundwater is affected (including thermal pollution) • effect of increased flows on channel stability, fisheries, and productive capacity in Willoughby Creek • effect of mitigation/pumping of water into the ground and the impact on watercourses In addition to these, the applicant						

	should discuss how the progression of quarrying (in various stages) impacts the water quality that is discharged to downstream systems.						
24.	Discussion of the site's ecoregion, ecodistrict and physiographic context is missing, as is a discussion about the relationship with significant Regional features such as the Mount Nemo Plateau. The previous hearing raised concerns about the variable local groundwater setting within discrete areas of the Mount Nemo Plateau, with concerns that groundwater flows were currently affected by the existing quarry and these impacts could extend further because of the cumulative impacts of the existing quarry plus the extension. There is the potential for significant harm to the off- site Jefferson's Salamander breeding habitat pools (the "wetland vernal pool" and "woodland vernal pool" shown on Figure 4.0), through impacts on their hydro period, if the groundwater inputs to the ponds are significantly affected by the extraction. The 2012 decision by the Joint Board noted that monitoring of water levels in the salamander breeding ponds (which are off-property) is critical because of the uncertainty regarding the impacts of lowering the groundwater table. The concern associated with the accuracy of assessment of groundwater inputs to the Jefferson's Salamander breeding habitat ponds was an important issue to the 2011 Joint Board and it is not clear what additional work has been done to address these concerns. Concerns that the connection between groundwater and surface features has been underestimated in the current application have again been noted by many technical experts in their review of this application.	General	North-South Environmental Inc.	This application is significantly different than the previous application. The extraction area is smaller which results in less groundwater drawdown and there is greater separation distance between the extraction area and off-site salamander breeding ponds. These ponds and the lack of potential impact have been extensively studied in the integrated groundwater and surface water model. More details regarding these features are provided in the attached Wetland Characterization Summaries.	A final response will be provided on resolution of groundwater issues, most of which are still in question. Modelling is also questioned by other technical experts. Wetland characterization summaries lack integration between surface water/groundwater findings and ecological implications of these findings. Wetland summaries have also not incorporated past knowledge of the wetlands obtained during the fieldwork for the previous application. During the past field work, some of these wetlands were found to provide habitat for amphibian species and abundance that would now meet criteria for Significant Wildlife Habitat (SWH), and in the absence of more recent field work the context of the past field work is important. The past field work to determine whether wetlands are important breeding sites for amphibians is also important as abundance of breeding amphibians can fluctuate between years due to weather - and amphibians rely on the "good" years to occur from time to time to maintain populations. Analysis of one of the wetlands (13015) has been omitted. This wetland supported breeding Spotted Salamanders, which are an indicator species of SWH for woodland amphibian breeding habitat. Additionally, in the adaptive management plan report, 13027 was used as a surrogate as 13034/13035 as these (the known Jefferson Salamander breeding ponds) were not accessible - do the water experts feel this is legitimate?	Updates and revisions have been made to the AMP, based on numerous and extensive discussions with NDMNRF. In general, these changes include additional monitoring locations (installed in spring 2020, 2021 and 2022), additional data collection and its assessment (and will continue to be collected and assessed), increases to data collection frequency, as well as updated thresholds and triggers and reporting requirements and timing. See updated AMP. The hydrological data, both ground water and surface water inputs, have been discussed and assessed extensively, as they are integral components to the ecological context of the features identified in the Study Area. Hydro period and water level data have been collected for years at some features, and other features have relatively less data (i.e., wetlands 13200 and 13201 were instrumented in 2020 and 13015 was instrumented in 2022 (previously, wetland 13015 was assessed with 13016)). This monitoring will continue as committed to in the most recent version of the AMP. Therefore, there will be a minimum of three years of monitoring data for 13015, which is considered an appropriate amount of time to and data to assess for Jefferson Salamander habitat, before the preparation and operation of Phase 1 will begin. See updated AMP. It is recognized that past fieldwork data and assessment for the previous application differ from the fieldwork data that was collected and assessed in 2019 and beyond for this application. Furthermore, SWH criteria and evaluations, along with other applicable policies and regulations, have been updated since the previous application. The recent multi-year and	JARTs comment still stands. Past assessments of amphibian breeding function obtained in 2011 should be incorporated into current analysis as they will inform the trigger levels and thresholds for surrounding wetland hydroperiods. JART groundwater experts have indicated that the issue of whether the Jefferson Salamander breeding ponds south of the southern extension (wetland 13035, in part, and wetland 13032) are perched above the water table (to the extent that there is no potential influence of the quarry on the hydroperiod) is still unresolved.

						multi-season data, and the current evaluation processes, more accurately reflect current conditions, impact assessments and proposed avoidance and mitigation measures. The water experts, both with JART and NDMNRF, agree that there is no groundwater connection or input to wetlands 13034 and 13035. These two wetlands are perched and are topographically higher than the proposed extraction area of the South Extension. While these inaccessible wetlands could not be instrumented and assessed as part of Nelson's comprehensive field program, the location, surrounding topography, lidar imagery, adjacent surface and groundwater instrumentation data and modeling has provided enough information for the water experts to be satisfied in the conclusion that these wetlands will not be affected by the proposed extraction	
25.	Golf course ponds were omitted from salamander trapping. The report states this is because they have predatory fish in them but the only pond that was electrofished was the northernmost pond. Other ponds were surveyed visually. Largemouth Bass were observed only in the main irrigation pond, the uppermost irrigation pond and the golf course irrigation channel. No fish were observed in the three smaller ponds. The author of this review has personal experience with Jefferson's Salamanders breeding in human-made ponds (and salamanders would be more likely to breed in smaller ponds that might be without fish). Salamander trapping should be conducted in the smaller golf course ponds, particularly smaller ponds that do not contain predatory fish.	General	North-South Environmental Inc.	As a point of clarification to the presence of predatory fish, Largemouth Bass was visually observed in all golf course irrigation ponds in September 2019, including the three smaller ones. All potential salamander breeding habitat was assessed and trapped as required. Discussions with the MECP confirm that the golf course irrigation ponds are not habitat for Jefferson Salamander and did not need to be surveyed. We are continuing to work with MECP for all SAR related matters and are adhering to their survey recommendations and protocols.	We continue to request that these ponds be investigated through minnow trapping for breeding salamanders. Having seen the ponds during the site visit on 24th November, they appear similar to human-made ponds where salamanders have been observed breeding by NSE in the past. The ponds have shallow-sloped edges with abundant leaf litter on the bottom, and there are some attachment sites (vegetation, leaves and twigs) along the edges. According to the Region's fisheries expert reviewer on this file, it may be possible for pond-breeding salamanders to breed in ponds where bass are present because bass are largely dormant (and non-feeding) in early spring just after snow melt, when salamanders move to breeding ponds. Salamander larvae tend to stay in the shallows out of the reach of bass.	Please see response to comment #4.	This comment still stands. We provide the following further point on Comment 25. Jefferson's Salamander is a highly elusive species. It is not found unless specific attempts are made to look for it using specific techniques at a specific time of year. The omission of salamander trapping from the golf course ponds risks overlooking the species, which in our opinion, has the potential to breed in the golf course ponds.
26.	Additional surveys should also be conducted for: a. Blanding's Turtle, according to Provincial Blanding's Turtle protocols, b. turtle nesting areas, and c. Snakes, according to the protocols for Milksnake.	General	North-South Environmental Inc.	Blanding's Turtle survey effort was discussed with MECP and addressed in the MECP response letter after completing Blanding's Turtle surveys, as per MECP direction, in 2021. Neither Blanding's Turtle nor its habitat were observed and are considered absent from the Study Area.	It is understood that Blanding's Turtle surveys were conducted in 2021. We anticipate being able to review the results of the surveys. It was observed during the site visit indicated that the western and southern extensions are potential habitat for Milksnake. For your information the	Additional turtle basking surveys were completed in spring 2021, following the Blanding's Turtle survey protocol (OMNR 2015) within all water features in the proposed West Extension Study Area, as per direction and discussion with MECP. No turtles were observed during these surveys. The conclusion remained unchanged: turtle	We provide the following further comment: We accept that the results of the surveys in 2021 indicated that Blanding's Turtle were absent from the West Extension, and that there was no overwintering habitat found (and that Snapping Turtle was found in the West Extension, as indicated by the response to comment 26). However,

				As stated in section 4.2.6, turtle nesting surveys were not completed in 2019 due to the lack of suitable microhabitat conditions. Further mitigation measures have been included in updated site plans. Exclusionary fencing adjacent to the extraction areas will be installed, as per discussions with MECP, to prevent negative impacts. It is unclear which Milksnake protocols are being referred to. However, available occurrence data (as determined in the desktop review of the NETR 2020, sections 2.2.3 and 2.2.5) did not identify SAR snakes in the Study Area or surrounding area. It is understood that snakes are a cryptic species and occurrence data is limited; however, as described in the NETR, habitat assessment surveys and visual encounter surveys during suitable weather conditions did not identify SAR snakes or individual or groupings of snakes large enough to indicate significant wildlife habitat in the 14 areas that were searched specifically for snake presence.	Milksnake protocols being referred to are the MNR Guelph District's 2013 protocols, attached at the back of these responses. Response not accepted. Dates, times and weather conditions should be summarized in Table 1 in the NETR, as this is standard practice for displaying field information. Some dates on data sheets have been obscured during copying and full review of survey dates and weather conditions is important, as bad weather can suppress activity of wildlife, leaving to a false impression that they are absent.	overwintering habitat is absent in the West Extension. Additional turtle basking survey effort was not completed in the proposed South Extension Study Area in spring 2021 due to unsuitable conditions for Blanding's Turtle habitat; therefore, BS6/Wetland 13203 (NETR 2020) is assumed turtle wintering area SWH for this application and carried forward to the Level 2 impact assessment. As per the SWH Ecoregion 7E Criterion Schedule (MNRF 2015), the pond (BS6) is the over-wintering SWH. This feature is located almost 120 m from the proposed Extraction Limit. It was confirmed amphibian breeding SWH in the NETR (2020). The anticipated indirect impact and mitigation measures that have been applied to this amphibian SWH type are the same that will be applied to the assumed turtle wintering area SWH (Wetland 13203; Wetland Characterization Summaries April 2021). The site plans have been revised to include this change (see Page 1 of 4 – Added Turtle Wintering Area). Management actions such as water level, pumping and monitoring details for this SWH type have been included in the revised AMP Version. See attached **Tab 4** for a copy of the Updated Table 1.	the South Extension was not surveyed to determine which species use the pond on the west arm of the west tributary. This pond, BS6 (part of Wetland 13203), should have been surveyed for Blanding's Turtle as it is already known to support Painted Turtle, which Nelson has assumed likely overwinters there (this pond is the only reported turtle wintering habitat in the proposed extension area). It is understood that this pond is assumed turtle wintering habitat and that it is over 120 m from the Extraction Limit. However, the issue is not how far it is from the extraction limit, but what impacts the works associated with the quarry will have on the pond: an issue that is not mentioned in Nelson's response. We reiterate that the outlet of the sump into this pond risks impairing its function through increasing water flows through the pond, as discussed in Comment 23.
27.	Weather conditions were omitted from the table summarizing field investigations. Though there are general notes about weather conditions in the text describing the field methods, the weather conditions should be shown for each date for amphibian, reptile and bird surveys.	General	North-South Environmental Inc.	In addition to the general notes about weather conditions in the methodology section, full weather details are recorded for each survey and provided on the data sheets in Appendix C of the NETR.	Response not accepted. Dates, times and weather conditions should be summarized in Table 1 in the NETR, as this is standard practice for displaying field information. Some dates on data sheets have been obscured during copying and full review of survey dates and weather conditions is important, as bad weather can suppress activity of wildlife, leaving to a false impression that they are absent.	See attached **Tab 4** for a copy of the Updated Table 1.	Addition of the dates, times and weather conditions to Table 1 is appreciated.

28.	The significant Woodlands analysis resulted in several woodlands (E, F and G) identified as Key Natural Heritage Features in the Regional Natural Heritage System being evaluated as non-significant. More discussion should be provided to explain the difference between the Region's and Nelson's analysis of these features. The discussion should include the rationale behind removing from the NHS both the features and the intervening restoration areas that provided a connected north-south linkage between these woodlands.	General	North-South Environmental Inc.	Section 6.2.2 of the NETR (2020) contains complete details on the analysis of wooded and woodland features through application of the Regional OP (2018). Wooded features E, F and G (among others) did not meet the minimum size threshold (0.5 ha), and therefore, did not meet the Regional definition of Woodland. Only Woodlands can be assessed for significance, and therefore, due to these areas not meeting the Regional definition of Woodland, they were not assessed for significance. In addition, section 9 of the NETR (2020) speaks to the Regional NHS; more specifically, it includes language from section 116.1 of the OP, which states that the boundaries of the NHS may be refined, with additions, deletions and/or boundary adjustments through several processes, including completion of an EIA. The technical requirements of an EIA have been met through this process, and therefore this data should be considered when reviewing the Regional NHS. Finally, the RNHS was created through a very high- level desktop exercise with little ability to zoom in and observe a closer look of features. These are highly disturbed patches on a highly active and regularly used golf course. These areas should not have been included in the RNHS. There is a large NHS south of the golf course that consists of the Lake Medad Valley, and there is a large NHS east and north of the existing quarry operation that consists of the Mount Nemo Plateau. Creating an arm of the NHS to/through a golf course and active quarry operation does not add to the resiliency of the NHS. Improving the resiliency should be identified in those larger, contiguous features that provide greater connection opportunities	Woodlands E, F and G were staked during the dripline visit on 3rd December, 2021. Measurement with a tape measure during the 24th November visit indicated that there were points where the edges of Woodland E were closer than 20 m. The revised measurement of woodland areas should be provided, and the analysis of all woodlands should be revised to reflect the new and most accurate measurements. It is understood that the stem count within woodland E was revised following a count of all trees. These results should be provided to JART. However, the woodland is in most respects a functional deciduous forest, and the results of the fauna and flora surveys within the forest indicate that it is functionally part of woodland D. It is dominated by native deciduous tree species. The canopy closure is more than 60%, the threshold required for classification of a woodland in the provincial Ecological Land Classification system. The woodland supports a forest bird Species at Risk and bat maternity colonies. Woodland E is less than 20 m from Woodland D: close enough to Woodland D to be considered a part of it, and the contiguous area of Woodland D and E is more than 0.5 ha. In addition, this woodland serves a function as a linkage through the golf course because of its location. The RNHS is justified in this location as it was created to maintain connection through the landscape after land use change. However, the quarry will not provide any connection, and the Regional NHS will become critical for linkage in the future. The RNHS in this area provides a connection between the woodland to the north of the golf course and the Escarpment to the south that is not provided by other connections. The RNHS was delineated to maintain connections to smaller features to ensure there is no gradual attrition of features as development proceeds. The golf course does provide some connectivity through the landscape, which was enhanced by the presence of the woodlots	The NDMNRF has provided clarification regarding which provincial criteria to use for assessing significance of woodlands for this license application relative to the PPS and NEP policy requirements. NDMNRF recommended that – the Greenbelt Plan (2005) Technical Definitions and Criteria for Key Natural Heritage Features in the Natural Heritage System of the Protected Countryside (MNRF Dec. 2012) (referred to as Technical Report). The Regional criteria were also considered as it relates to the Region of Halton Official Plan requirements. Polygons E, F and G were each identified as separate patches of treed areas and these three polygons were also identified within the proposed extraction limit of the West Extension. Polygon E contains only a tree canopy layer; there is no sub-canopy, understory or natural ground cover. It is a stand of mature maples with a regularly maintained turf grass ground cover and paved golf cart paths. It was delineated and classified as an FOD5/DIST to reflect not only the canopy coverage but its existing use and state of management. The tree density composition is well below the minimum density threshold provided in the Forestry Act, which is the same definition and density threshold referenced in the Natural Heritage Reference Manual (MNR 2010). This is how this area was identified and defined in the NETR 2020. The Burlington Extension is located outside of the Protected Countryside of the Greenbelt Natural Heritage System; furthermore, woodland identification and assessment are determined whether the area is within one of two identified geographic areas, divided to account for forest cover differences: either the North Area or the South Area. The Burlington Extension happens to be located outside of either of these two identified geographic areas. Therefore, the more conservative assessment (South Area) was applied to this review. Polygon E	We accept the rationale for the fact that Woodlands F and G were not included in the protected area. However, Woodlands F and G would have served an important function as stepping stones of habitat that strengthen the linkage through the golf course. The function of these woodlands should be replicated in linkages to the surrounding features. The comment regarding the linkage of Woodlands D and E to the north and south still stands. We provide further comment regarding the main issue brought up by Comment 28: the issue of the switch in linkage direction, and the width of the corridor, were not addressed in the response to Comment 28. Though we are directed to the response to Comment 2, Comment 2 does not address the appropriateness of the switch in the corridor from south to west and back to south, or the width of the proposed corridor to the south. In addition, the comment does not take into consideration that the proposed linkage to the west through phase 6 would be non-functional, as it is interrupted by the infiltration pond.

						would now be considered contiguous with, and a part of, significant woodland polygon D. This is due to the canopy coverage and the proximity to an adjacent woodland: polygon E contains >60% canopy cover and therefore meets the woodland definition referenced in the Technical Report (the Forestry Act definition does not apply in this assessment approach). Regarding its proximity to polygon D, the dripline of polygon E is approximately 16 m at its closest point of its western edge from the dripline of polygon D. It is approximately 18 m at its closest point from polygon D at its eastern edge. The remaining section of dripline between the two ends of the feature is >20 m from the dripline of polygon D. The average gap width between the two polygon driplines is >20 m. Based on the ELC canopy cover and the proximity between polygons E and D, polygon E is now identified as significant woodland. Aggregate development is prohibited within a significant woodland, and therefore, this area has been removed from the Limit of Extraction. The site plans have been revised to reflect the removal of polygon E from the Limit of Extraction Polygons F and G also have been assessed using the South Area criteria of the Technical Report. Neither of these two polygons meet any of the criteria for woodland significance: Size: Polygons F and G are each less than 4 ha (0.31 ha and 0.54 ha, respectively as per staked dripline data collected on Dec. 3, 2021); Natural Composition, Age or Tree Size and Proximity are not applicable due to each of the polygons being less than 1 ha; Rarity: polygon F is too small (<0.5 ha) to apply this criterium; polygon G is >0.5 ha and therefore this criterium has been assessed. Polygon G does not contain any of the following: a provincially rare treed vegetation community, a provincially rare woodland plant species nor a species with a Southern Ontario Coefficient of Conservatism rank of 8, 9 or 10.	

						Therefore, both polygons F and G are not significant woodlands, and therefore do not require any changes to the impact assessment or to the Limit of Extraction. The site plans do not require any revisions with regards to polygons F or G. NDMNRF considers this issue addressed. Please also see response to comment #2	
29.	The function of woodlands E and F, particularly as stepping stones that link Woodland D to adjacent features, should be discussed. This is particularly important for Woodland E, which appears to be less than 20.0 meters from Woodland D on the basis of on-line aerial photography, and would therefore meet the criterion for inclusion as a continuous part of woodland D, as stated in Section 6.2.1 (last paragraph on page 50). Since Woodland E meets the criteria for Significant Wildlife Habitat, its contributing function to Woodland D should be assessed.	General	North-South Environmental Inc.	Section 6.2.1 of the NETR (2020) includes the information that wooded features were considered a contiguous unit if they were <20 m apart. On-site surveys determined that wooded feature E is >20 m from Woodland D and, therefore, is not included as a contiguous part of Woodland D. Not only is wooded feature E <0.5 ha and >20 m from another wooded feature, it is a highly disturbed area that has no understory development due to golf course maintenance, and the ground cover consists of turf grass or sparse cover of Garlic Mustard, Herb Robert and exposed soil. It also includes paved golf cart paths throughout. Full details have been provided in Table 2 of the NETR (2020).	We understand that the individual woodland E may be degraded. However, we continue to dispute that it is more than 20 m from the adjacent woodland D. Measurement of the separation of the two woodlands on 24th November indicated that the separation is 17 m. As noted in Comment 28, the close proximity of the woodland means their functions would complement each other. Similarly, Woodland F is actually connected to Woodland M via a strip of woodland approximately 14 m wide, which is interrupted only by a small cart path. These woodlands would have many functions in common, particularly related to bird habitat - it is likely that all woodlands would be incorporated into one area of habitat, though it may be that woodland D is the core area of the habitat. The linkage provided by these woodlands through a golf course (which in itself provides more connectivity than a quarry), would be more functional than a quarry.	Please see response to comment #28. As was observed during the dripline staking site visit on December 3, 2021, a hedgerow is located between Wooded areas F and M. Wooded area F is also very small (0.31 ha), as staked in the field. This area is too small to be evaluated for significance and therefore is not a key feature of the NHS.	We accept that Woodland F and G are too narrow/too small to be considered a significant woodland, and appreciate the incorporation of Woodland E into the protected area. However, as noted in Comment 29, the stepping stone function of the linkage these woodlands provided should be maintained.
30.	There is almost no discussion of impacts other than surface water on Woodland D: the area of woodlands that will be retained between the existing quarry and the western extension. This area will become fragmented as it will be surrounded by existing and proposed quarry land. There is a strong north-south emphasis in the Regional Natural Heritage System through the extension lands, and this linkage will be eliminated throughout the extraction. The phasing of the extraction and the placement of the infiltration pond do not mitigate fragmentation. In addition, a note on the Operational Plan regarding the western edge of the existing quarry states that this edge is “subject to	General	North-South Environmental Inc.	Please see attached Wetland Characterization Summaries for details on Wetland 13200. The proposed Extension Areas are sited within an active golf course and agricultural area. There is a Regional and Provincial NHS that does run north- south; however, the area of the proposed expansion does not appear to negatively affect the redundancy of these smaller branches of the RNHS. The major areas of the NHS run along the Medad Valley, which is west of the proposed West Extension, as well as along the	The branch of the NHS in this area provides more than simple redundancy. The NHS provided connection between the woodland to the north of Colling Road, and then through the golf course south to the Escarpment in the vicinity of Kerncliffe Park. While golf courses and agricultural land provide somewhat interrupted linkage, they are better than a quarry, which lacks even the cover provided by crops, hedgerows and "rough" areas because bare rock is inimical to wildlife movement. In addition Woodland D is proposed for retention as a significant feature. In order to ensure its continued function it needs to be connected to the adjacent features	Please see responses to comments #2 and #28.	This comment still stands.

	separate Site Plan Amendment to reduce setback to 0 m", which would isolate the woodland completely. Clarity is required to describe exactly what changes are proposed to the existing plan, when they will occur, and to assess the cumulative impacts of the increased setback and the extension.			Mount Nemo Plateau and Grindstone Creek Complex, located east of the proposed South Extension. The proposed Extension areas are located between these two RNHS branches and are not impeding or removing any of the features that make up these two branches; the Extension areas are well outside of these two large systems. Based on the Region's NHS mapping, there are some smaller systems that lie parallel to, and between, these two major systems; however, these smaller systems do not connect to the larger NHS, north of the Study Area. These smaller branches of the overall NHS do not provide connectivity to begin with, and therefore, the removal or disturbance of golf course features and their potential for enhancement and future connectivity opportunities can only add to the limited contribution being made to the smaller NHS.	in the landscape, which is the function that the NHS served here. This significant woodland will lose functions if it is separated from the surrounding landscape. Having seen the woodlands in question during the site visit we continue to contend that Woodland D should be connected to other features within the NHS. Woodland E has less understory, it is true, but it is dominated by native tree species and the canopy closure is sufficient to define it as a woodland. It has been identified as having several functions typical of woodlands (it harbours bat maternity roost habitat and species of Conservation Concern). Herb-Robert, noted in the understory and discussed in the report as an indicator of disturbance, is noted as a native species by NHIC and VASCAN. It is likely that the understory would re-establish itself within two to three years if the mowing of the understory were to cease. The landscape through the golf course is currently well-connected, and this connection will be severed during and after the proposed extraction.		
31.	Fragmentation will in effect create a literal island with no physical connection. Impacts of fragmentation should be described, and appropriate mitigation proposed so sufficient corridors are provided to allow movement of wildlife. Provincial and Regional policies require that the test of no negative impact be met. These two policies will not be met if there is no physical linkage/connection with the woodland to the south. According to the Niagara Escarpment Plan, diversity and connectivity between key natural heritage features must be maintained and/or enhanced. The Regional Official Plan Guidelines' Aggregate Resources Reference Manual also notes that it should be demonstrated that the long- term ecological function and biodiversity of the natural heritage system can be maintained, restored or where possible improved. While the rehabilitation plan shows that the southern linkage will be restored in the final rehabilitation plan, the time frame to restoring this linkage is unclear. Section 4 of the Final Rehabilitation and Monitoring Study (page 14) appears to indicate that it	General	North-South Environmental Inc.	The proposed Extension Areas are sited within an active golf course and agricultural area. There is a Regional and Provincial NHS that does run north- south; however, the area of the proposed expansion does not appear to negatively affect the redundancy of these smaller branches of the RNHS. The major areas of the NHS run along the Medad Valley, which is outside and west of the proposed West Extension, as well as along the Mount Nemo Plateau and Grindstone Creek Complex, located outside and east of the proposed South Extension. The proposed Extension areas are located between these two RNHS branches and are not impeding or removing any of the features that make up these two branches; the Extension areas are well outside of these two large systems. Based on the Region's NHS mapping, there are some smaller systems that lie parallel to, and between, these two major systems; however, these smaller systems do	See response to # 30. The features that are being maintained are significant woodlands, and as such are key features which need to be connected. There is no connection shown in the AMP. The severing of these features from the surrounding area will mean the impacts to the features from the quarry will persist for many years. Woodland D is presently well- connected through the eastern edge of the golf course and the lower quality woodland E enhances this connection. To some extent, woodland F also enhances the connection as it, and the hedgerows and remnant woodlands along the eastern edge of the golf course, are part of the connected system that would allow movement of animals and plants between the Niagara Escarpment and the smaller woodland north of Colling Road. It is understood that the Rehabilitation Plan has been revised to provide a connection to the south. However, we are concerned that the connection is too narrow, and the slopes on each side of	Please see responses to comments #2 and #28.	This comment still stands.

	could be more than 30 years before this linkage is restored.			not connect to the larger NHS, north of the Study Area. These smaller branches of the overall NHS do not provide connectivity to begin with, and therefore, the removal or disturbance of golf course features and their potential for enhancement and future connectivity opportunities can only add to the limited contribution being made to the smaller NHS. In addition, the Rehabilitation Plan has been revised (and provided to JART) to include additional area and create a connection between the two features.	the connection too steep, to provide an effective connection between the woodlands and the landscape to the south. In addition, the connection is still severed to the north of Woodland D, removing the NHS connection for the woodland to the north of Colling Road.		
32.	Exposure to wind and high light levels in Woodland D will likely increase. The population of Large Toothwort (Cardamine maxima), a Provincially rare plant species with a status of S3, is particularly adapted to cool, moist, sheltered forests and would likely be affected by the increase in exposure as it is on the eastern side of Woodland D. The two wetlands within Woodland D that are collectively numbered 13200 (the wetlands between the existing quarry and western extension, which will become physically isolated) are discussed only to say that since the catchment will be removed, mitigation such as discharge of quarry water will have to be used to maintain these wetlands. There should be further discussion of impacts, including isolation, fragmentation of surrounding habitat, noise, drying winds and light, etc., in addition to impacts of pumping quarry water.	General	North-South Environmental Inc.	As summarized in section 6.2.1, woodland D is relatively isolated and located on the golf course, adjacent to the existing quarry. While a portion of this woodland is native, the cultural woodland area is non-native, with an abundance of Black Locust, an undesirable tree species, and the FOD5/DIST area contains only a canopy layer, along with turf grass and paved golf cart paths in the ground layer (sub- canopy and understory vegetation are absent). This feature is highly disturbed. Both the catchment area and corridor will be re- established as part of the Rehabilitation Plan. There is high potential to enhance this woodland both in species diversity and composition. The proposed rehabilitation plans will create a system that is better connected and functional than what currently exists in the golf course and adjacent quarry. If there are additional specific mitigation measures, please provide them for Nelson's consideration for inclusion in the AMP.	See response to #30 above. This comment specifically asked about other mitigation measures that will be used for impacts on the wetlands within these woodland patches. As the comment stated, there should be further discussion of impacts in addition to changes in hydro period caused by reduction in the catchments, including isolation, fragmentation of surrounding habitat, noise, drying winds and light, etc., in addition to impacts of pumping quarry water. During the site visit on 24th November, it could be seen that Woodland D is of higher quality than this response implies. The patches are separated by fairways, but the report of their function indicates they are highly connected. The timelines for the restoration between the patches should be fully described. Connections to the NHS should be maintained throughout the life of the quarry, not only following extraction. It is not clear when these connections will be re-established. The timelines for re-establishing the connections to the NHS, and for restoring the connections between the woodlands and wetlands that make up Woodland D, should be described. We would like to review the proposed restoration.	Please see responses to comments #2 and #28 with regard to potential impacts such as isolation and fragmentation. Woodland D is located in an area where it is immediately adjacent to an actively operated quarry along the entirety of its east side and golf course maintenance and activity immediately adjacent to the north, south and west of it. Therefore, the existing conditions already expose Woodland D to noise, wind exposure and/or light (i.e., quarry blasting and operation activities, human activity and movement, regular maintenance, etc.) The proposed setbacks to the Limit of Extraction, the phased operation approach, along with the progressive rehabilitation process all ensure that Woodland D will not be negatively impacted by the quarry extension.	This comment still stands. We provide further comment that additional mitigation should be implemented to reduce edge effects on the eastern side of the woodland. We realize that Woodland D is exposed to existing impacts but the increased potential for cumulative impacts is a concern, and can only be dealt with by addressing each individual impact.

33.	The discussion of wetlands should include Wetland 13203, which is the only wetland identified that provides Significant Wildlife Habitat for breeding amphibians, as well as habitat for painted turtle.	General	North-South Environmental Inc.	Wetland 13203 was evaluated by MNRF and determined to be non-significant and is also reliant on pumping from the existing quarry. Full details are provided in the Wetland Characterization Summaries.	Wetland 13203 may be non-significant in the provincial context but appears to have significance in the Regional context. The significance in Regional context should be described and analyzed. We understand that it is proposed to provide additional water to this pond from a sump on the Southern Extension. At the time of the site visit the amount of water was uncertain, but was thought to be in the order of 50L/sec. We are concerned that this amount would overwhelm the pond's function to provide amphibian habitat or turtle overwintering habitat, as it would push water through the pond so fast that the substrate may erode, and any amphibian eggs in the pond would be flushed out. The function of this pond and its significance in a Regional context should be considered when finalization the sump outlet.	Similar to that of wetland 13200, the Erosion and Sedimentation Control (ESC) Plan is generally intended to mitigate for potential impacts from quarry construction, operations and rehabilitation activities. This ESC Plan will include incorporation of the following elements to ensure avoiding impacts to any watercourse or wetland habitats. Specifically, pumping from existing sump 0100 will mitigate for any potential hydrological impacts (i.e., hydro period) to wetland 13200. Should this feature require pumping from sump 0100 (data collection is on-going), the design will include a riprap/apron discharge mat to disperse the flow. Regular monitoring and inspection during pumping discharge will occur and be documented and provided on a regular basis. These measures, committed to with the NDMNRF for pumping to wetland 13200, will also be committed to when pumping to wetland 13203.	This comment still stands. We provide further comment that Nelson's response does not address the proposal to pump water from the quarry floor in the southern extension to BS6 / Wetland 13203, which functions as amphibian breeding pond/turtle overwintering habitat, during dewatering. The response only considers the impacts from pumping from the existing sump 0100, which is not what this comment referred to.
34.	There is no discussion of potential cumulative impacts of the existing quarry and the extensions (only a very brief mention of cumulative impacts).	General	North-South Environmental Inc.	See response to Comment 13.	The response to comment 13 takes into consideration only the aquatic aspects of cumulative impacts. Please address this in terms of terrestrial ecological impacts. CH has asked for information that would inform this response.	The amount and extent of natural features within the Limit of Extraction is relatively minimal, considering both the immediately adjacent natural heritage features and the natural heritage features found on the larger landscape (i.e., the Medad Valley and the Mount Nemo Plateau). Wooded area E is now being retained and considered contiguous with Woodland D; therefore, the removal of features (Wooded features F and G) has been reduced to a total of 0.85 ha, 0.31 ha and 0.54 ha, respectively. Wooded feature F is confirmed SWH for bat maternity colony, and wooded feature G is also confirmed SWH for bat maternity colony, as well as confirmed SWH for Eastern Wood-pewee habitat. One singing male was heard during the first round of breeding bird surveys. The adjacent and surrounding landscape is large enough to support the breeding habitat needed by the Eastern Wood- pewee. With regard to bat habitat, and as discussed in other comments in this	We provide further comment that Nelson's June 2022 response is not a fulsome discussion of cumulative impacts. We would expect the discussion to include, for example, the interactive impacts of increase in heat island effect related to creation of the adjacent area of bare rock with the increase in wind due to the removal of vegetation.

						table for this habitat type (albeit our discussions with MECP were in regards to SAR bats), the adjacent and surrounding landscape is suitable and large enough to support bat species. Therefore, the relatively minimal removal of habitat, which will occur outside of the active season of either wildlife type (tree removal will only occur between December 1 and March 14), will not negatively affect Eastern Wood-pewee or bat maternity colony – individuals or habitat. Also, as explained in comment #2, Woodland D will remain connected to the landscape throughout the extraction phasing, and active, progressive rehabilitation also will be taking place throughout the extraction process. Therefore, connectivity and rehabilitation will ensure that movement and linkage impacts will not occur. Another consideration regarding cumulative impacts is that the existing haul routes will continue to be used; there will be no increase in truck traffic and no increase or change in the haul route. This will all remain consistent with current conditions.	
35.	Discussion of mitigation is incomplete: there should be a discussion about the mitigation of impacts in the short term (in addition to impacts related to erosion and sediment control) as extraction progresses (as required by the Aggregate Resources References Manual) – impacts of the quarry will not be addressed by the rehabilitation for many years.	General	North-South Environmental Inc.	Additional mitigation discussion is provided in the Wetland Characterization Summaries and AMP.	Comments on wetland characterization summaries: results from previous investigations for SWH and significant species should have been included, as this would provide information critical to determining the ecological function of the wetlands and ponds in the southern extension. Summaries of the ecological function would inform the mitigation for water balance impacts. We note that wetland 13015 has been omitted. This wetland met the qualifications for SWH in the previous studies in 2015 (it supported Spotted Salamander, an indicator species of SWH) so it should have been included in the analysis. It is unclear whether there would likely be impacts on this wetland's hydro period, and what mitigation is proposed for this wetland.	Please see response to comment #24.	This comment still stands. We provide further comment in the response to comment 24.

36.	Mitigation should include a discussion of Wetland 13203.	General	North-South Environmental Inc.	Full details are provided in the Wetland Characterization Summaries.	Discussion of the observation of a Painted Turtle was omitted from this Wetland Characterization Summary. In addition, we understand from discussions with the study team during the November 24th site visit that Snapping Turtle was observed in this pond. The timing of the observations should be provided. If turtles were observed in this pond in early spring, they were likely overwintering in the pond. As noted for comment 33, we have concerns about the proposal to discharge water from dewatering the West Extension into this pond, as it would likely impair the function of the pond to support breeding amphibians or overwintering turtles.	Please see responses to comment #26 and #44.	We provide further comment that per Nelson's response to this further comment, it was clarified that Snapping Turtle was not found in this pond (the species found was Painted Turtle, also evaluated as a Species at Risk but without a formal listing under the Endangered Species Act, 2007). However, surveys were not conducted in this pond for overwintering turtles – though it was assumed that the pond was SWH for overwintering turtles the species of turtle was not determined. The determination of species is important because different turtle species have different requirements for overwintering habitat, particularly with respect to oxygen requirements. As in the response to comment 33, Nelson have not addressed the potential impacts of directing the discharge from the proposed quarry floor in the south extension to this pond, which would likely affect amphibian breeding habitat and turtle overwintering habitat.
37.	All studies should be coordinated and integrated. In particular, the findings of the Hydrogeologic and Hydrologic Impact Assessment, Surface Water Assessment and Level 1 and 2 Natural Environment Technical Report should inform each other and should be reviewed for consistency	General	Conservation Halton	The water resources and natural environment team worked very closely on the assessment of the application. To assist the agencies the attached wetland and watercourse characterization summary tables have been prepared to integrate all of the findings from the various technical reports. DFO's guidance and conditions were provided after the Summary tables were prepared and circulated. Nelson is happy to work through the tables with JART to ensure that all DFO conditions and mitigation measures are included in the AMP and that all threshold and trigger values are updated, if needed, based on DFO recommendations.	The wetland characterization summaries only provide an annual water budget analysis, and the impact assessment and mitigation sections do not include the requested ecological interpretation for existing (as per the TOR with proposed 25-year baseline), interim (for each identified extraction phase) and both post extraction scenarios (rehabilitation scenario 1 and rehabilitation scenario 2). Please revise, present, and summarize daily water balance analyses as average monthly water volumes in tabular format, showing existing, interim and post extraction (as outlined above) with and without mitigation to establish and confirm seasonal variations and include an ecological interpretation of the results. This will set targets/thresholds required to ensure no negative impacts. The watercourse characterization summaries only provide groundwater interactions and proposed reductions, however, do not include surface water flow analysis, impact assessment or mitigation sections for existing, interim and post extraction scenarios (as outlined above). Update to integrate surface water analysis, revise to present and	All wetlands that could be impacted have been addressed in the updated AMP. The updated AMP includes flow and temperature mitigation and monitoring requirements within watercourses to ensure no harmful, alteration, disruption or destruction to fish habitat in accordance with DFO letter of advice.	On January 1, 2023, Ontario Regulation 596/22 came into effect. As a result, technical review services for planning and development applications previously provided by Conservation Halton (CH) under Memorandums of Understanding with municipalities (e.g., technical reviews related to natural heritage and select aspects of stormwater management) can no longer be provided. O. Reg. 596/22 does not affect CH's mandatory programs or services. CH has only reviewed this comment based on natural hazard, and wetland matters, per Ontario Regulation 686/21 and Ontario Regulation 162/06. CH has no further comment from a regulatory perspective. We defer any remaining natural heritage related comments to the other JART members to confirm whether it has been addressed. Halton Region staff have reviewed Nelson's response and provided

					summarize with and without mitigation to establish seasonal variations and include ecological interpretation of the results. This will set targets/thresholds required to ensure no negative impacts. DFO guidance and conditions should be included within the watercourse summaries to ensure all appropriate mitigation measures are being included as part of the AMP and ensure there will be no negative impacts on the watercourse form and function for existing, interim and post extraction scenarios (as outlined above).		the following JART response: The original comment still stands as all studies should be coordinated and integrated and be reviewed for consistency. Sarah Mainguy, NSE, has reviewed Nelson's response and provided the following JART response: Findings should be presented to provide an interpretation of how each wetland will be affected seasonally in order to understand the critical year-to-year variation in seasonal inundation of the wetlands.
38.	Not all of the natural heritage features that have the potential to be impacted are identified in the report. For example: • PSWs that are within the zone of influence of the proposed quarry but outside of the 120.0 meters adjacent lands are discussed only at a high level, though potential exists for impact as noted in the Hydrogeological and Hydrological Impact Assessment Report and the Surface Water Assessment. • Significant Wildlife Habitat (SWH) discussions did not include all of the identified SWH in the study area (e.g., FOD7-4, seeps and springs, amphibian movement corridors, etc.). • The extent of fish habitat on the site and within the zone of influence should be confirmed by DFO. • Connectivity across the landscape should be considered in more broader terms. Recommend revising the report to discuss all of the natural features that have the potential to be impacted by the proposed quarry and mitigation measures developed as appropriate.	General	Conservation Halton	Wetland Characterization Summaries provide further details. The FOD7-4 and seeps and springs are discussed in more detail in this submission. The amphibian movement corridor will remain untouched. No direct impacts are anticipated due to its location outside of the Study Area at the far edge of the 120 m adjacent lands. Potential hydrological impacts and associated mitigation measures are provided in detail in the Wetland Characterization Summaries – wetland 13203 – appended to this response submission. DFO has confirmed in its letter dated June 23, 2021, that the constructed golf course ponds and interconnecting channels are not considered to be fish habitat. Connectivity across the landscape and the natural heritage system has been previously addressed in this submission.	Not addressed. Regarding PSWs within the zone of influence but outside the 120 m adjacent lands, see Comment No. 37 above. Not addressed. Include all candidate and confirmed Significant Wildlife Habitat within the wetland and watercourse characterization summaries to determine potential impacts and provide mitigation measures. Partially addressed. The direct and indirect impacts on fish and fish habitat downstream of the ponds (within the zone of influence) during and post extraction will need to be confirmed by DFO and appropriate mitigation measures provided to ensure there is no negative impact. Not addressed. It is unclear where connectivity across the landscape has been addressed.	Please see responses to comments #91 (wetlands), #26, #101 and #124 (SWH), updated site plans and #2 and #28 regarding connectivity. The updated AMP includes flow and temperature mitigation and monitoring requirements within watercourses to ensure no harmful, alteration, disruption or destruction to fish habitat in accordance with DFO letter of advice.	On January 1, 2023, Ontario Regulation 596/22 came into effect. As a result, technical review services for planning and development applications previously provided by Conservation Halton (CH) under Memorandums of Understanding with municipalities (e.g., technical reviews related to natural heritage and select aspects of stormwater management) can no longer be provided. As such, we defer this comment to the other JART members to confirm whether it has been addressed. Matrix Solutions Inc. has reviewed Nelson's response and provided the following JART response: Confirmation of fish habitat, supported by policy definition from DFO remains outstanding. Sarah Mainguy, NSE, has reviewed Nelson's response and provided the following JART response: The issue of impacts on PSWs within the zone of influence of the quarry, but outside the 120 m boundary, has not been addressed. Monitoring should be conducted in PSW wetlands within and beyond the existing zone of influence, whatever that is identified to be. Wetlands beyond the existing area of quarry influence would be valuable as representing background conditions. There are continued concerns

							regarding connectivity of the wetlands and surrounding forest in feature D, which are outlined in comment 42 Effectiveness of proposed mitigation is in question. Additional mitigation for impacts on SWH has not been addressed
39.	Please include a more detailed discussion on net gain as per Halton Region's Aggregate Resources Reference Manual. Currently direction is to refer to the Site Plan and AMP, which does not give enough detail to ensure that net gain is achieved.	General	Conservation Halton	Limited natural heritage features are proposed for removal and substantial natural heritage features are proposed for creation and enhancement. For example, woodland cover will have a net gain of 28 ha. Wetland cover will have a net gain of 3.6 ha. The native diversity and composition of habitat will increase greatly from that which is golf course and agriculture. We disagree that the site plans do not provide sufficient detail for the creation of these habitats. In addition, MNRF has to be satisfied that these habitats are created prior to the surrender of the license.	Recommend including net gain discussion and summary table within report to demonstrate this.	These details have been reviewed and updated with the NDMNRF and have been further updated on the site plans.	Please see Response to Comment # 38. Sarah Mainguy, NSE, has reviewed Nelson's response and provided the following JART response: As additional potential impacts have been identified, there is no assurance that there will be a net gain (for example, if wetlands further than 120 m are impacted)
40.	Savanta states: "An assessment of the quality and extent of natural heritage features found on, and adjacent to, the Subject Lands and the potential impacts to these features from the proposed aggregate application will be undertaken in association with the following legislation and policies." It should be clear that the significance of each feature will be evaluated according to the criteria provided by the Province and Region. Two pieces of legislation should be added to the list of policy and legislation in this section: • the *Migratory Birds Convention Act* and • *Fish and Wildlife Conservation Act*.	Section 2.1. Natural Heritage Policy Overview	North-South Environmental Inc.	Comment noted.		No further response required.	Resolved.
41.	Recommend expanding the applicable PPS policies to include those in the Policy 2.2 Water, given that some of these speak to natural heritage features and areas, and the connection to the water system.	Page 9 Section 2.1.1. Provincial Policy Statement	Conservation Halton	See response to Comment 10.	While it is appreciated that this section of the PPS is indirectly covered in various sections, the review agencies are requesting that a specific section be provided to discuss Policy 2.2 of the PPS in the Natural Environment Technical Report. CH also concurs with NEC's response to Comment No. 10 above.	Please see response to comment #10.	Please see Response to Comment # 38 Sarah Mainguy, NSE, has reviewed Nelson's response and provided the following JART response: The response provided by NEC in #10 is still applicable, especially because of the questions that have been raised concerning the imperviousness of the Halton Till.

42.	Policy 110 (7.2) should be specifically discussed in this section, as it addresses the requirement for a systems-based approach to the assessment of impacts as follows: “In accordance with Section 118(3)d), apply the following systems based approach in the assessment of the impact of a new or expanded mineral aggregate operation on the Region’s Natural Heritage System…”	Section 2.1.3. Halton Regional Official Plan	North-South Environmental Inc.	Policy 110 (7.2) has been considered in the preparation of the rehabilitation plan which outlines the short-, medium- and long- term natural heritage features that will be created to enhance the Regional Natural Heritage System compared to existing conditions. The NETR report addresses how the Regional Natural Heritage System will be enhanced both in terms of size, diversity and function. The detailed policy analysis is included in the Planning Report.	Notwithstanding this, we would like to see an analysis that specifically refers and responds to Policy 110 (7.2). The timelines for “short, medium and long-term” should be estimated.	Please see proposed Burlington Quarry Extension site plans. The site plans include the timing requirements for the ecological enhancements. As Nelson has noted, the South Extension will be completed within 10 years and the West Extension will be completed within 20 years of extraction commencing. As noted on the site plans, some elements are required prior to extraction and other features are created during progressive and final rehabilitation. Based on the timelines for the proposed quarry from an ecological perspective, these enhancements would be considered both short and medium term enhancements.	This comment still stands. As pointed out in comment number 28, we question the effectiveness of the attempt to switch from the existing southern linkage to a western linkage, where it will be interrupted by the infiltration pond, followed by another switch to a linkage to the south where the connection will be narrow and steep-sided.
43.	The paragraph in Savanta’s report in Section 2.1.6 indicates the following: “Some projects may be eligible for exemption from the DFO review process, as specified under Step 3 of the DFO Fish and Fish Habitat Protection Program review process (DFO 2019b; e.g., artificial waterbodies with no hydrological connection to occupied fish habitat).” In the Fish Habitat Discussion section in 7.2.4, it is mentioned that “There is no direct or indirect fish habitat within the proposed Limit of Extraction within either the South or West Extension areas. Therefore, no direct encroachment into any watercourse providing fish habitat will occur and no direct impacts on fish habitat are anticipated within the Limit of Extraction, during any phase of the Project.” Since there is a hydrological connection by way of the outflows to direct and indirect habitat, it would seem that the irrigation ponds within the golf course have been ruled out as not fish habitat. This would suggest that the *Fisheries Act* does not apply to harmful alterations to these ponds. Unless the ponds are self-contained, pollutants could potentially be released into the discharges flowing out of these ponds to direct and indirect fish habitat. It is unclear how the irrigation ponds would not be considered fish habitat if	Section 2.1.6. Federal *Fisheries Act*	Matrix Solutions Inc.	DFO has confirmed in letter dated June 23, 2021, that the constructed golf course ponds and interconnecting channels are not considered to be fish habitat.	An opinion from the DFO Reviewer was expressed in an email containing the Letter of Advice. This opinion does not seem to tie back to the definition of what is fish habitat, particularly as there is an outflow to fish bearing waters that are affected by quarry activities. Wording in the letter appears to be implied that the waters internal to the quarry are of no concern to DFO providing that the outflows do not impact fish habitat immediately downstream of the quarry.	As previously noted in our original response, DFO has confirmed in their email of June 23, 2021, that they do not consider the drainage features on the golf course to be fish habitat. As the regulatory authority on what should be considered fish habitat, we are relying on DFO’s decision on this matter. Although we provided DFO with information regarding the golf course drainage features (in our letter dated August 14, 2020), we were not a part of their decision-making process and cannot speak for them in this regard.	This item is addressed in Response #14. Rationale for why golf course ponds and connecting watercourses per Fisheries Act policy has not been provided. The applicant defers to DFO email communication that these watercourses are not fish habitat.

	they are hydrologically connected to fisheries habitat and impacts from alterations to these ponds could have a downstream impact.						
44.	The background data collection should have included Citizen Science databases such as eBird and iNaturalist. The report notes that in the NHIC background search, four 1.0 square kilometre “squares” were examined. In fact, six squares are needed to encompass the site: 17NJ 8805, 8905, 9005, 9105, 9104 and 9004. If the search is broadened to include the immediately surrounding habitat (as is the usual approach), approximately 12 squares should have been selected. This larger study area is justified because the locations of significant species are often not known exactly, and many wildlife species are mobile enough to roam more widely within the landscape than where they were reported. This section should be summarized by a more inclusive table listing all the SAR that have been noted by an extensive review of background sources in the general area, with their habitat requirements. This should have directed Savanta’s survey methodology and focus. In addition, several Species at Risk were left out of the analysis. The following additional species, noted in the two Ontario Reptile and Amphibian Atlas squares that encompass the site, were omitted from the sources mentioned: Ontario Herpetofaunal Atlas: • Western Chorus Frog (latest record 2019) – Threatened Federally, Not at Risk Provincially. • Blanding’s Turtle (latest record 2017) – Threatened Provincially and Federally • Midland Painted Turtle (latest record 2018) – Special Concern Federally • Map Turtle (latest record 2018) –	Section 2.2. Background Data Collection	North-South Environmental Inc.	Both e-Bird and iNaturalist sources are considered citizen science databases that collect, archive and share species observations. As the observations and identifications can be submitted by anyone, and the records are not officially vetted, the data obtained from these tools should not be used as a clear indicator of species presence. Species may be filtered out based on habitat and targeted survey efforts. The following SAR were identified in the citizen science databases: Bald Eagle (special concern – eBird observation near the cliffs of the escarpment near Mount Nemo; preferred habitat absent within Study Area) Barn Swallow (threatened – eBird observation, as well as a confirmed observation within the Study Area and discussed in the NETR 2020)Golden Eagle (endangered–eBird observation near the cliffs of the escarpment near Mount Nemo; preferred habitat absent within Study Area) Blanding’s Turtle (threatened – iNaturalist observation 3.5 km from Study Area; preferred habitat absent within Study Area) Northern Map Turtle (special concern –iNaturalist observation within 1km of Study Area; preferred habitat and food source absent within Study Area) American White Pelican (threatened – iNaturalist observation within 1 km of Study Area; preferred habitat absent within Study Area. Species range limited to Northern Ontario; observation likely a migrant) Lilliput mussel (threatened – iNaturalist observation within 1 km of Study Area; preferred habitat and host fish species absent within Study Area) Based on the habitat assessments	Response accepted with regard to eBird and iNaturalist sources, however there were, as noted, significant omissions from the Ontario Herpetofaunal Atlas. These should be addressed. Wetland 13203 supports Painted Turtle and Snapping Turtle, and it should have been investigated for Blanding's Turtle as well. It is understood that Blanding’s Turtle surveys were conducted in 2021. We would like clarification on whether Wetland 13203 was included and whether the surveys were conducted in early spring. We would like the opportunity to review the additional survey results.	Please see response to comment #26. As noted in the NETR (2020), the Painted Turtle was observed on April 22, 2019 at wetland 13203 (BS6). One individual does not meet the criteria for SWH (minimum five individuals observed at one survey). Also noted in the NETR (2020), the Snapping Turtle was observed on June 11, 2019 at BS3, on the West Extension golf course turf between the golf course irrigation ponds. This date is considered too late to confirm overwintering habitat. In addition, the irrigation ponds are highly managed with water input and levels reliant on the diversion of water at the Weir Pond, which is dependent on the pumping from the existing quarry. The irrigation ponds are not considered suitable habitat for this species.	The Painted Turtle observation is understood to be an incidental observation – the response to comment 26 makes it clear that turtle overwintering surveys were not completed on the South Extension. It is disingenuous to state that the number of turtles did not meet the criteria for SWH when the proper surveys were not conducted. Snapping Turtle (only one of which would qualify the pond as SWH) could have been missed because the overwintering surveys were not conducted at the correct time of year and weather conditions.

	Special Concern Provincially and Federally • Milksnake (latest record 2019) – Special Concern Federally, Not at Risk Provincially.			and field survey program discussed in the 2020 NETR, the conclusions remain unchanged.			
45.	This section provides a listing of the natural features within the defined Study Area and the Broader Landscape. The first paragraph in this section states that Savanta has relied, in part, on supporting background information from government agencies and previous site surveys/investigations to provide additional insight into the overall character of these Subject Lands. The second paragraph describes how Savanta was involved in the previous application and states that "given the period of time that has passed, changes in policies and the changes in both the footprint and field conditions, we have not relied on it but have considered the field data and information obtained during that process to enhance the background data collection review and establishment of the field program." The lack of reference to previous historical work from 2004 and 2006 limits the understanding of the fisheries context regarding quarry operations and surrounding fish habitat. The next sections describing the fish habitat in the 2020 NETR are therefore very limited, whereas the fisheries information from the previous work by Stantec is extensive.	Section 2.2. Background Data Collection	Matrix Solutions Inc.	Comments on fish habitat have been discussed extensively above. DFO is the regulatory agency responsible for fish habitat and issued a letter of advice dated June 23, 2021. Nelson will implement the recommendations of DFO to protect fish habitat. More details are provided in the attached Watercourse Characterization Summaries. DFO's guidance and conditions were provided after the Summary tables were prepared and circulated. Nelson is happy to work through the tables with JART to ensure that all DFO conditions and mitigation measures are included in the AMP and that all threshold and trigger values are updated, if needed, based on DFO recommendations.	Yes, consider previous comments made above.	The updated AMP includes flow and temperature mitigation and monitoring requirements within watercourses to ensure no harmful, alteration, disruption or destruction to fish habitat in accordance with DFO letter of advice.	The applicant's NETR contains fish habitat information on irrigation ponds and connecting watercourses internal to the quarry footprint- the value of this information is limited as the applicant's position is that these are waterbodies are not fish habitat. The lands within 120m of the south and west quarry extension were not sampled for fish due to private property limiting access to those lands. To determine the effect of the Burlington Quarry Extension moving forward, future impacts can be measured by changes to the fish community (i.e. fish community diversity changes over time, sentinel species composition, SAR species occurrences). There is currently no plan to monitor or sample fish populations downstream of the quarry discharges due to the assumption that the current discharges will have similar quality and quantity as the existing flows. The comment still stands as there are NHIC records of Redside Dace within the reaches of Willoughby Creek just upstream of the quarry discharge confluence, and impacts to their habitat remains a concern.

46.	Features on or within the Study Area (bottom of Page 15 and top of page 16) should have included a discussion of the Mount Nemo Plateau. This is a landscape feature that is not mapped per se as an ecological feature – however, it has been identified as an important area for wildlife connectivity and it was identified as a significant recharge zone by the previous study team. Previous findings of groundwater connection with the wetlands in the previous hearing should be addressed.	Section 2.2.1. Natural Features Desktop Summary	North-South Environmental Inc.	The function of the Mount Nemo Plateau as a recharge function is addressed in the water resources report and discussion regarding the important areas for wildlife connectivity on the Mount Nemo Plateau are discussed above.	The comment referred to the Mount Nemo Plateau as an ecological feature, for wildlife connectivity. This should be discussed as well. The second part of this comments is not addressed. There are significant doubts that should be addressed about the groundwater findings regarding connections with wetlands. The infiltration pond has been proposed as mitigation for potential reduction in seepage within the Medad Valley at the edge of the Mount Nemo Plateau. It has also been proposed to discharge to the wetland north of Side road 2, at the south end of the Western Extension. However, at the meeting of experts on 21st October, 2021, when the efficacy of the infiltration pond (to provide infiltration) was questioned by JART groundwater experts, Nelson's response was that the infiltration pond had been proposed to replace the golf course ponds as an amenity, and that it was not required. The function of the infiltration pond should be clarified.	Through discussions with MNDMNRF, a revision to the integrated model was completed and remodeling of the effects of the mitigation from the proposed infiltration pond has been being completed by Earth FX. See attached **Tab 3** for a copy of the presentation and technical memo prepared by Earthfx. In addition, GEI prepared an updated memo regarding the Medad Valley which confirms with the mitigation and monitoring proposed that there will be no negative impact to the ecological features and functions within the Medad Valley PSW and ANSI. See attached **Tab 5**.	We understand there are concerns from JART's groundwater experts regarding whether the infiltration pond would provide the required discharge to the Medad Valley. We understand there are concerns from groundwater experts regarding the placement of the monitoring wells in the Medad Valley.
47.	Discussion of the fisheries context is found in Section 2.2.9 Conservation Halton Long-Term Environmental Monitoring Program Data, where characterization of the Grindstone Creek Watershed and Bronte Creek Watershed from Conservation Halton in 2002 was used to describe fish habitat. The fish habitat character from 2002 and fish species data in 2012 provided in this section from Conservation Halton provides a very limited background information despite the wealth of more detailed fisheries information contained in historical reports, which provide an indication of baseline conditions. This section confirms no fish community sampling is known to have been conducted in the unnamed tributary of Willoughby Creek downstream from the Subject Lands. Furthermore, no fish sampling has been completed on the West Branch of the Mount Nemo Tributary of Grindstone Creek. The Mount Nemo Tributary has been characterized as intermittent.	Section 2.2.9. Conservation Halton Long-Term Environmental Monitoring Program Data	Matrix Solutions Inc.	See previous responses regarding fish habitat. Contrary to this comment, as described in NETR Section 5.3.2, starting on Page 43, fish community sampling was completed on the West Arm of the West Branch of the Mount Nemo Tributary. The NETR also references the results of previous fish community surveys completed in the West Arm of the West Branch by Stantec as well as surveys by MNRF in the East Arm of the West Branch.	This comment refers to the approach used in the earlier historical reports as being more extensive in coverage as it also covers areas greater than 120m from the quarry footprint. It is important to understand the effects beyond the quarry footprint as the applicant states that the waterbodies within the footprint are not fish habitat. The fish data that are outside of the quarry footprint appear to be very limited and is dependent on previous work by others.	See response to comment # 17.	The response to this issue is the same as Response # 45 above

48.	This section should have included a description of the Ecoregion and Ecodistrict context of the site.	Section 3. Physiographic Conditions	North-South Environmental Inc.	Comment noted.	We reiterate that the ecoregion and ecodistrict context should be described. The mitigation that is required for potential cumulative impacts to the biophysical attributes of this area cannot be understood without this context.	Comment noted.	This comment still stands.
49.	In addition to considering individual Coefficients of Conservatism, Floristic Quality Analysis (FQA) should be included to provide an assessment of vegetation quality in each community as a whole.	Section 4. Field Investigations and Methods - Section 4.1.2	North-South Environmental Inc.	The NETR discusses plant species that have a high CC value and their associated communities. At this point, regarding FQA, it is our understanding that baseline values have not been established formally in Ontario (i.e., none that have been peer reviewed and published). Without formal baseline values, relative comparisons of communities are not reliable and would not add value to the current assessment and results. The NETR assesses floristic quality for the Study Area as a whole by using the CC values, and therefore, the vegetation data has been sufficiently assessed and applies appropriate mitigation measures.	The FQA would provide an analysis of relative quality for communities on the site, and could provide an explanation for the contention, for example, that woodland D is of low quality. In addition, the comparative analysis may provide a better rationale than is provided currently for communities that are proposed to be removed. For example, during the site visit it appeared that Woodland D was of relatively high quality in relation to many vegetation communities in southern Ontario, and Woodland F appeared to be of similar quality.	Significant woodlands and wetlands are considered components of the NHS. The criteria for each of these component types were considered and assessed when evaluating the field data to determine significance. As explained in the original response to this comment, the approach using the CC values provides good context in the feature characterizations and the identification and evaluation methods are consistent with Regional policy.	We suggest that this comment is moot since woodland E is being retained.
50.	A sampling plot radius of 5.0 meters is smaller than that generally accepted for sampling of woodlands (e.g. the sampling method for determining whether there are enough trees with cavities to meet the threshold for bat maternity colony habitat is 12.0 meters). This small sampling radius could have influenced the assessment of Significant Woodlands, if the small radius was used in the smaller woodlands as noted. A description of how the location of sampling plots were selected should be provided. It would be easy to unconsciously select areas with fewer trees for sampling if plots were selected in the field.	Section 4. Field Investigations and Methods - Section 4.1.4	North-South Environmental Inc.	Woodland stem density surveys and bat maternity colony surveys have differing objectives and should not be compared with respect to plot size. The latter is targeting larger trees capable of supporting bat maternity roosts and therefore requires larger plots. Woodland stem density surveys target all trees measurable at DBH – since many of the trees observed in the 5m plot communities were small diameter, a smaller plot size was deemed appropriate. 5m radius plots were only used in two of the five vegetation communities assessed; the remaining three consisted of 10m radius (two communities) and 15m radius (one community). In these instances, rationale for using the 5m radius plots was based on size of the overall feature and visibility within the plot (i.e., polygon CUT1-1), and observed variability within the community (e.g., varying density of stems in the overall community, varying species, and/or varying maturity; i.e., polygon CUT1b). The issue of visibility, in this case, relates to density of shrub species,	Whether sampling for numbers of trees that represent bat habitat (which includes all trees over 10 cm), or sampling for numbers of trees that qualify a polygon as a woodland (which includes all trees), the sampling methods should be very similar, as they are both intended to provide an estimate of numbers for the whole polygon extrapolated from a smaller area. It continues to be our opinion that 5 m plots are too small to provide an accurate estimate of trees within the larger area, especially since the number of plots was not provided. It was noted during the field visit that Polygon G was quite heterogeneous, so larger plots would be more likely to provide an accurate estimate within this polygon. This is an important metric, as it is used to provide the justification for removal of this woodland unit, so the sampling should be rigorous. It was noted by NSE staff during the site visit that 5 m plots could potentially have under-estimated the stem density within polygon E, and potentially stem density could have been under- estimated within other polygons as well. It was understood through discussions during the field visit that a stem count was conducted of all	To ensure proper coverage and more accurate data, a smaller plot size (5 m radius) can be used. If smaller plots are used, then more plots are simply needed to ensure that suitable minimum coverage is achieved within the feature. Professional experience has shown that more coverage and better representation is determined when using smaller plots in smaller features or in features that are somewhat linear in shape. Smaller plots are also more beneficial for features with high stem density. When the plots are larger in high stem density features, there is a greater chance of missing or double counting the stems. Therefore smaller, but more, plots can provide more reliable results when assessing smaller features, linear features or those with high stem densities.	We suggest that this comment is moot since polygon E is being retained.

				where an abundance of Staghorn Sumac, Common Buckthorn, and Multiflora Rose made it difficult to count stems reliably in larger plots. Since 10% community coverage was generally the target, it meant that smaller communities would require fewer large-diameter plots to achieve this target. For these two communities, only one 10m plot would be necessary to exceed that target. For polygon CUT1b, it was determined on site that a single plot appeared unlikely to sufficiently address the variability within the overall community. Determination of plot location consisted first of desktop imagery interpretation – selecting locations that appeared to capture community variability, which was then adjusted on site (if necessary) to ensure the pre-planned plots could be safely accessed and that any variability within the community was proportionately represented.	trees within Polygon E, and this is considered more appropriate. We look forward to reviewing the results of the stem density counts in polygons E and G.		
51.	The golf course ponds should have been included in salamander surveys (Figure 4a, Appendix A) and aquatic turtle surveys. Though these are human-made, there is the potential that one or more of them may provide habitat for SAR, including Jefferson's Salamanders (The retained consultant has personally observed this and other Ambystoma species in human-made ponds). There is no detail on time or weather during amphibian, bird, turtle and snake surveys, to permit a full assessment of whether wildlife survey methods were appropriate. Appropriate weather conditions (generally relatively warm, with no precipitation and low winds) are essential for reptile, amphibian and bird surveys. Inappropriate weather conditions can lead to the false conclusion that the species is not present. Surveys did not conform to the MNRF protocols for Blanding's Turtle, for which five visits are required prior to June, in highly specific weather conditions.	Section 4.2. Wildlife Surveys	North-South Environmental Inc.	All potential salamander breeding habitat was assessed and trapped as required. Discussions with the MECP confirm that the golf course irrigation ponds are not habitat for Jefferson Salamander and did not need to be surveyed. We are continuing to work with MECP for all SAR related matters and are adhering to their survey recommendations and protocols. In addition to the general notes about weather conditions in the methodology section, full weather details are recorded for each survey and provided on the data sheets in Appendix C of the NETR. Blanding's Turtle survey effort was discussed with MECP and addressed in the MECP response letter after completing Blanding's Turtle surveys, as per MECP direction, in 2021. No Blanding's Turtle or its habitat were observed and are considered absent from the Study Area.	Please see response to comment 25. We reiterate that the golf course ponds are similar to human-made Jefferson Salamander breeding pond habitat that we have observed in other areas of southern Ontario. Response not accepted regarding timing and weather conditions of field visit. It is standard practice to provide a summary of field visit information for ease of review, and some of this information is obscured on the scanned data sheets. A full list of time and weather conditions for each site visit should be provided.	Please see response to comment #25.	This comment is duplicated in comment 25. Nelson has provided the timing and weather conditions of field visits, as accepted in comment 27.

52.	It is not clear that MNRF/MECP were involved in selection of sampling sites; only that they were consulted regarding survey protocols. This should be clarified. Conservation Halton should also have been consulted regarding survey locations and methods. As noted above, the retained consultant has had experience with Jefferson's Salamanders and other Ambystoma species use of human-made ponds, so golf course ponds should have been included in trapping.	Section 4.2.2. Salamander Habitat Assessment and Hydro-period Monitoring Methodology	North-South Environmental Inc.	All potential salamander breeding habitat was assessed and trapped as required. Discussions with the MECP confirm that the golf course irrigation ponds are not habitat for Jefferson Salamander and did not need to be surveyed. We are continuing to work with MECP for all SAR related matters and are adhering to their survey recommendations and protocols.	Following our site visit to the site on 24th November, we reiterate that the golf course ponds appear to be appropriate habitat for breeding salamanders, based on our experience with human-made salamander breeding ponds in southern Ontario (see comment 25).	Please see response to comment #51.	This comment is redundant as it is duplicated in Comment 25.
53.	It is not clear whether tail-tip samples were obtained for genetic testing.	Section 4.2.3. Salamander Minnow Trapping Survey Methodology	North-South Environmental Inc.	Table 6 includes full details of the 2019 trapping results. No salamanders were caught during the trapping surveys; therefore, no tail-tip samples were obtained.	Response accepted.	Resolved – thank you	Resolved.
54.	This section states: "Survey protocols were created in consideration of MNRF (2012) and Toronto Zoo (Caverhill et al. 2011) turtle survey methods." This is imprecise language as it is unclear what "consideration" means: whether MNRF protocols were followed, or whether they were just given "consideration". If a variation in the protocols was followed this must be fully described. Clear times and weather conditions for each visit have not been provided. The final paragraph in this section notes that turtle nesting surveys were not completed due to absence of suitable habitat. However, turtles are frequently observed to nest on lawns (personal experience of the author), and turtles frequently nest at long distances from their basking habitat. Turtle nesting surveys should have been conducted at the appropriate time of year. There is no indication that methods for surveying non-basking turtles were used. As noted above, Blanding's Turtle (Threatened) have been noted within the Ontario Amphibian and Reptile Atlas "squares" in the vicinity of the site in addition to Midland Painted Turtle (Recently evaluated as Special Concern) and Snapping Turtle (Special Concern). Blanding's Turtles bask less often than other turtle species, and must be surveyed particularly early in the year, in ideal	Section 4.2.6. Turtle Basking Habitat and Nesting Surveys	North-South Environmental Inc.	In addition to the general notes about weather conditions in the methodology section, full weather details are recorded for each survey and provided on the data sheets in Appendix C of the NETR. The 2019 spring season had a cool and wet start, providing limited 'ideal condition' days for surveying for reptile species. Although reptile surveys do have 'ideal condition' temperatures and general condition guidelines, these are not always the set standard. Other considerations in determining suitable weather conditions include past weather patterns (i.e., weather leading up to the day of survey) and reptile behaviour in the local landscape (information obtained from the provincially recognized Reptile Course on Beausoleil Island, 2017). Turtle basking surveys are considered appropriate between ice-off and mid- June. Surveys should occur between 6 and 25 degrees during sunny or partly cloudy conditions and be above 15 degrees in fully cloudy, but not stormy, conditions. These conditions were all satisfied when completing the turtle basking surveys in 2019. One of the more important considerations when deciding to commence turtle basking surveys is to ensure that the air	We reiterate that a summary of details of weather and timing for each survey for review, as is standard practice. The above text omits several details of weather conditions at the date and time of the surveys. Weather and timing during the surveys are crucial details in determining whether the surveys were conducted appropriately. Blanding's Turtle protocols state that 5 surveys need to be completed in the earliest part of the season. The reason for this is that this species does not bask as much as other turtles, and does not bask as late. Additional turtle surveys should have been conducted in the early part of the season. We reiterate that the dates of the turtle surveys were not according to MNRF protocols for turtle basking surveys, which are focused on the early spring period just after they emerge from hibernation, and which we have found highly effective for detecting basking turtles. It appears that some of the surveys were conducted in cloudy conditions that also would not have been conducive to detecting basking turtles. It should be clarified which ponds were surveyed according to Blanding's Turtle surveys in 2021, particularly whether these included surveys of the pond within Wetland 13203, the pond where Painted Turtle and Snapping Turtle were seen.	Please see responses to comment #26 and #44. Please also note that a Snapping Turtle was not observed at wetland 13203. As noted in the NETR (2020), the Snapping Turtle was observed on the West Extension at BS3 on the golf course turf grass between the irrigation ponds.	This comment is duplicated in Comment 26 and 44. The summary of our concerns is that while turtle overwintering surveys were conducted on the West Extension, they were not conducted on the South Extension. Even though the assumption was made that Pond B6 on Wetland 13203 is turtle overwintering habitat because of the finding of a Painted Turtle there, there was no further effort to determine which species overwinter in the pond in addition to Painted Turtle, and there has been no discussion in Nelson's responses as to how turtle habitat will be maintained in this pond while using it as a discharge for dewatering of the south extension quarry floor.

	weather conditions, as detailed by Blanding's Turtle survey protocols (MNRF 2013).			temperature is warmer than the water temperature, along with the previous and current weather conditions. April 22: Survey was completed in partial overcast/partially sunny conditions (with a mix of sun and cloud presence – cloud presence was the highest in the morning and decreasing into the afternoon) after a weekend with cool, rainy weather. The previous two days prior to the basking surveys included a partially sunny day, even with temperatures below 15 degrees Celsius, resulting in more active basking observations in the surrounding geographic area. Additionally, the air temperature was higher than the water temperature, further supporting basking conditions. May 10: The two days prior to the survey were cool, and the day prior was rainy. The morning of May 10 was the warmest portion of the day (hovering at 17 degrees) with a mix of sun and cloud conditions. Additionally, the air temperature was higher than the water temperature, further supporting basking conditions. June 11: This survey date falls within the ice-off and mid-June timing window and meets the ideal conditions previously specified. Additionally, the wet and cool spring conditions in 2019 support an early June survey date due to a delayed spring season. The potential basking features that were surveyed are primarily characterized by open irrigation ponds that are mowed to the feature edge and provide limited basking opportunities, given the sloped edges, lack of basking habitat (e.g., rocks, logs) and open water conditions with no vegetation to create visual barriers from predators. The features are deep and generally hold water cooler than the air temperature. Based on the above, this SWH type is still considered absent.			

				As indicated in section 4.2.6, suitable nesting micro- habitat characteristics included open, sunny areas of looser sand and gravel mineral soils adjacent to undisturbed shallow weedy areas of marsh habitat. Such habitat conditions were absent from the Study Area. Turtle nesting surveys were not completed due to absence of suitable habitat. Blanding's Turtle survey effort was discussed with MECP and addressed in the MECP response letter after completing Blanding's Turtle surveys, as per MECP direction, in 2021. No Blanding's Turtle or its habitat were observed and are considered absent from the Study Area.			
55.	Times and weather conditions for snake surveys are important, but have not been provided for each survey. It is noted that visual encounter surveys were conducted on mild spring mornings, but the following sentence says they were conducted between 8:00 AM and 5:00 PM, which means not all were conducted in the morning. The first sentence notes that survey methods are based on MNRF species at risk protocols, but the final sentence on the first paragraph of this section notes that specific protocols were not applied as no threatened or endangered snakes have been recorded in the area based on the species desktop summary. Milksnake (a species of Federal Special Concern) has been recorded in this area by the Ontario Herpetofaunal Atlas, so the MNRF protocol for Milksnake surveys (which are often used to guide surveys for non-SAR species generally) could have been followed.	Section 4.2.7. Snake Habitat and Visual Encounter Methodology	North-South Environmental Inc.	In addition to the general notes about weather conditions in the methodology section, full weather details are recorded for each survey and provided on the data sheets in Appendix C of the NETR. The 2019 spring season had a cool and wet start, providing limited 'ideal condition' days for surveying for reptile species. Although reptile surveys do have 'ideal condition' temperatures and general condition guidelines, these are not always the set standard. Other considerations in determining suitable weather conditions include past weather patterns (i.e., weather leading up to the day of survey) and reptile behavior in the local landscape (information obtained from the provincially recognized Reptile Course on Beausoleil Island, 2017). Snake visual encounter surveys are considered appropriate between April and September (though spring emergence is ideal between April and leaf- out). It is also recommended that surveys should occur between 10 and 30 degrees during sunny or partly cloudy conditions, and above 15 degrees in fully cloudy, but not stormy, conditions. These conditions were all satisfied when completing the visual encounter surveys in 2019. In addition to the weather condition	Please provide details of weather and timing for each survey for review, as is standard practice. Weather and timing are crucial data in determining whether the surveys were conducted appropriately. Surveys conducted in the wrong weather or timed to the wrong time of day may give false results, with snakes appearing to be absent when they are in fact present. The site appears suitable for Milksnakes, and without the details of survey weather and timing, the survey results cannot be reviewed appropriately.	See attached **Tab 4** for a copy of the Updated Table 1.	This comment is resolved by the provision of the weather conditions and timing for snake surveys, as requested.

				parameters that are recommended during the survey, the weather conditions and pattern from the previous days leading up to the survey date are also of importance. April 22: Survey was completed in partial overcast/partially sunny conditions (with a mix of sun and cloud presence – cloud presence was the highest in the morning and decreasing into the afternoon) after a weekend with cool, rainy weather. The previous two days prior to the basking surveys included a partially sunny day, even with temperatures below 15 degrees Celsius, resulting in more observations in the surrounding geographic area. Additionally, the majority of the snake surveys were completed in the afternoon with cloud cover between 40-60%, providing suitable sunny conditions. May 10: The two days prior to the survey were cool, and the day prior was rainy. The morning of May 10 was the warmest portion of the day (hovering at 17 degrees) with a mix of sun and cloud conditions, and the afternoon was mostly sunny. June 11: This survey was completed within the suitable timing window (April to leaf-out) and during suitable weather conditions. Due to the cool and delayed start of spring in 2019, leaf emergence occurred into early June. Based on the above, this SWH type is still considered absent.			
56.	It is stated that the MNRF Guidelines for Bobolink and Eastern Meadowlark point counts were followed. These guidelines state that 3 surveys should be conducted, in the early, mid and late season. A third survey date for these species is not listed.	Section 4.2.8. Breeding Bird Surveys	North-South Environmental Inc.	Historical communication with MNRF confirmed that two surveys are sufficient if the species was observed during survey rounds one or two. Bobolink was observed on the Camisle Golf Course, adjacent to the proposed South Extension; therefore, a third survey was not required due to confirming presence with first two rounds.	Response accepted.	Resolved – thank you	Resolved.

57.	It is noted in this section that survey methods targeted habitat for Little Brown Myotis, Northern Myotis and Tri-colored Bat, but that surveys were conducted in leaf-off condition, focusing on tree cavity assessment. However, surveys for Tri-colored bat habitat must be conducted in leaf-on condition, as Tri-colored Bats nest in leaf clusters.	Section 4.2.9. Bat Habitat Assessment Survey Methodology	North-South Environmental Inc.	As noted in section 4.2.9, survey methods applied for the 2019 bat habitat assessment surveys include a combination of protocols established by the MNRF (MNR 2011 and MNRF 2017), discussions with MECP and professional experience. Bat habitat survey guidance from the province has been in flux since the release of the MNR 2011 document due to the incorporation of on-going bat research, and therefore discussions with provincial authorities is the preferred approach to establishing survey methods. MECP guidance for assessing forest/woodland habitats for maternity roosting bats does not recommend surveys for leaf clusters. Tri-colored Bats are known to prefer leaf clusters, with data showing a preference for dead leaf clusters in particular, though cavity and peeling bark roosts have also been identified as roosting habitat for this species. All FO/SW ELC communities (eight were identified) were considered potential habitat for SAR bats (tree cavities, peeling bark and leaf clusters are typically present in all FO/SW communities, so none of these habitats were overlooked). Of these eight communities, three of them fell within the proposed limit of extraction and were further surveyed using acoustic methods to determine species presence.	Response accepted.	Resolved – thank you	Resolved.
58.	It is noted on page 29 that “any calls with a positive identification were manually vetted by a wildlife ecologist with training in bat species identification by sonagram.” Calls noted as “NoID” should also be vetted by an ecologist with training, as Myotis sp. calls are frequently recorded without identification to species. The three Myotis species that occur in southern Ontario (as well as the Tricoloured Bat Perimyotis subflavus) have very similar calls that cannot always be identified by auto-ID algorithms, but all Myotis and Perimyotis species are considered Endangered.	Section 4.2.10. Bat Acoustic Survey Methodology	North-South Environmental Inc.	Correct. To help emphasize the effort applied to the assessment of bat acoustic recordings please note the following clarification to the bat acoustic survey methodology. Due to the challenge in identifying some high frequency calls, wildlife ecologists trained in bat species frequency identification individually assessed the high frequency calls to ensure that the auto-ID results were accurate. If a call could not be identified beyond *Myotis* sp., it was left as *Myotis* sp and included in the SAR results.	Response accepted.	Resolved – thank you	Resolved.

59.	Typically, an assessment of potential HDF is done prior to going on site using orthoimage interpretation or ArcHydro analysis to look for drainage features that have a catchment of 2.5 hectares or larger. The report should describe how this was completed.	Section 4.3.1. Headwater Drainage Feature Assessment	North-South Environmental Inc.	Aerial photo interpretation was completed to identify potential HDFs that may need to be looked at and the results of a November 2018 site reconnaissance were considered prior to completion of HDFA Round 1. However, the entire proposed West Extension Subject Lands and South Extension Licensed Boundary and all areas within 120 m were walked during HDFA Round 1 to identify potential HDFs. Therefore, it was not necessary to rely on arc-hydro mapping to identify features, as this was done through field investigation.	Response accepted.	Resolved – thank you	Resolved.
60.	Please discuss how the delay in the Headwater Drainage Feature (HDF) Assessment timing impacted the results of the assessment and provide additional mitigation as necessary. For example, the first round of the HDF Assessment was completed on April 18, 2019 with a temperature of 22.0 degrees, which is outside of the spring freshet of that year. The second round was completed outside of its typical period (June 3, 3019 vs Late April – May) and the last round was at the very end of the window as well (August 26, 2019 vs July-August).	Page 29 Section 4.3.1. Headwater Drainage Feature Assessment	Conservation Halton	Round 1 in 2019 was just beyond the typical window identified by the HDFA Guideline (late March – mid-April) and while not at the peak of the freshet, the timing was sufficient to identify HDFs on the landscape. OSAP (Section 4: Module 11) notes that round 1 should be completed after the spring freshet. Mid to late spring 2019 was very wet and as a result of waiting to get a period of at least 48 hours with no rain (and preferably 72 hours as noted in OSAP Section 4: Module 11), delay until early June was required to achieve appropriate base flow conditions, per guidelines. The OSAP (Section 4: Module 11) indicates sample event 3 is conducted in July to mid-September following at least 3 days with no flow generating precipitation	Addressed.	Resolved – thank you	Resolved.

61.	This section describes the fish community sampling that was completed on June 17 and 24, 2019. Backpack electrofishing (using a Halltech HT-2000 electrofishing unit) and seine netting (using a 30.5-metre long by 1.83- meter high, small mesh seine net) were used in combination to survey all habitats present. The other excavated golf course ponds were steep-sided and too deep to wade; therefore, visual observations of fish presence were recorded. As fish sampling methods are known to be selective to fish, discussion of biases associated with these methods should have been included in this section as the methodology used for fish sampling is biased to larger fish. No attempt was made for example, to use minnow traps in areas that are too deep to wade to obtain an understanding of smaller bodied fish species. Visual fish observations yield limited information and accuracy of fish identification is based on the experience of the observer. At the very least, the mesh size of the netting should have also been indicated as well as catch per unit effort to understand the relative abundance of fish. If the objective of the fish sampling was to demonstrate an understanding of the fish community, including the presence/absence and types of fish inhabiting various watercourses in the study area, a discussion on gear selection and deployment should have been included. The presence or absence of fish is a useful indicator in determining a particular pond's potential to support other species such as the Jefferson Salamander.	Section 4.3.3 Fish Community	Matrix Solutions Inc.	We note these comments relate to the anthropogenic ponds on the golf course, which has been confirmed as not being fish habitat by DFO. We note the following: Although catch per unit effort was not specifically noted in the report or the results table (Table 14) it can be readily calculated based on the reported numbers and effort (electrofishing seconds). However, in our opinion, little relevant information can be garnered from a calculation of catch per unit effort that cannot already be readily discerned from looking at the raw results. Electrofishing within the interconnecting channels between ponds is considered to be a completely effective method to sample the fish community in those areas. DFO has confirmed (via email on June 23, 2021, which accompanied the Letter of Advice) that the ponds and interconnecting channels on the golf course are not considered fish habitat. It is acknowledged that deep water sampling was not completed in the anthropogenic ponds. However, we suggest that the visual assessment methodology was very effective in identifying the species of fish that were observed, given that Largemouth Bass, including YOY, juveniles and adults are readily identifiable to species and viewing conditions during the survey were excellent. It is our opinion that there was no opportunity to inaccurately identify those fish that were visually observed in the ponds. Further, the active sampling that was completed in the ponds and interconnecting channel only identified the presence of Largemouth Bass, thereby validating the visual observations of only one species. We cannot discount the possibility that other species could potentially be present in the anthropogenic ponds in areas that were not sampled. It is well documented that fish can invade ponds through a number of means	Comments noted. Further clarification required.	If the further clarification requested is in regard to DFO's assessment that the golf course ponds and drainage channels are not considered fish habitat, then we note that, as the regulatory authority on what should be considered fish habitat, we are relying on DFO's decision on this matter. Although we provided DFO with information regarding the golf course drainage features (in our letter dated August 14, 2020), we were not a part of their decision-making process and cannot speak for them in this regard.	The response to this issue is the same as Response # 45 above It is still unclear why the applicant undertook fisheries sampling efforts within the irrigation ponds and watercourses if their position is that these habitats are not considered to be fish habitat. If this information was to document what fish will be destroyed/salvaged or relocated moving forward, it is not known what the fate of these fish will be.

				of transport including human induced stocking, accidental release, birds and migration from downstream watercourses. Therefore, is possible that if other gear was utilized, additional fish species could potentially have been captured. However, regardless of whether or not other species were present in the anthropogenic ponds on the golf course, our opinion of whether or not these ponds are characterized as fish habitat under the Fisheries Act would not change for the reasons outlined in Section 6.6.1 of the NETR. Again, DFO has confirmed in letter dated June 23, 2021 that the constructed golf course ponds and interconnecting channels are not considered to be fish habitat. Further to this, regardless of the fish composition of the ponds, in our opinion, it is inarguable that the ponds and interconnecting channels do not provide an important ecological function for the natural fish community in Willoughby Creek. As expanded upon in the NETR, it is our opinion that removal of the ponds and irrigations channels would have a net benefit for the natural watercourse downstream. Therefore, in our opinion, any further studies in these ponds are not warranted, since the long- term management remains the same (i.e., removal). Based on our experience in similar areas, fish from man-made ponds such as this are not typically permitted to be transferred back to the natural environment elsewhere, given the potential for diseases and contaminants. Largemouth Bass have been visually confirmed in all of the Golf Course ponds and this has been considered in the assessment of potential to provide Jefferson Salamander habitat.			

62.	Giant Swallowtail (S3) was not included in the mapping of significant species on Figures 7a and 7b. It was omitted because its host plant, Prickly Ash, was not observed within the areas where the butterfly was observed. However, nectaring habitat is important for butterfly species and this species should have been added to the mapping in order to inform mitigation.	Section 5.2.1. Insects	North-South Environmental Inc.	Giant Swallowtail observations were made of two individuals moving through the golf course. Therefore, lack of habitat and behavior of observed species concluded that habitat for this species is considered absent from the Study Area. However, pollinator plant species are recognized as an important component to open areas, and therefore, as noted in the Site Plans, appropriate seed mixes will be applied following Conservation Halton guidelines.	Response accepted.	Resolved – thank you	Resolved.
63.	Please provide the number of surveys, location of sites and dates of the egg mass surveys.	Page 35 Section 5.2.4. Egg Mass Survey Results	Conservation Halton	Egg mass observations were being reported on various message forums for the Burlington and Milton areas in early April. Therefore, as provided in section 4.2.4 and Table 1, egg mass surveys were completed at features V1, V2, V3 and V4 on April 10, 2019.	Addressed.	Resolved – thank you	Resolved.
64.	The report indicates that no amphibians were heard calling from ACC11 however wetland 13037 (PSW12) is identified as an amphibian breeding area in the MNRF Grindstone Creek Headwaters PSW evaluation. Recommend referencing the evaluation and discussing in the report.	Page 36 Section 5.2.5. Amphibian Call Count Survey Results	Conservation Halton	The Grindstone Creek Headwaters Wetland Complex Wetland Evaluation Report (MNRF 2007) does not identify wetland 13037 (PSW12) as amphibian breeding habitat; however, it does indicate so for PSW11, which is what I'm assuming is meant in this comment. The data for this report is dated 2007. As of 2019, amphibians were not heard calling from this feature, nor was any amphibian captured during salamander trapping surveys in 2019.	Correct, this should be PSW11 not PSW12. Please include the Grindstone Creek Headwaters Wetland Complex evaluation report as species data will help to provide understanding of cumulative impacts for all scenarios and help to form target thresholds for wetland function.	Wetland Evaluation Report is attached as **Tab 6.**	Please see Response to Comment # 38. Sarah Mainguy, NSE, has reviewed Nelson's response and provided the following JART response: Information from past wetland evaluation is applicable, given that the highest amphibian breeding survey results are not obtained every year. This wetland appears to function as amphibian breeding habitat in some years, and should be acknowledged as such so that mitigation can be applied to the wetland.

65.	It should be noted that Midland Painted Turtle's S4 status does not indicate "common and secure" as stated on page 36. The S4 status definition, according to NatureServe Conservation Status Ranks (which are used by NHIC) is: "Apparently Secure— At a fairly low risk of extirpation in the jurisdiction due to an extensive range and/or many populations or occurrences, but with possible cause for some concern as a result of local recent declines, threats, or other factors." In addition, Midland Painted Turtle has recently been evaluated by the Committee on the Status of Species at Risk in Canada (COSEWIC, 2018) as a Species at Risk in Canada with a status of Special Concern, indicating a greater level of concern about its status. On page 27, it was stated that turtle nesting surveys were not completed due to absence of suitable habitat, so this section should not refer to nesting survey results. It is possible that both turtles observed on the golf course (Snapping Turtle and Midland Painted Turtle) nest on the golf course or in the southern extension study area and surveys should be conducted for nesting habitat. The finding of a Snapping Turtle walking on land from one irrigation pond to another on June 11, 2019 (and described as an observation of a turtle "moving through the area"), is within the nesting window for this species and this was just as likely to have been an observation of a turtle searching for nesting habitat. Locations of turtle observations should have been shown on Figure 7a (Significant Wildlife Habitat and Species at Risk Observations).	Section 5.2.6. Turtle Basking Habitat and Nesting Survey Results	North-South Environmental Inc.	Golf course sand traps and active agricultural fields are not considered suitable turtle nesting habitat and would therefore not be considered candidate habitat requiring further assessment. These areas are not suitable for nesting due to disturbances associated with frequent sand trap raking (e.g., multiple times daily) and disturbances associated with agricultural activities or shading from planted crop vegetation that will prevent the successful incubation and hatching of any eggs, should any be laid in these areas. The EcoRegion Schedule (MNR 2015) does not explicitly state that the species of Special Concern must be on the SARO List; however, it is a document that is an extension and guidance for the SWH Technical Guide (MNR 2000), and it does state that the information within the schedule will require periodic updating to keep pace with changes to wildlife species status in the Species at Risk in Ontario (SARO) list, or as new scientific information pertaining to wildlife habitats becomes available. The SWH EcoRegion Schedule is also a provincial guidance document; therefore, if a species does not have a provincial status of Special Concern, it should not be considered as Special Concern for the purposes of SWH.	This comment did not apply only to golf course sand traps. Other areas of the golf course may provide habitat. In addition, turtles frequently nest at the edge of agricultural fields. Snapping Turtle qualifies as a species of Conservation Concern, while whether Midland Painted Turtle is a Species of Special Concern is, we agree, somewhat ambiguous. However, protection of SAR in Canada requires protection at all scales, including provincial and regional. The SWHTG (MNR 2000) notes that species of Conservation Concern "may refer to species that are rare at some larger scale (ecological region, province, global)" (Page 64). Midland Painted Turtle has similar nesting habitat requirements to Snapping Turtle. We reiterate that searches should be conducted for turtle nesting habitat. The third comment in this row was not responded to. Locations of turtle observations should have been shown on Figure 7a.	Please see response to comment #26. In addition, the site plans have been revised to assume turtle wintering SWH at BS6. As was stated in the NETR (2020), suitable turtle nesting habitat (further defined in the SWH Criteria Schedules for Ecoregion 7E, MNRF 2015) was absent from the Study Area.	The response provided by Nelson is accepted.
66.	Headwater Drainage Features are discussed in a separate report by a member of the Study Team.	Section 5.3.1. Headwater Drainage Feature and Aquatic Habitat Results	Matrix Solutions Inc.	Acknowledged.	Addressed.	Resolved – thank you	Item has been acknowledged
67.	Please note that the identified H2 is a regulated watercourse under Ontario Regulation 162/06 and not a headwater drainage feature as discussed in the report. Please revise the table accordingly.	Page 39 Section 5.3.1. Headwater Drainage Feature and Aquatic Habitat Results	Conservation Halton	In our experience elsewhere in Halton Region, H2 would appear to meet the criteria to be considered a headwater drainage feature. The feature consists of a headwater wetland (which per the TRCA/CVC HDFA Guidelines is considered to be	Conservation Halton utilizes multiple criteria including hydrology, channel form, hazard risk, aquatic species/habitat, and riparian condition/terrestrial habitat to determine if a feature is a HDF or regulated watercourse. Regarding	Comment noted. This feature will be considered a regulated watercourse moving forward. We do not expect that there will be any implications associated with it being a regulated watercourse as opposed to our initial assessment of it as an HDF.	Addressed.

				a headwater drainage feature) and a short interconnecting channel. This is a first order feature, is intermittently flowing and has a drainage area less than 50 ha (which has been used as a general guideline threshold to differentiate HDFs from watercourses in other areas of Halton). Based on this, we suggest H2 does meet typical criteria to be an HDF and not a watercourse. We would appreciate further clarification from Conservation Halton as to what criteria has been used to designate H2 as a watercourse and not an HDF and explanation as to how this is consistent with approaches taken elsewhere in Halton Region. In our opinion, whether or not it is classified as a watercourse or HDF does not have any implications for the assessment of potential impacts in the NETR, nor any other project related implications. In our opinion, whether or not it is classified as a watercourse or HDF does not have any implications for the assessment of potential impacts in the NETR, nor any other project related implications.	H2, while the drainage area is less than 50 ha, it is located within important or valued aquatic habitat, riparian conditions, or terrestrial habitat, therefore it is considered regulated. CH staff agree the classification will not change the outcome for the assessment of potential impacts in the Natural Environment Technical Report.		
68.	The information provided in this section describes the watersheds associated with the West Extension and the South Extension of the Burlington Quarry. West Extension primarily affects the outflow to the Willoughby Creek Tributary and an unnamed tributary that comes from the Medad Valley which are both in the Bronte Creek Watershed. The South Extension primarily affects the outflow to the Mount Nemo Tributary, which is part of the Grindstone Creek Watershed. The degree to which fish assessment is discussed is not only limited to within 120.0 meters, but the fish sampling is limited to areas where Savanta has been given land access, and where they have been able to sample. This not only provides a limited fish species list but also a much smaller sampling study area. As the reach of Willoughby Creek north of Colling Road was not sampled or visited due to private ownership, characterization of fish habitat and fish presence was inferred from past reports. Given the magnitude of the proposed West Extension and implications on the	Section 5.3.2. Fish and Fish Habitat Assessment Results	Matrix Solutions Inc.	See previous responses regarding fish habitat. More details are provided in the attached Watercourse Characterization Summaries.	Justification of why a different approach to fish habitat characterization was used, instead of what was provided historically, which emphasizes the links to adjacent natural features. It seems counterproductive to undertake fish sampling activities and have them ruled out as they are not considered fish habitat. Concern is based on: - Limited sampling effort- if artificial ponds were not considered fish habitat – visual sampling and possibility of other fish not noted- seems haphazard- if it is going to be ruled out anyway that whatever fish is going to there it doesn't seem to matter as it is not fish habitat- why sample effort concentrated there if this was not deemed. - Reliant on older information where fish community sampling	See response to comment # 17.	The response to this issue is the same as Response # 45 and # 61 above.

	downstream reaches, information regarding downstream effects is sparse. It is not surprising that only very few fish species are observed and reported in this section. As access has presumably been granted to others such as Worthington to directly observe karsts within the Willoughby Tributary, the applicant should explain if landowner consent to enter private property for the purposes of sampling and investigation was attempted. The baseline aquatic habitat for these receiving stream systems are described in historical ecological reports (e.g., 2004 and 2006 electrofishing surveys). The significance of the Willoughby tributary in terms of fisheries is highlighted within these historical reports. These reports, completed by Stantec as 2004 Level 2 NETR (Stantec 2004) and 2006 Level 2 NETR (Stantec 2006) discuss natural features within a 5.0 kilometer radius of the study area, and was focused on identifying ecological links to environments not immediately adjacent to the Subject Lands. These reports state that “these links are important to understand Regional environmental features that could be impacted by on site operations”. Justification should be provided why a different approach was used in the 2020 Level 1 and 2 NETR.				does matter- i.e. outflows- but limited information exists - Sampling only done in specific areas within 120m of quarry footprint- not much to go on Considering that private access is not allowing for Data collection, fish data is very limited.		

69.	This section discusses how the presence/absence of natural heritage features as defined in the PPS (MMAH 2020) within the Study Area is assessed. The NHRM (MNR 2010), NEP (2017), Halton Region OP (2018) and City of Burlington OP, which provide technical guidance for implementing the natural heritage policies of the PPS, were referenced to assess the potential significance of natural areas and associated functions. Under Subsection 6.6 however, the discussion on Fish Habitat is only limited to what waterbodies are considered fish habitat under the *Fisheries Act*. Key pieces of policy information such as (a) identification of the connections and linkages between natural heritage features and areas, surface water features and groundwater features; and (b) how the diversity and connectivity of the natural features in an area and the long- term ecological function and biodiversity of the natural heritage system can be maintained, restored or where possible improved as they pertain to fish habitat is omitted from this discussion.	Section 6. Natural Heritage Feature Assessment	Matrix Solutions Inc.	The purpose of this section was to identify where direct and indirect fish habitat was present. Reference to potential significance assessment is relevant to other types of natural heritage features and areas (i.e., Significant Woodlands, Significant Wildlife Habitat), but in our opinion, there is no similar "significance" assessment for fish habitat under the PPS; it either is or is not fish habitat for the purposes of this assessment. That is not to say that some fish habitat is not more significant (outside the PPS context of significant natural features and areas). Therefore, it is not clear how the requested content is consistent with the intent of this section of the report. Any discussion on points a) and b) as identified in the comment, would appear more appropriate for the impact assessment section of the report and it is not clear what value they would add to this section, nor how it would be consistent with the other sections in this report (which focus on determining the presence/absence of significant natural features and areas as defined in the natural heritage policies of the PPS).	SAR (Redside Dace) and Brook trout are species that have been identified in past studies. Good to know if there are still these species left as part of the baseline condition. There is significance attached to these species and their habitats.	DFO Aquatic SAR mapping does not identify the presence of Redside Dace within any watercourses in the predicted zone of influence of the quarry, nor has MECP identified any potential issues with respect to Redside Dace. The closest Redside Dace habitat identified on DFO's mapping is located on Bronte Creek approximately 4 km (straight line distance) upstream from the mouth of Willoughby Creek. Also see response to # 17.	The response to this item is similar to Response #45. The Natural Heritage Information Center has 2 records of Redside Dace (Classified as Endangered under SARO and COSEWIC) within the Medad Meltwater ANSI in locations 17NJ8805 and 17NJ8806 which are in Willoughby Creek reaches north of Colling Road and along Cedar Springs Road. Given the lack of more recent information, it is hard to determine if Redside Dace is still present (The location of 17NJ8805 is where the discharge from the West Extension enters Willoughby Creek main branch).
70.	Once the additional hydro period information for the wetlands is complete, please revise and include an ecological interpretation of the data in this report. The data should be assessed from a dry, wet and average climate conditions perspective to ensure that proposed changes do not exacerbate natural dry conditions.	Page 46 Section 6.1.2. Significant Wetlands – 120 m Adjacent Lands	Conservation Halton	More details are provided in the attached Wetland Characterization Summaries.	Not addressed. See response to Comment No. 37 above.	Please see response to comment #37.	Please see Response to Comment # 37. Sarah Mainguy, NSE, has reviewed Nelson's response and provided the following JART response: The original comment still stands as the variation in seasonal inundation is very important to amphibian breeding, especially the persistence of a long hydro-period in some years. All available information should be included.

71.	The MNRF Grindstone Creek Headwaters PSW Evaluation notes that the larger wetland of the 13037 (PSW12) is seepage-fed and contains a seep that can be seen discharging to the surface, whereas the report indicates that this wetland is precipitation and surface runoff fed with groundwater contribution to be less than 2.0%. Recommend referencing the evaluation and discussing in the report.	Page 46 Section 6.1.2. Significant Wetlands – 120 m Adjacent Lands	Conservation Halton	More details are provided in the attached Wetland Characterization Summaries.	Partially addressed. Discussion is provided within the summary regarding seepage, however reference to PSW evaluation has not been included. Recommend updating the summary to include findings from the evaluation to determine cumulative impacts for existing conditions to help inform appropriate mitigations for wetland function for existing (as per the TOR with proposed 25-year baseline), interim (for each identified extraction phase) and both post extraction scenarios (rehabilitation scenario 1 and rehabilitation scenario 2).	Please see responses to comments #34 and #125. Also, the revised AMP includes more monitoring stations, additional data and updated threshold and trigger values for checking and mitigating impacts. See updated AMP.	Please see Response to Comment # 38. Sarah Mainguy, NSE, has reviewed Nelson's response and provided the following JART response: Factors contributing to cumulative impacts will include the increase in heat island effect, drying winds and direct light. These will affect wetlands through drying standing water and moist soils. As noted in the response to comment 34, these additional impacts should be addressed.
72.	All of the PSWs within the zone of influence of the quarry should be discussed in this report, regardless if they are within the 120.0 meters adjacent lands. There are number of PSWs in the Grindstone Creek PSW Complex that may be impacted by the quarry that are not discussed in the report.	Page 46 Section 6.1.2. Significant Wetlands – 120 m Adjacent Lands	Conservation Halton	The Wetland Characterization Summaries (attached) provide feature characteristics, impact assessments by each Phase and mitigation measures.	The characterization summary for Wetland 13015 is missing. Please update to include. See response to Comment No. 37 above.	Please see response to comment #24.	Please see Response to Comment # 38. Sarah Mainguy, NSE, has reviewed Nelson's response and provided the following JART response: The issue of assessment of wetlands that will be affected by the quarry is still outstanding. All wetlands that will potentially be affected by the quarry should be included in the assessment.
73.	Please confirm the source of water input for the SAS1 inclusion within the MAM2-2/SWT2-2.	Page 49 Section 6.1.3. Othe Wetlands within the 120 m Adjacent Lands	Conservation Halton	The SAS1 inclusion is an online pond on the West Arm of the West Branch of the Mount Nemo Tributary. The source of water for this is primarily quarry discharge from Sump 0200.	Addressed.	Resolved – thank you	Resolved.

74.	This section should include a detailed discussion of why the analysis came to a different conclusion regarding the significance of woodlands E, F and G from the Regional Natural Heritage System's analysis. The potential functions of these woodlands to provide connectivity (i.e., stepping stone function) of Woodland D to adjacent features should be discussed. Review of aerial photography for this area indicates that Woodland E is less than 20.0 meters from Woodland D, and should be investigated as a continuous part of Woodland D, as it is noted in Section 6.2.1 that woodlands within 20.0 meters should be treated as a continuous unit.	Section 6.2. Significant and Other Woodlands	North-South Environmental Inc.	Wooded features E, F, G do not meet the definition of Woodland under the ROP (2018), (0.48 ha; 0.22 ha; 0.48 ha, respectively) and are all greater than 20 m apart. Therefore, these are not features, nor should they be considered 'stepping stones' due to their size and distance apart from each other.	See response to comment 29.	Please see responses to comments #28 and #29.	We suggest this comment is moot as Woodland E has been retained, and the need for effective linkage is discussed more broadly in Comment 28.
75.	The significance and role of Woodland E relating to the RNHS should be expanded upon. Provide further analysis to confirm the functions and contributions of Woodland E for: • SWH (Eastern Wood-Pewee Habitat, Bat Maternity Roost Habitat); • Separation distance from Woodland D; • Overall connectivity/ linkage opportunities within the RNHS; and • Overall significance. It is recommended that detailed avoidance rationale be provided to reflect the role Woodland E plays within the larger RNHS and all associated impacts.	Page 53 Section 6.2.2. Halton Region Official Plan	Conservation Halton	Wooded feature E is described in detail in Table 2 of the report. It is an area that is <0.5 ha made up of mid-age to mature canopy trees mostly of Sugar Maple. There is no subcanopy or understorey. The ground cover consists of maintained turf grass, Garlic Mustard and some Herb- Robert, all of which is mowed regularly. Paved golf cart paths also make up part of the ground cover in this small stand of trees, serving as an aesthetic feature for the golf course. It is small and isolated (<20 m from other treed areas). High bat activity may serve more of an indicator that this polygon is situated in the flight path of bats moving between the Medad Valley and the open water areas of the active quarry for foraging purposes.	Response does not address the comment. It is understood the Region established driplines for all woodlands including woodland E. Confirmation is needed from the Region regarding boundary delineation and size of the woodland to determine next steps.	Please see response to comment #28.	Please see Response to Comment # 38. Sarah Mainguy, NSE, has reviewed Nelson's response and provided the following JART response: Woodland E has been retained – this comment has been addressed.
76.	This section notes that species of conservation concern include "species listed as S1 to S3 or SH by SRANKS and those listed on the Species at Risk in Ontario List as Special Concern." However, neither the Natural Heritage Reference Manual nor the Ecoregion Schedules state that the species of Special Concern must be on the Species at Risk in Ontario List. As noted in Section 7.4.2.2, Midland Painted Turtle has been evaluated as a Species at Risk in Canada by COSEWIC, and should have been discussed here; its location should also be shown on Figure 7b.	Section 6.4. Significant Wildlife Habitat	North-South Environmental Inc.	The EcoRegion Schedule (MNR 2015) does not explicitly state that the species of Special Concern must be on the SARO List; however, it is a document that is an extension and guidance for the SWH Technical Guide (MNR 2000), and it does state that the information within the schedule will require periodic updating to keep pace with changes to wildlife species status in the Species at Risk in Ontario (SARO) list, or as new scientific information pertaining to wildlife habitats becomes available. SWH EcoRegion Schedule is also a provincial	See response to Comment 65.	Please see response to comment #65.	We suggest that this comment is moot since Pond B6 has been evaluated as SWH for turtle overwintering due to the presence of Painted Turtle. However, the issue of how this function is to be maintained while discharging water from dewatering the Southern Extension quarry floor has not been addressed.

	The location of the Snapping Turtle (a Species of Special Concern) should have been shown on Figure 7a. This species should have been discussed, as it can rely on human-made habitat. While human-made habitat is excluded from some SWH (such as turtle overwintering habitat) it is not excluded as SWH for species of conservation concern.			guidance document; therefore, if a species does not have a provincial status of Special Concern, it should not be considered as Special Concern for the purposes of SWH.			
77.	The FOD7-4 community is rare in the Province and is therefore confirmed SWH, regardless of its frequency in Halton Region. The report should provide the full 30.0 meter buffer for this woodland, an impact assessment for this feature and mitigation measures developed as necessary.	Page 57 Section 6.4.1. SWH Assessment Summary, Table 19	Conservation Halton	A 30 m setback will be applied for this feature, and the site plans will be revised to identify this buffer and the mitigation measures to protect and enhance this feature.	Not addressed. CH undertook a preliminary review of the revised site plans received on January 19 and 20th, 2022, as it relates to this comment. Please accurately show the 30 m setback from the limit of all natural features, as it is unclear on the plans. Please note that this also does not constitute a comprehensive review of the site plans.	A 30 m setback has been applied to the staked dripline of the FOD7-4 communities in both the West and South Extensions. The dripline and the setback distances have been added to the updated site plans.	Please see Response to Comment # 38. Sarah Mainguy, NSE, has reviewed Nelson's response and provided the following JART response: This has been addressed.
78.	The Grindstone Creek Headwaters PSW Evaluation notes that a number of the wetlands adjacent to the proposed south extraction support amphibian breeding. Further discussion on the potential use of these wetlands by amphibians and potential SWH should be provided. Recommend referencing the evaluation and discussing in the report.	Page 57 Section 6.4.1. SWH Assessment Summary	Conservation Halton	The Grindstone Creek Headwaters Wetland Complex Wetland Evaluation Report (MNRF 2007) is dated 2007. The existing surface water and ground water reports state that there will be no impacts to the features, once mitigation measures have been applied. Further details are also provided in the attached Wetland Characterization Summaries.	Recommend to reference evaluation within report, as the information can be used to help identify cumulative impacts associated with existing (as per theTOR with proposed 25-year baseline), interim (for each identified extraction phase) and both post extraction scenarios (rehabilitation scenario 1 and rehabilitation scenario 2) to determine ecological impacts and provide appropriate mitigation measures to ensure no negative impacts.	The Grindstone Creek Headwaters Wetland Complex Wetland Evaluation Report was accessed and assessed in discussion and consideration with the NDMNRF.	Please see Response to Comment # 38. Sarah Mainguy, NSE, has reviewed Nelson's response and provided the following JART response: The 2007 surveys are relevant to these wetlands because amphibians rely on “good” years that maintain populations.
79.	This subsection starts with providing a definition of what is fish habitat. The paragraph goes on to state that “definition of fish habitat includes direct fish habitat (i.e., habitat that may be occupied by fish on a permanent or periodic basis) and indirect fish habitat (i.e., habitat that would not be used directly by fish, but that may be important for downstream direct fish habitat).” The rest of this section goes on to say that there is no fish habitat in the proposed limit of extraction. The reasons provided for not considering these areas as fish	Section 6.6. Fish Habitat	Matrix Solutions Inc.	DFO has confirmed in letter dated June 23, 2021, that the constructed golf course ponds and interconnecting channels are not considered to be fish habitat.	See previous comments	As previously noted in our original response, DFO has confirmed in their email of June 23, 2021, that they do not consider the drainage features on the golf course to be fish habitat. As the regulatory authority on what should be considered fish habitat, we are relying on DFO’s decision on this matter. Although we provided DFO with information regarding the golf course drainage features (in our letter dated August 14, 2020), we were not a part of their decision-making process and	The response to this item is the same as Response #14

	habitat should include justification to explain why these habitats do not fit the definition of fish habitat.					cannot speak for them in this regard.	
80.	The rest of this section goes on to assign fish habitat categories based on their support function to fisheries. As the basis for fish habitat designations appear to be related to hydrologic connections rather than the fish occupancy, as well as origin, and whether the fish population is considered "natural" to the area, this needs to be rationalized back to the *Fisheries Act* (i.e., the basis under the *Act* that these habitat classifications are warranted).	Section 6.6. Fish Habitat	Matrix Solutions Inc.	DFO has confirmed in letter dated June 23, 2021, that the constructed golf course ponds and interconnecting channels are not considered to be fish habitat.	See previous comments	As previously noted in our original response, DFO has confirmed in their email of June 23, 2021, that they do not consider the drainage features on the golf course to be fish habitat. As the regulatory authority on what should be considered fish habitat, we are relying on DFO's decision on this matter. Although we provided DFO with information regarding the golf course drainage features (in our letter dated August 14, 2020), we were not a part of their decision-making process and cannot speak for them in this regard.	The response to this item is the same as Response #14
81.	Confirmation from DFO is needed on the status of fish habitat on the site. Until this is confirmed, it is premature to state that no fish habitat is present.	Page 59 Section 6.6. Fish Habitat	Conservation Halton	DFO has confirmed in letter dated June 23, 2021, that the constructed golf course ponds and interconnecting channels are not considered to be fish habitat.	Not addressed. See Comment No. 38 above.	As previously noted in our original response, DFO has confirmed in their email of June 23, 2021, that they do not consider the drainage features on the golf course to be fish habitat. As the regulatory authority on what should be considered fish habitat, we are relying on DFO's decision on this matter. Although we provided DFO with information regarding the golf course drainage features (in our letter dated August 14, 2020), we were not a part of their decision-making process and cannot speak for them in this regard.	Please see Response to Comment # 38. Matrix Solutions Inc. has reviewed Nelson's response and provided the following JART response: Confirmation of fish habitat, supported by policy definition from DFO remains outstanding.

82.	Recommend additional impact assessment as it pertains to fish habitat outside of the project footprint, given the potential impact to the water inputs to the offsite watercourses. Until such time that this occurs or direction from DFO is received, a precautionary approach should be taken.	Page 59 Section 6.6. Fish Habitat	Conservation Halton	DFO has provided a Letter of Advice, dated June 23, 2021, indicating that in their opinion no harmful alteration, disruption or destruction (HADD) of fish habitat will occur provided the recommendations in the letter of advice are followed.	Partially addressed. The DFO Letter of Advice provides recommendations and mitigation measures, however predicted flow rates for groundwater discharge to the tributaries and the effects of groundwater and surface water changes on fish and fish habitat for existing (as per the TOR with proposed 25-year baseline), interim (for each identified extraction phase) and both post extraction scenarios (rehabilitation scenario 1 and rehabilitation scenario 2) to the offsite watercourses remains a concern. Specifically, as it pertains to the seasonal requirements to sustain the downstream coldwater fish community within the Unnamed Tributary of Willoughby Creek. Recommend including additional discussion within the watercourse characterization summaries in regards to seasonal requirements and include proposed mitigation measures to help sustain overall function within the AMP.	See response to comment # 17. The updated AMP outlines seasonal flow and water temperature thresholds, monitoring and adaptive management measures.	Please see Response to Comment # 38. Matrix Solutions Inc. has reviewed Nelson's response and provided the following JART response: The applicant's updated AMP includes discussion of groundwater and surface water impacts associated with the quarry expansion and proposes to maintain flow regimes associated with current quarrying activities. Furthermore, the updated AMP proposes the creation of an infiltration pond to mitigate the loss of groundwater contribution associated with the West Extension quarry. As these measures will be maintained moving forward, the updated AMP satisfies this comment, although the not much is known about the current impacts of the quarry discharge on the Willoughby Creek (due to lack of fish sampling information) and the effectiveness of the infiltration pond in maintaining groundwater flows upstream of the quarry discharge in Willoughby Creek.
83.	As noted in Section 7.2 above, there are additional species that are listed in the background review sources that should be discussed in this section. Of these, there is the potential for two of these species to occur in the study area: • Blanding's Turtle • Jefferson Salamander In addition, Snapping Turtle should be added to the discussion of SAR within the Limit of Extraction.	Section 6.7. Habitat of Endangered and Threatened Species	North-South Environmental Inc.	Jefferson Salamander is discussed in Sections 6.7 and 7.2.5. Blanding's Turtle survey effort was discussed with MECP and addressed in the MECP response letter after completing Blanding's Turtle surveys, as per MECP direction, in 2021. No Blanding's Turtle or its habitat were observed and are considered absent from the Study Area. Snapping Turtle is a species of special concern (SC) and therefore is not discussed within Habitat of Endangered or Threatened Species.	See comment 25 with regard to Jefferson's Salamander. As discussed above, we continue to feel that additional effort should have been expended in Blanding's Turtle surveys. We understand surveys were completed in 2021. It should be clarified whether surveys included wetland 13203, which was the only location noted for other turtle species. The Snapping Turtle is considered a Species at Risk (with a status of Special Concern). It should be discussed in its own section within the discussion of SAR within the Limit of Extraction.	Please see responses to comment #26 and #44.	This comment has been duplicated in Comment 28.

84.	Recommend consultation with MECP regarding Species at Risk for this project to determine if the surveys and associated survey efforts are acceptable and to determine the current regulation limits for those identified. Any feedback from MECP should be provided to JART.	Page 62 Section 6.7. Habitat of Endangered and Threatened Species	Conservation Halton	Species at risk discussions are on-going with MECP. Of note, MECP confirmed that the golf course irrigation ponds are not habitat for Jefferson Salamander and did not need to be surveyed. We are continuing to work with MECP for all SAR related matters and are adhering to their survey recommendations and protocols.	Addressed.	Resolved – thank you	Resolved.
85.	Recommend that the general mitigation measures discuss the potential impacts associated with blasting. Currently, blasting is discussed for wetlands, but as there are other natural heritage features present, this should be expanded to a general list.	Page 66 Section 7.1. General Mitigation Measures	Conservation Halton	As per the Memorandum titled *Blast Vibration and Water Overpressure at Adjacent Waterbodies* (Explotech 2021), mitigation has been recommended to prevent negative impacts on fish and fish habitat in adjacent waterbodies during blasting activities. Specifically, maximum recommended explosive loads per delay have been provided for varying separation distances from fish habitat. During the spawning season, maximum vibration limits of 13 mm/s at the closest spawning habitat have been recommendation. Vibration monitoring has also been recommended to confirm compliance with DFO limits for ground vibration.	Partially addressed. To ensure that the reports are comprehensive, we recommend including this information in the Natural Environment Technical Report.	Blasting recommendations to protect fish and fish habitat have been added to the Site Plans.	Please see Response to Comment # 38. Matrix Solutions Inc. has reviewed Nelson's response and provided the following JART response: The applicant's blasting consultant has indicated appropriate mitigation measures are in place to ensure that blasting impacts do not impact fish habitat. The location of fish habitat has been shown in the Site Plans. This comment has been addressed.
86.	Without having access to the approved Spills Action Centre report for the existing quarry, it is challenging to know if what is contained in it is appropriate for the proposed expansion. Recommend including this detail in the application.	Page 67 Section 7.1.2. Accidental Spills	Conservation Halton	The Spill Contingency and Pollution Prevention Plan is attached.	Partially addressed. The Spill Contingency and Pollution Plan does not include the proposed expansion areas. Please update accordingly.	As noted in the site plans (page 2 of 4; Note 8 Natural Environment b.), prior to site preparation, the Spill Contingency and Pollution Plan will be updated to include the proposed extension areas.	Addressed.
87.	This section discusses the Level 2 evaluation of the potential impacts due to the quarry development and operation. The Level 2 assessment also includes recommendations regarding any mitigation and/or enhancement measures, as well as rehabilitation plans. The discussion pertaining to fish habitat is in Subsection 7.2.4 where the discussion pertaining to fish habitat impacts are simplified.	Section 7. Level 2 Impact Assessment	Matrix Solutions Inc.	Comment noted – responses to other comments address this general statement.	See previous comments	The updated AMP includes flow and temperature mitigation and monitoring requirements within watercourses to ensure no harmful, alteration, disruption or destruction to fish habitat in accordance with DFO letter of advice.	These items are addressed in the updated AMP provided by the applicant.

88.	The location of the berm adjacent to the weir pond should be changed to 30.0 meters from the wetland, rather than 14.0 meters as currently proposed, to ensure the hydrologic and ecologic function of this pond is not impacted.	Page 68 Section 7.2.1. Wetlands	Conservation Halton	A 30 m setback will be applied to this feature, and the site plans will be revised to identify this buffer and the mitigation measures to protect and enhance this feature.	Partially addressed. CH undertook a preliminary review of the revised site plans received on January 19 and 20th, 2022, as it relates to this comment. While the proposed berm appears to be outside the 30 m setback of wetland 13202 and weir pond, it is still shown within the extraction area. Recommend to revise the extraction limit to exclude the proposed berm as well as the 30 m setback to the wetland. Please note that this does not constitute a comprehensive review of the site plans.	A 30 m setback has been applied to the staked wetland community (wetland 13202) in the West Extension. The berm is now situated outside of the 30 m setback. These changes have been added to the updated site plans.	Addressed.
89.	For indirect water quality impacts, recommend including turbidity in the assessment.	Page 68 Section 7.2.1. Wetlands	Conservation Halton	See water resources report. This report addresses the water quality of discharged water.	Partially addressed. To ensure that the reports are comprehensive, we recommend including this information in the Natural Environment Technical Report.	Turbidity monitoring will be completed as discussed in the updated AMP.	Addressed.
90.	More information has been requested with respect to the water balance assessment for the wetlands adjacent to the extraction areas. Please refer to comments on the Surface Water Assessment and the Level 1 and 2 Hydrogeologic and Hydrologic Impact Assessment. The Natural Environment Report should be revised to provide an ecological interpretation of those changes, as applicable.	Page 68 Section 7.2.1. Wetlands	Conservation Halton	More details are provided in the attached Wetland Characterization Summaries.	Not addressed. See response to Comment No. 37 above.	Please see response to comment #37.	Please see Response to Comment # 37. Sarah Mainguy, NSE has reviewed Nelson's response and provided the following JART response: Additional information is still required that provides the information on how seasonal inundation varies from year to year.
91.	All of the wetlands that have the potential to be impacted by the quarry application should be discussed in this report. The zone of influence of the quarry is identified as 800.0 meters away and there is potential impact in those PSWs between 120.0 meters to 800.0 meters from the quarry. The Natural Environment Report should be revised to discuss all of the potential features impacted and mitigation measures discussed to ensure they are not impacted. This will ensure that all of the connections and linkages between the NHF, surface water features and groundwater features are identified.	Page 68 Section 7.2.1. Wetlands	Conservation Halton	More details are provided in the attached Wetland Characterization Summaries.	Not addressed. See response to Comment No. 37 above.	Please see response to comment #37.	Please see Response to Comment # 38. Sarah Mainguy, NSE has reviewed Nelson's response and provided the following JART response: The issue of impacts on PSWs within the zone of influence of the quarry, but outside the 120 m boundary, has not been addressed. Monitoring should be conducted in PSW wetlands within and beyond the existing zone of influence, whatever that is identified to be. Wetlands beyond the existing area of quarry influence would be valuable as representing background conditions.
92.	Please provide the details of the monitoring collected in the spring 2020 wetlands 13200, 13201 and 13202.	Page 69 Section 7.2.1. Wetlands	Conservation Halton	More details are provided in the attached Wetland Characterization Summaries. Additional data that is being collected will assist in the development of the AMP in consultation with the agencies.	Not addressed. Understanding the monitoring data is an important component to the development of the impact assessment and mitigation measures, additional monitoring data should not be	Please see response to comment #37.	Please see Response to Comment # 37 Sarah Mainguy, NSE has reviewed Nelson's response and provided the following JART

					deferred to the AMP. Update characterization summary accordingly.		response: Location details have been provided on monitoring within these wetlands in the AMP. However, results of baseline monitoring have not been provided. This comment remains outstanding.
93.	Is it suggested that the catchment areas of the wetlands to the east of the extraction will be maintained, however as noted in the Surface Water Assessment drawings DP-1 and DP-2, it appears that there will be changes to the catchment areas of the wetlands. Please confirm and revise as necessary.	Page 70 Section 7.2.1. Wetlands	Conservation Halton	More details are provided in the attached Wetland Characterization Summaries.	Not addressed. It is understood that MNRF completed wetland boundary delineation in October, 2021. Based on this updated delineation, please confirm if there are any changes to catchment areas and provide updated information within the Wetland Characterization Summaries.	Please see response to comment #37.	Please see Response to Comment # 37. Sarah Mainguy, NSE has reviewed Nelson's response and provided the following JART response: Analysis of impacts to revised catchments has been provided in revised AMP (July 2022) – however, assessment of whether they are correct should be provided by surface water expert
94.	Please include a discussion on the potential impacts of reduced groundwater flows on the wetlands. For example, will less saturated soils lead to a great drawdown in water levels? Will there be impacts to the temperature of these wetlands from less groundwater and will this impact amphibian breeding?	Page 70 Section 7.2.1. Wetlands	Conservation Halton	More details are provided in the attached Wetland Characterization Summaries.	Not addressed. See response to Comment No. 37 above.	Please see response to comment #37.	Please see Response to Comment # 38. Sarah Mainguy, NSE has reviewed Nelson's response and provided the following JART response: Analysis of impacts to any groundwater inputs has been provided in revised AMP – however, assessment of whether they are correct should be provided by a groundwater expert
95.	In the Hydrogeological Report, Wetland 21 (13201) is considered to be compromised due to the road and culvert, and its water budget is not considered representative of future conditions. Please confirm how changes to this wetland will be assessed and mitigated, especially as this wetland is adjacent to a rare vegetation community.	Page 70 Section 7.2.1. Wetlands	Conservation Halton	More details are provided in the attached Wetland Characterization Summaries.	Not addressed. See response to Comment No. 37 above.	Please see response to comment #37.	On January 1, 2023, Ontario Regulation 596/22 came into effect. As a result, technical review services for planning and development applications previously provided by Conservation Halton (CH) under Memorandums of Understanding with municipalities (e.g., technical reviews related to natural heritage and select aspects of stormwater management) can no longer be provided. O. Reg. 596/22 does not affect CH's mandatory programs or services. CH has only reviewed this comment based on natural hazard, and wetland matters, per Ontario Regulation 686/21 and Ontario Regulation 162/06. The proposed discharge pipe for mitigation is within the CH Regulated area and is outside the

							proposed Licence boundary, therefore a CH Permit will be required. Given the above, CH has no further comment from a regulatory perspective. We defer any remaining natural heritage related comments to the other JART members to confirm whether it has been addressed. Sarah Mainguy, NSE has reviewed Nelson's response and provided the following JART response: Mitigation described for this wetland in the revised AMP (pumping in perpetuity), but rare vegetation community is not discussed; the pumping should not affect the forest community
96.	This section discusses indirect impacts to this wetland, but the discussion is restricted to the hydro period. This wetland (and the surrounding woodlands) will become isolated from the surrounding landscape; they will be surrounded by the existing quarry to the east, and the quarry extension to the north, west and south. The removal of stepping-stone connections provided by Woodlands E and F will exacerbate the isolation of Woodland D containing the wetlands. Connections to the west will be severed. The remaining patch of natural habitat will be perched above the quarry floor on all sides. The impacts of fragmentation on this wetland should be discussed. Impacts to wetland unit within this area would likely include a more rapid rate of drying in wetland and woodland soils, as well as increased temperature extremes because of increased winds, the increased heat island effect induced by the quarry's exposed rock, and increased ambient sunlight. This would likely affect Significant Woodlands and Significant Wildlife Habitat (Eastern Wood-pewee and Large Toothwort) as well as the wetland environment. A 15.0 meter buffer would likely not mitigate this impact, as physical edge effects can be seen at a distance of greater than 15.0 meters from the edge. Additional mitigation (in addition to the 15.0 meter	Section 7.2.1. Wetlands (Specifically Units SWD3-2a (Wetland 13200))	North-South Environmental Inc.	As summarized in section 6.2.1, woodland D is relatively isolated and located on the golf course, adjacent to the existing quarry. While a portion of this woodland is native, the cultural woodland area is non-native, with an abundance of Black Locust, an undesirable tree species, and the FOD5/DIST area contains only a canopy layer, along with turf grass and paved golf cart paths in the ground layer (sub- canopy and understory vegetation are absent). There is high potential to enhance this woodland both in species diversity and composition. The proposed rehabilitation plans will create a system that is better connected and functional that what currently exists in the golf course and adjacent quarry.	See response to comment 32. This question specifically addressed wetlands in this area as well as buffers to the wetlands. It was not asking about the woodlands, which have been addressed elsewhere, except in the context of the woodlands' contribution to wetland function. There will be a considerable time lag (potentially decades) between disruption of the connection of the woodlands/ wetlands in this area before rehabilitation of the connection is provided. Connection of the woodland and wetlands should be maintained during extraction, both to the north and to the south.	Please see responses to comments #2, #28 and #32. In addition to the additional information provided in the noted responses above, the AMP has been updated to include further monitoring and thresholds and/or triggers to ensure wetland 13200 is not negatively impacted by the quarry extension. See updated AMP.	We have commented on the ineffectiveness of the proposed switch from the southern linkage to a western linkage in Comment 28. This response is the first to address the potential for cumulative impacts on the features within the surroundings of Woodland D, such as the interspersed wetland (13200) and the population of the rare Toothwort. The proposed mitigation is intended "to provide monitoring and thresholds and/or triggers to ensure wetland 13200 is not negatively impacted by the quarry extension." The monitoring itself does not ensure impacts will be mitigated, it just ensures the impacts are understood. Without a clear statement as to what constitutes an impact, and clear actions to be implemented if monitoring shows an adverse impact, the monitoring will be ineffective.

	buffer) and monitoring for this impact should be discussed.						
97.	As discussed with wetlands, the woodlands within the West Extension will be physically isolated and fragmented by the cumulative effect of the surrounding quarries, especially since the woodlands will become perched above the quarry floors. Woodland D, in particular, will be subject to high levels of drying winds, increased albedo from the surrounding quarries, and their function will decline. In turn, these impacts will likely lead to declines in insect populations that are important as prey species. Connections to the Medad Valley (identified as a Regional linkage) to the west are severed, and this connection would be highly important to animal movement through the landscape and persistence of meta- populations within Woodland D.	Section 7.2.2. Woodlands	North-South Environmental Inc.	As summarized in section 6.2.1, woodland D is relatively isolated and located on the golf course, adjacent to the existing quarry. While a portion of this woodland is native, the cultural woodland area is non-native, with an abundance of Black Locust, an undesirable tree species, and the FOD5/DIST area contains only a canopy layer, along with turf grass and paved golf cart paths in the ground layer (sub- canopy and understory vegetation are absent). There is high potential to enhance this woodland both in species diversity and composition. The proposed rehabilitation plans will create a system that is better connected and functional that what currently exists in the golf course and adjacent quarry. The proposed Extension Areas are sited within an active golf course and agricultural area. There is a Regional and Provincial NHS that does run north- south; however, the area of the proposed expansion does not appear to negatively affect the redundancy of these smaller branches of the RNHS. The major areas of the NHS run along the Medad Valley, which is west of the proposed West Extension, as well as along the Mount Nemo Plateau and Grindstone Creek Complex, located east of the proposed South Extension. The proposed Extension areas are located between these two RNHS branches and are not impeding or removing any of the features that make up these two branches; the Extension areas are well outside of these two large systems. Based on the Region's NHS mapping, there are some smaller systems that lie parallel to, and between, these two major systems; however, these smaller systems do not connect to the larger NHS, north of the Study Area. These smaller	Please see response to comment 30. As has been noted above, the RNHS within the eastern part of the western extension is important in maintaining linkage of features both within and outside the golf course. The woodlands in this area are of high quality, and the NHS linking the woodlands to features within and outside the golf course is appropriate.	Please see response to comment #30.	The issue of the ineffectiveness of the proposed linkage is discussed in Comment 28.

				branches of the overall NHS do not provide connectivity to begin with, and therefore, the removal or disturbance of golf course features and their potential for enhancement and future connectivity opportunities can only add to the limited contribution being made to the smaller NHS.			
98.	The report indicates that bat maternity colonies in the study are not unique in the subject lands or even the landscape. The Significant Wildlife Habitat Mitigation Support Tool (2014), Index 12, states that Bat Maternity Colonies are critical to the survival of local bat populations and the loss of any site has significant impacts on bat populations. Recommend that this discussion be revised to reflect Provincial policy and direction as it pertains to this type of SWH.	Page 72 Section 7.2.3. Significant Wildlife Habitat	Conservation Halton	The Significant Wildlife Habitat Mitigation Support Tool (SWHMiST; OMNR 2014) was created as a guide for planners to better understand the functions of habitat, potential impacts and possible mitigation techniques. It is a tool that can be considered for mitigation purposes after significant wildlife habitat has been confirmed. It is not a tool that mitigates for candidate features. The management options listed within the SWHMiST are based on the best available information at the time of its publication (e.g., 2014) and are not meant to limit the use of other relevant mitigation information. Therefore, other resources can, and should, be consulted when assessing appropriate and feasible mitigation measures. This will help ensure that those measures provided are consistent with current practices and policies. The SWHMiST also states that suitable maternity sites are limited and that the loss of any site has significant impacts on bat populations. The behavioral activity of the bats when the recordings were collected indicated foraging behaviors. This polygon is surrounded by irrigation ponds on the golf course and open water in the existing quarry. Foraging opportunities are abundant in the area, and this polygon is likely situated in a flight path of foraging bats. There is a total of 0.48 ha of bat maternity colony habitat within polygon E. There is more than 6 ha of FOD and SWD within the 120 m Adjacent Lands northeast and southeast of the Limit of Extraction.	Discussion on this should be included in the report.	The response provide in the July 2021 response submission was pulled from the NETR (2020) and has also been discussed in detail with MECP. We realize that MECP does not oversee SWH bat species; however, SAR bat habitat impacts and species impacts were discussed and resolved through our impact assessment and mitigation approach. The site plans have been updated to expand the tree removal avoidance window (it is now March 15 through November 30), as recommended by MECP. In addition to this, wooded area polygon E, which has been identified as both SWH and SAR bat maternity colony habitat is now being retained and removed from the Limit of Extraction. The site plans have been updated to show these changes.	Please see Response to Comment # 38. Sarah Mainguy, NSE has reviewed Nelson's response and provided the following JART response: This comment is addressed.

				There is an even larger tract of NHS that is immediately adjacent to the 120 m Adjacent Lands that contains the Medad Lake Valley, a significant valley land and wetland complex. It is not anticipated that the removal of 0.48 ha of highly disturbed habitat will have a negative impact on maternity colonies due to the large contiguous tracts of candidate habitat surrounding the Study Area. Recommended mitigation measures include site selection, minimization of affected habitat (states this is a satisfactory mitigation option), timing, habitat restoration and preservation of bat foraging habitat are all included in the SWHMiST. Each of these measures is addressed and will be achieved.			
99.	The Rare Vegetation Community FOD7-4 is not discussed in this section. As this is a confirmed SWH in the study area (confirmed in Table 19 as well) and as it may be impacted by the proposed quarry, this SWH should be discussed.	Page 72 Section 7.2.3. Significant Wildlife Habitat, Table 19	Conservation Halton	As noted in previous responses, the site plans will be revised to include a 30 m setback to this feature and include mitigation measures to protect and enhance this feature.	Partially addressed. CH undertook a preliminary review of the revised site plans received on January 19 and 20th, 2022, as it relates to this comment. Please accurately show the 30 m setback from the limit of all natural features, as it is unclear on the plans. Please note that this does not constitute a comprehensive review of the site plans.	A 30 m setback has been applied to the staked dripline of the FOD7-4 communities in both the West and South Extensions. The dripline and the setback distances have been added to the updated site plans.	Please see Response to Comment # 38. Sarah Mainguy, NSE has reviewed Nelson's response and provided the following JART response: This comment is addressed.
100.	FOD7-4 is not fully protected as it extends out past where the buffer is located. This SWH should be protected with a 30.0 meters just as the rest of the natural features are. Please revise.	Page 72 Section 7.2.3. Significant Wildlife Habitat. Figure 8a	Conservation Halton	In the West Extension, there will be a 30 m setback from the edge of the FOD7-4 to the proposed limit of extraction, as well as to the edge of the berm. In the South Extension, there will be a 30 m setback from the FOD7-4 to the edge of the berm.	Not addressed. See response to Comment No. 99 above.	Please see response to comment #99.	Please see Response to Comment # 38. Sarah Mainguy, NSE has reviewed Nelson's response and provided the following JART response: This comment is addressed.
101.	In addition to the SWH discussed, Amphibian Movement Corridors should 9 be discussed as this is identified in Table 19 as present.	Page 74 Section 7.2.3. Significant Wildlife Habitat	Conservation Halton	The amphibian movement corridor will remain untouched. No direct impacts are anticipated due to its location outside of the Study Area at the far edge of the 120 m adjacent lands. Potential hydrological impacts and associated mitigation measures are provided in detail in the Wetland Characterization Summaries – wetland 13203 – appended to this response submission.	Not Addressed. Update characterization report to include discussion regarding all associated SWH present and include within impact assessment.	The site plans have been revised to include the woodland area within 230 m of the wetland (see Page 1 of 4 – Added additional Amphibian Breeding (woodland) area). The impact assessment and mitigation measures that have been applied to the SWH type also apply to the movement corridor. Therefore, the breeding pond, the surrounding woodland habitat, including the movement corridors are all addressed in the NETR (2020), as well as in the updated site plans.	Please see Response to Comment # 38. Sarah Mainguy, NSE has reviewed Nelson's response and provided the following JART response: This comment is addressed.

102.	Fish Habitat, the potential direct and indirect impacts of the proposed development, including during the temporary construction phase, the long-term operations phase and the post-operations rehabilitation phase, are assessed based on direct impacts and indirect impacts. Direct are deemed non-existent in the proposed Limit of Extraction within either the South or West Extension areas as there is no fish habitat present there. Indirect impacts are dealt with as being minimal due to minimal construction work and lack of intrusion outside of the extraction area and continuing to pump quarry water to supplement flow as recommended by the Surface Water Assessment Report (Tatham 2020). The basis for flow supplementation in terms of volume, water quality and quantity should be explained in terms of its effects on fish habitat downstream of the quarry extension areas. In 2006 Level 2 NETR Report (Stantec 2006) Willoughby Creek has been described in previous reports as “the watercourse of greatest ecological sensitivity” as this Bronte Creek tributary was noted to support critical brook trout spawning and rearing habitat, as noted with the presence of juvenile brook trout captured during 2003 surveys. The Level 2 Natural Environment Technical Report notes that Brook Trout are reliant on groundwater for virtually all portions of their life cycle: spawning, incubation, nursery refugia, and thermal refugia during summer. The loss of groundwater discharge to this system would represent a negative effect. The basis for the maintenance of the quarry water in terms of how flow regime quantity and water quality will be maintained is lacking in this section. In the 2004 Level 2 NETR (Stantec 2004), fisheries inventory of the station (Station 1) reports a healthy population of juvenile Brook Trout in the reaches of Britannia Road and Cedar Springs Road Intersection and 80.0 meters downstream, which is located approximately 1.2 kilometres from the confluence of the Willoughby unnamed tributary to the mainstem of Willoughby Creek. This is consistent with the Bronte	Section 7.2.4 Fish Habitat	Matrix Solutions Inc.	DFO has provided a Letter of Advice, dated June 23, 2021, indicating that in their opinion no HADD of fish habitat will occur provided the recommendations in the letter of advice are followed. See additional details in the Watercourse Characterization summary. DFO’s guidance and conditions were provided after the Summary tables were prepared and circulated. Nelson is happy to work through the tables with JART to ensure that all DFO conditions and mitigation measures are included in the AMP and that all threshold and trigger values are updated, if needed, based on DFO recommendations.	Where is the AMP which reflects the DFO recommendations- how is this mechanism controlled- flow regime?	The updated AMP includes flow and temperature mitigation and monitoring requirements within watercourses to ensure no harmful, alteration, disruption or destruction to fish habitat in accordance with DFO letter of advice.	These items are addressed in the updated AMP provided by the applicant. Surface and groundwater monitoring is being proposed in the updated AMP, but biological monitoring for fish is not part of the AMP. The applicant’s position is that maintaining flow conditions similar to existing conditions moving forward should result in minimal impacts to the fish community. The AMP proposes how flow and temperatures are maintained to achieve what is currently present, but we do not know what ecological impacts this has at present and for the future.

	Creek Watershed Study, which noted extensive spawning activity in the area of the Cedar Springs community and Cedar Springs Road. The details for maintaining flow should be discussed in this section extending beyond 120.0 meters as the reports of the water levels in the Willoughby creek running dry were reported by conservation authority staff and maintaining flow during periods of drought is a concern (Bronte Creek, Urban Creeks and Supplemental Monitoring conducted by Conservation Halton 2012).						
103.	The proposed settling pond outlet at the bank of the West Arm watercourse and associated longer term sump should be assessed in further detail so that the outlet does not impact the natural features present. Mitigation measures should be developed to limit impact, such as the use of a flow spreader to reduce bank erosion.	Page 76 Section 7.2.4. Fish Habitat	Conservation Halton	Tatham has completed a preliminary design for the outlet of the temporary settling pond/longer term sump in the south extension. As suggested by Conservation Halton, the proposed outlet consists of a stone core wetland pocket set back approximately 5 m from the average annual high-water mark of the West Arm of the West Branch. The wetland pocket will have a level spreader around the perimeter to promote dispersed discharge when flows exceed the storage/infiltration capacity of the structure. This will negate the need for any direct conveyance structure or channel that would directly impact the watercourse and riparian vegetation. The wetland pocket will consist of a 450-mm thick base layer of 100 to 300 mm riverstone. The voids in the riverstone will be filled with topsoil and planted with suitable native wetland vegetation species. The proposed design of the outfall prevents direct impacts on fish habitat in the watercourse as there is no requirement for any in-water work. Alterations to riparian vegetation between the wetland pocket and the watercourse will be minimized to the extent possible with activities of the contractor generally restricted to the landward side of the outfall. An erosion and sedimentation control plan shall be prepared and implemented throughout construction. All areas temporarily	Addressed subject to the site plans being updated to include cross-sections of the design and details within the revised NETR.	The cross section and details will be added to the proposed Burlington Quarry Extension Site Plans.	On January 1, 2023, Ontario Regulation 596/22 came into effect. As a result, technical review services for planning and development applications previously provided by Conservation Halton (CH) under Memorandums of Understanding with municipalities (e.g., technical reviews related to natural heritage and select aspects of stormwater management) can no longer be provided. O. Reg. 596/22 does not affect CH's mandatory programs or services. CH has only reviewed this comment based on natural hazard, and wetland matters, per Ontario Regulation 686/21 and Ontario Regulation 162/06. Through the review of the revised site plan dated September 2022, a proposed discharge pipe has been shown to outlet into the watercourse and associated wetland. The proposed stone core wetland associated with this outlet will need to be pulled back (as much as possible) to be outside of the wetland limit. As the proposed outlet is within the CH Regulated area and is outside the proposed Licence boundary, a CH Permit will be required. The above referenced comment can be addressed as

				disturbed during installation of the outfall will be restored with suitable native vegetation species following construction. ESC measures will remain in place until the disturbed area around the outfall is sufficiently revegetated. Post- construction monitoring will be completed to verify that the outfall is performing as intended and that no unanticipated impacts are occurring as a result of operation. If impacts are observed during monitoring (e.g., unexpected erosion downstream from the outfall) remedial measures will be implemented.			part of the CH permit application. Given the above, CH has no further comment from a regulatory perspective. We defer any remaining natural heritage related comments to the other JART members to confirm whether it has been addressed. Halton Region will review the updated site plan to ensure the inclusion of a cross-section that demonstrates mitigation measures that limit impact to the natural features.
104.	Please confirm winter target numbers for baseflow upstream of Colling Road, as only spring, summer and fall are provided.	Page 77 Section 7.2.4. Fish Habitat	Conservation Halton	This will be addressed though the provisions of the AMP to ensure the pumping regime maintains base flow and seasonal flow of water.	Not Addressed. The proposed mitigation measures should be included within the watercourse characterization summaries to demonstrate that the proposed seasonal flows are appropriate to ensure no negative impacts in the existing, interim and post extraction scenarios (as outlined in the response to Comment No. 37 above).	Monthly flow targets are identified in the AMP. See updated AMP.	Please see Response to Comment #38. Matrix Solutions Inc. has reviewed Nelson's response and provided the following JART response: The flow targets for the AMP for the winter are still unresolved as these targets are still being determined. The concern is how baseflow levels will be maintained upstream of Colling Road with the Infiltration Pond. If flow reductions were to occur within these reaches, can the Infiltration Pond provide the necessary water level mitigation to maintain this flow? The comment still stands.
105.	The potential impact of a 3.0% reduction in groundwater in the creeks and wetlands as it relates to temperature changes has not been provided. Even a small reduction can alter the ecological function of these features and this should be assessed in the report. In addition, consider temperature changes from the proposed mitigation pond.	Page 80 Section 7.2.4. Fish Habitat	Conservation Halton	Given that groundwater discharge only occurs on a seasonal basis and that these wetlands and downstream creeks that are being referenced in this comment (East Arm of the West Branch of the Mount Nemo Tributary and the Unnamed Tributary of Lake Medad) are typically dry from late spring through summer, which corresponds to the time period when resident fish communities are typically most sensitive to water temperature increases. Therefore, the potential effect of water temperature changes on fish is expected to be mitigated by the intermittent nature of the wetlands and watercourses.	Not addressed. The watercourse and wetland characterization summaries (including for the East Arm of the West Branch of the Mount Nemo Tributary) speak to a proposed 1% groundwater reduction and not 3% as stated within the Natural Environment Technical Report. Please update the characterization summaries accordingly to include an impact assessment and potential negative impacts and alteration on ecological function of watercourses and wetlands. The 3% reduction as provided in the NETR is based on an impacted scenario. As such, the impacts may be greater once more information has been obtained.	The updated AMP includes flow and temperature mitigation and monitoring requirements within watercourses to ensure no harmful, alteration, disruption or destruction to fish habitat in accordance with DFO letter of advice.	Please see Response to Comment #38. Matrix Solutions Inc. has reviewed Nelson's response and provided the following JART response: The updated AMP indicates that flow and temperature mitigation requirements will be determined by target thresholds yet to be determined. No further resolution of impacts can be determined from Updated AMP from a proposed 3% groundwater reduction. Comment still stands.

106.	Please discuss and quantify how the 4.0-6.0% reduction in runoff volume compares to a dry year and the potential impacts of this on the creeks and wetlands.	Page 80 Section 7.2.4. Fish Habitat	Conservation Halton	More details are provided in the attached Watercourse Characterization Summaries and will also be provided and discussed in the AMP.	Not addressed. Details regarding 4-6% reduction in run off volumes are not well discussed in the summaries. Include additional information regarding the potential impacts (as it relates to an already impacted scenario) on the watercourses and wetlands between a dry year and wet year to help quantify changes proposed for existing, interim (for each identified extraction phase) and both post extraction scenarios (rehabilitation scenario 1 and rehabilitation scenario 2) to provide the appropriate mitigation measures.	The updated AMP includes flow and temperature mitigation and monitoring requirements within watercourses to ensure no harmful, alteration, disruption or destruction to fish habitat in accordance with DFO letter of advice.	Please see Response to Comment #38. Matrix Solutions Inc. has reviewed Nelson's response and provided the following JART response: he updated AMP indicates that flow and temperature mitigation requirements will be determined by target thresholds yet to be determined. No further resolution of impacts can be determined from Updated AMP from a proposed 4% to 6% reduction in runoff volumes except to implement mitigation measures once threshold values are triggered. Comment still stands.
107.	There is a disagreement about the justification provided with respect to the connectivity of the area. While the proposed expansion lands are currently in a non-natural state, there are limited barriers to obstruct the movement of species across the landscape. The connectivity that these lands currently provide would be lost based on the proposal. The diversity and connectivity of the overall Mount Nemo Plateau should be considered to ensure that the proposal does not restrict wildlife movement.	Page 80 Section 7.2.4. Fish Habitat	Conservation Halton	As summarized in section 6.2.1, woodland D is relatively isolated and located on the golf course, adjacent to the existing quarry. While a portion of this woodland is native, the cultural woodland area is non-native, with an abundance of Black Locust, an undesirable tree species, and the FOD5/DIST area contains only a canopy layer, along with turf grass and paved golf cart paths in the ground layer (sub- canopy and understory vegetation are absent). There is high potential to enhance this woodland both in species diversity and composition. The proposed rehabilitation plans will create a system that is better connected and functional that what currently exists in the golf course and adjacent quarry. The proposed Extension Areas are sited within an active golf course and agricultural area. There is a Regional and Provincial NHS that does run north- south; however, the area of the proposed expansion does not appear to negatively affect the redundancy of these smaller branches of the RNHS. The major areas of the NHS run along the	Not Addressed. Once the golf course related activities and maintenance of the lands cease, the understory would begin to re-establish. The woodland D provides multiple functions including SWH that is important to consider regarding continued connectivity. Currently the proposed expansion lands are connected and would be lost in the interim and post extraction scenarios. It is this connectivity between the larger RNHS branches that should be considered in regard to wildlife movement. CH concurs with response to Comment Nos. 28, 29 and 30 above.	Please see response to comment #2.	Please see Response to Comment #38. Sarah Mainguy, NSE has reviewed Nelson's response and provided the following JART response: Comment in #42 provides concerns regarding maintenance of linkage.

				Medad Valley, which is west of the proposed West Extension, as well as along the Mount Nemo Plateau and Grindstone Creek Complex, located east of the proposed South Extension. The proposed Extension areas are located between these two RNHS branches and are not impeding or removing any of the features that make up these two branches; the Extension areas are well outside of these two large systems. Based on the Region's NHS mapping, there are some smaller systems that lie parallel to, and between, these two major systems; however, these smaller systems do not connect to the larger NHS, north of the Study Area. These smaller branches of the overall NHS do not provide connectivity to begin with, and therefore, the removal or disturbance of golf course features and their potential for enhancement and future connectivity opportunities can only add to the limited contribution being made to the smaller NHS.			
108.	A reduced buffer to some Significant Woodlands is proposed, however justification for this reduction is not included. As these woodlands are also supporting other natural features and functions, and as the site can accommodate full 30.0 meter buffers, this reduction is not supported.	Page 82 Section 8. Niagara Escarpment Plan	Conservation Halton	In the West Extension, there will be a 30 m setback from the edge of the FOD7-4 to the proposed limit of extraction, as well as to the edge of the berm. In the South Extension, there will be a 30 m setback from the FOD7-4 to the edge of the berm.	Not addressed. See response to Comment No. 99.	Please see response to comment #99.	Please see Response to Comment #38. Sarah Mainguy, NSE has reviewed Nelson's response and provided the following JART response: This comment is addressed.
109.	As SWH is a Key Natural Heritage Feature, the vegetation protection zone should be 30.0 meters from these features. Please revise.	Page 82 Section 8. Niagara Escarpment Plan	Conservation Halton	In the West Extension, there will be a 30 m setback from the edge of the FOD7-4 to the proposed limit of extraction, as well as to the edge of the berm. In the South Extension, there will be a 30 m setback from the FOD7-4 to the edge of the berm.	Not addressed. See response to Comment No. 99.	Please see response to comment #99.	Please see Response to Comment #38. Sarah Mainguy, NSE has reviewed Nelson's response and provided the following JART response: This comment is addressed.
110.	The only mitigation proposed for the loss of a unit of Significant Wildlife Habitat (Woodland E) is compensation through the rehabilitation plan. As noted in Halton's EIS guidelines, section 3.7.2., "It is important to note that compensation for	Section 9. Regional Official Plan	North-South Environmental Inc.	Wooded feature E is described in detail in Table 2 of the report. It is an area that is <0.5 ha made up of mid-age to mature canopy trees mostly of Sugar Maple. There is no subcanopy or understorey. The	See response to comment 28. Woodland E was assessed in the NETR as habitat for bat maternity roosts (Section 5.2.9). The re-assessment of the same woodland in these responses as a flight path	Please see responses to comment #28 and #98.	We suggest that this comment is moot since Woodland E is being retained.

	feature removal or anticipated negative impacts is not acceptable under the ROP." Thus, removal of this woodland would result in negative impacts to the Natural Heritage System. Avoidance is preferred over compensation. As noted previously, the function of Woodland E to provide linkage and other benefits to the Natural Heritage System should be further examined, particularly as this woodland is considered part of the Regional NHS and is in very close proximity to Woodland D. In Google imagery, the closest distance between Woodland D and Woodland E appears to be approximately 10.0-15.0 meters (i.e. it is not greater than the 20.0 meters considered to be the threshold for considering Woodland E separately), and so the function of Woodland E as a potential part of Woodland D should also be examined. The role of Woodland E in contributing to Eastern Wood-pewee and bat maternity roost habitat (for example in terms of numbers of nest sites, habitat area, foraging habitat, etc., as well as the potential importance of this area in the future when the connections to the north and south are removed) should also be considered in more detail. The rationale for avoidance of, rather than compensation for, impacts should be considered.			ground cover consists of maintained turf grass, Garlic Mustard and some Herb- Robert, all of which is mowed regularly. Paved golf cart paths also make up part of the ground cover in this small stand of trees, serving as an aesthetic feature for the golf course. It is small and isolated (<20 m from other treed areas). High bat activity may serve more of an indicator that this polygon is situated in the flight path of bats moving between the Medad Valley and the open water areas of the active quarry for foraging purposes.	(presumably to explain the high number of calls recorded) is not backed by further evidence. Evidence that has led to the re-assessment of this woodland as a flight path rather than a maternity roost should be provided.		
111.	Please expand the SWH section to include the rare vegetation community FOD7-4 identified in the Level 1 Report. Discussion on how will be protected and any additional mitigation measures should be provided in addition to the SWH included in this section.	Page 84 Section 9. Regional Official Plan	Conservation Halton	As noted in previous responses, the site plans will be revised to include a 30 m setback to this feature and include mitigation measures to protect and enhance this feature.	Not addressed. See response to Comment No. 99.	Please see response to comment #99.	Please see Response to Comment #38. Sarah Mainguy, NSE has reviewed Nelson's response and provided the following JART response: This comment is addressed.
112.	Cumulative impacts discussed in the report are limited. Recommend that this section be expanded upon to provide more detail and discussion on what the cumulative impacts of the proposed quarry might be. For example, the existing quarry began in the 1950s and has impacted the natural environment since then. If the existing quarry is continued to be used, rather than rehabilitated as originally planned, then this would result in longer, cumulative impacts on the area.	Page 86 Section 10. Regional Official Plan Guidelines – Aggregate Resources Reference Manual	Conservation Halton	See response to Comment 13.	Not addressed. The Natural Environment Technical Report should discuss impacts as it relates to the existing conditions (as per the TOR with proposed 25-year baseline) to identify cumulative impacts and help develop the AMP and rehabilitation plan.	Please see response to comment #34.	Please see Response to Comment #38. Sarah Mainguy, NSE has reviewed Nelson's response and provided the following JART response: Cumulative impacts have been addressed only with regard to surface water and ground water – other cumulative impacts have not been analyzed as described for example in comment 24 and 31

113.	This section notes (Paragraph 1) that: "despite that no direct or indirect impacts will occur to Jefferson Salamanders or their habitat, habitat creation and enhancement opportunities have been identified for this species." It is proposed to restore 4.0 hectares of agricultural land between the eastern woodland south of the quarry, where Jefferson Salamander has been noted breeding, to an adjacent woodland to the west, where Jefferson Salamander has not been observed despite repeated surveys in several years, and despite apparently suitable habitat. The objective of the habitat creation is stated in paragraph 3 of this section: "This would enhance JESA habitat by providing increased coverage of summer refuge and overwintering habitat and improve connectivity between the two existing woodlands… The design of this restoration could also increase opportunity for JESA breeding by incorporating pit and mound construction techniques." Though it is not stated in the NETR, it is clearer in the Progressive and Final Rehabilitation and Monitoring Study that the proposed restoration is to address Section 110 of the Regional Official Plan, especially C:) Priorities for restorations or enhancements to the Greenbelt and/or Regional Natural Heritage Systems through post-extraction rehabilitation shall be based on the following in descending order of priority: [i] restoration to the original features and functions on the areas directly affected by the extractive operations, [ii] enhancements to the Greenbelt and/or Regional Natural Heritage Systems by adding features and functions on the balance of the site, [iii] enhancements to the Greenbelt and/or Regional Natural Heritage Systems by adding features and functions in areas immediately	Section 11.2. Jefferson Salamander Habitat Creation and Enhancement Opportunities	North-South Environmental Inc.	Restoration details and implementation will be determined with MECP and the Registration process.	Since the restoration was provided to satisfy Regional policies, the Region should be circulated in reviewing these details. The registration process is a process that will not provide the opportunity for comment by the Region and the opportunity of response to the proposed restoration.	The Jefferson Salamander habitat creation and enhancement opportunity is not to satisfy Regional policies or a requirement of the ESA. No Jefferson Salamander habitat is proposed for removal and the application already includes significant ecological enhancements within the proposed license area for the proposed Burlington Quarry Extension which exceeds the Regional policy requirements. As per our recent meeting with JART's Natural Environment team, we understand that JART is going to further discuss if they would like Nelson to actively plant this area to create a woodland or prefer that this portion of the regulated habitat remain as agricultural area that will ultimately naturally regenerate if the Extension is approved. Nelson remains committed to enhance this area but will wait for further direction from JART. If this area is actively planted, it will be planted in accordance with the species and densities noted on the proposed Burlington Quarry Extension for other areas that will be planted to create woodland conditions.	This comment still stands. Nelson's response states that the enhancement of this area is up to JART's preference, as follows: "we understand that JART is going to further discuss if they would like Nelson to actively plant this area to create a woodland or prefer that this portion of the regulated habitat remain as agricultural area that will ultimately naturally regenerate if the Extension is approved." We reiterate that we would like to understand whether this area would in fact be enhanced for salamander movement through studies of salamander movement. We would like to understand how policy 110 (C) will be addressed.

	surrounding the site, [iv] enhancements to that part of the Greenbelt and/or Regional Natural Heritage Systems in the general vicinity of the site, and [v]Enhancements to other parts of the Greenbelt and/or Regional Natural Heritage Systems in Halton.) Restorations or enhancements shall proceed immediately after extraction in a timely fashion.						
114.	Comments on the proposed restoration and enhancement are as follows: • This proposal is speculative, without even rudimentary detail to support feasibility. There is no certainty that created ponds would provide a sufficient hydro period and water quality for Jefferson Salamander to breed. There are no goals or objectives that drive the restoration, so no assurance that the restoration would create persistently suitable habitat for the long term.	Section 11.2	North-South Environmental Inc.	Restoration details and implementation will be determined with MECP and the Registration process.	See response to #113.	Please see response to comment #113.	Please see response to comment #113.
115.	Comments on the proposed restoration and enhancement are as follows: • Jefferson Salamander has a high fidelity to its habitat, and is a notable habitat specialist. If Jefferson Salamanders are not present in the western woodland, there is no basis to speculate that they would use the restored habitat. The western woodland may not be suitable for Jefferson Salamander. There are many habitat needs that must be met for this species that have not been explored, such as the presence of breeding ponds with suitable hydro period and water quality, small mammal burrows to provide overwintering habitat, invertebrate prey populations, and downed woody debris to provide refuge for post-breeding adults and transforming juveniles.	Section 11.2	North-South Environmental Inc.	Restoration details and implementation will be determined with MECP and the Registration process.	See response to #113.	Please see response to comment #113.	Please see response to comment #113.

116.	Comments on the proposed restoration and enhancement are as follows: • Salamander breeding and overwintering habitat is associated with mature woodlands, with their associated attributes of deep shade, leaf litter, high soil humidity, small mammal populations to provide burrows and abundant ground dwelling invertebrates to provide prey. It would take decades for the restored area to provide sufficient shade, humidity and hibernation sites to become suitable for Jefferson Salamander. If the quarry extensions had impacts on groundwater, the restoration site (even if it were feasible) would likely be too late to restore sufficient habitat to ensure JeffersonSalamander survival in this area.	Section 11.2	North-South Environmental Inc.	Restoration details and implementation will be determined with MECP and the Registration process.	See response to #113.	Please see response to comment #113.	Please see response to comment #113.
117.	Comments on the proposed restoration and enhancement are as follows: • Jefferson Salamander movements are difficult to predict without movement studies. There is no evidence to show that salamanders would move in this western direction so that it could function as a linkage. More detailed studies of salamander movements and habitat needs should be conducted.	Section 11.2	North-South Environmental Inc.	Restoration details and implementation will be determined with MECP and the Registration process.	See response to #113.	Please see response to comment #113.	Please see response to comment #113.
118.	Comments on the proposed restoration and enhancement are as follows: • The potential for creating an ecological sink should be considered. The western woodland and restoration site would be within 120.0 meters of the southern extension boundary, with the potential that these could be affected by the quarry.	Section 11.2	North-South Environmental Inc.	It is unclear what features are noted and what is being asked.	This comment referred to the potential for a creation of habitat for Jefferson Salamander in an ecological sink in the 120 m zone of influence of the quarry.	Please see response to comment #113.	Please see response to comment #113.
119.	Comments on the proposed restoration and enhancement are as follows: • This proposal does not address the primary recommendation in the Jefferson Salamander Recovery Strategy (2018): The short- term recovery approaches should focus on the protection of existing populations of the Jefferson Salamander and Unisexual Ambystoma (Jefferson Salamander dependent population) by minimizing further loss or degradation of known	Section 11.2	North-South Environmental Inc.	Restoration details and implementation will be determined with MECP and the Registration process.	See response to #113.	Please see response to comment #113.	Please see response to comment #113.

	habitat or potential recovery habitat. Recovery approaches should also focus on verifying, documenting, and monitoring the distribution and habitats used by extant, historic, and potential subpopulations. Developing and evaluating mitigation and restoration techniques, actively conducting research, and developing long-term management activities should also be prioritized to ensure the recommended recovery goal will be achieved.						
120.	There is no evidence that this proposed restoration would enhance habitat for Jefferson Salamander. The restored area would likely function as a small patch of disturbed forest habitat. Sufficient baseline detail should be supplied to show that it is at least potentially feasible. Goals and objectives should be provided to guide the restoration. Even as a preliminary suggestion, the restoration should be proposed according to "SMART" principles: the restoration goals should be "specific, measurable, agreed-upon, realistic and time bound".	Section 11.2	North-South Environmental Inc.	Restoration details and implementation will be determined with MECP and the Registration process.	See response to #113.	Please see response to comment #113.	Please see response to comment #113.
121.	Recommend including the smaller portion of wetland 13037 on the ELC map. It is currently not identified.	Figure 3b	Conservation Halton	This is included in the Wetland Characterization Summary Tables.	Addressed.	Resolved – thank you	
122.	Please discuss why amphibian monitoring was not conducted in the SWS3-2a/b communities in the western expansion area and the SWS/MAM2-2 associated with the West Arm. Table 2 notes that surface water in SWS3-3b was usually present in the spring as well as July and September. Should suitable habitat be present, then recommend that amphibian monitoring occur.	Figure 4a and Table 2	Conservation Halton	There is no SWS3-2a/b; however, it is assumed that this comment is intended for SWD3-2a/b. Therefore, wetland 13200 (SWD3-2a) did not contain water, and therefore was not considered a suitable feature to survey for amphibian breeding. Wetland 13201 (SWD3-2b) did contain water and therefore amphibian call count stations ACC8 and ACC9 (Figure 4a) were surveyed in 2019.	Addressed.	Resolved – thank you	
123.	Recommend that all of the hedgerows in the proposed extraction areas be assessed for potential bat habitat.	Figure 5a and Figure 5b	Conservation Halton	Section 5.2.9 notes that the 7E Criteria Schedule (MNR 2015) indicates that candidate bat maternity colony habitat is limited to FOD, FOM and SWD and SWM communities that contain a minimum density of >10 habitat trees with a dbh > 25 cm per hectare. Recent and on-going correspondence with MECP indicates that only FO and SW communities (no minimum density requirements) are potential roosting habitat. Therefore, hedgerows were not surveyed based	Addressed.	Resolved – thank you	

				on current provincial guidance at the time of study.			
124.	Please clarify why the FOD5-6 south of the proposed south extraction area was not assessed for bats. If suitable habitat is present, recommend that this assessment occur.	Figure 5b	Conservation Halton	This area is assumed candidate habitat for bat roosting habitat, and FOD5-6 is already protected based on the setback and mitigation measures shown on the site plans.	Partially addressed. CH undertook a preliminary review of the revised site plans received on January 19 and 20th, 2022, as it relates to this comment. Please accurately show the 30 m setback from FOD5-6, and highlight as candidate SWH habitat for bat roosting habitat, as it is unclear on the plans. Please note that this does not constitute a comprehensive review of the site plans.	The FOD5-6 is greater than 30 m from the Limit of Extraction. The Limit of Extraction has been placed 30 m from the staked dripline of the cultural plantation. The FOD5-6 is south of the plantation, situated even further from the Limit of Extraction. We realize that MECP does not oversee SWH bat species; however, SAR bat habitat impacts and species impacts were discussed and resolved through our impact assessment and mitigation approach. The site plans have been updated to expand the tree removal avoidance window (it is now March 15 through November 30), as recommended by MECP. Therefore, due to the >30 m setback of the Limit of Extraction to the assumed SWH maternity colony bat habitat and the precautionary mitigation measures provided in the NETR (2020) and updated site plans, it is anticipated that there will be no negative impacts to the assumed bat maternity colony SWH in the FOD5-6 located south of the South Extension. The assumed bat maternity colony SWH in FOD5-6 will be added to page 1 of the proposed Site Plans for the Burlington Quarry Extension.	Please see Response to Comment #38. Sarah Mainguy, NSE has reviewed Nelson's response and provided the following JART response: This comment is addressed.
125.	Seeps were identified by the MNRF PSW evaluation in wetland 13037. This SWH should be considered as candidate and additional surveys done to determine the presence of these seeps.	Table 19	Conservation Halton	See additional details in the Wetland Characterization Summaries. There will be no negative impacts to the ecological features and functions of this wetland.	Response does not address the comment. Provide additional details regarding seeps and candidate SWH as per MNRF PSW evaluation report to ensure there are no negative impacts and appropriate mitigation measures are provided. Provide details regarding additional surveys to be completed to confirm SWH.	No seeps or springs have been identified within wetland 13037 (Savanta 2020, Tatham 2020). The Karst Report (Worthington 2020) also does not identify such features within wetland 13037. Worthington (2020) identified sinks and springs approximately 700+ m from wetland 13037, which the report states feed into the West Arm of the West Branch of the Mount	Please see Response to Comment #38. Sarah Mainguy, NSE has reviewed Nelson's response and provided the following JART response: This comment is addressed.

						Nemo Tributary. Based on extensive field investigations by multiple disciplines, our conclusion stands that there are no seeps within wetland 13037. This item is considered addressed to the satisfaction of the NDMNRF.	
126.	Recommend that additional targeted surveys be undertaken to assess the potential for turtle habitat. It is noted that turtles have been known to use irrigation ponds and as there were limitations to being able to sample some of the deeper irrigation ponds, habitat may be present.	Table 19	Conservation Halton	A total of six turtle basking stations were established to survey five features within the Study Area, including the irrigation ponds (see Figure 4a from report). In addition, Blanding's Turtle survey effort was discussed with MECP and addressed in the MECP response letter after completing Blanding's Turtle surveys, as per MECP direction, in 2021. No Blanding's Turtle or its habitat were observed and are considered absent from the Study Area.	Addressed.	Resolved – thank you	Resolved.
127.	The table notes that monarchs were not observed during the insect surveys, however the CUM field sheets note four individuals on Sept 11 and 19. Recommend that host and feeding pollinating plant species be considered when developing restoration plans.	Table 19 and Field Sheets	Conservation Halton	Pollinator plant species are recognized as an important component to open areas, and therefore, as noted in the Site Plans, appropriate seed mixes will be applied following Conservation Halton guidelines.	Partially addressed. CH undertook a preliminary review of the revised site plans received on January 19 and 20th, 2022, as it relates to this comment. Within Section D, CH recommends including a note stating that pollinator plant species are an important component to open areas and incorporate in appropriate areas as part of the rehabilitation plans. Please note that this does not constitute a comprehensive review of the site plans.	The proposed Burlington Quarry Extension site plans will be updated to include a note in Section D (page 3 of 4) on pollinator habitat and species.	Please see Response to Comment #38. Sarah Mainguy, NSE has reviewed Nelson's response and provided the following JART response: Notes regarding pollinator habitat have not been added as of July 2022 site plan.
128.	The ELC field notes are not complete as soils were not competed. Please discuss how this may impact the classification of the vegetation communities.	Field Sheets	Conservation Halton	The ELC communities range from dry-fresh to fresh- moist, to wetland – showing community type variability was captured. Soil moisture was based on species composition, which effectively informed the accurate classification of vegetation communities. Outside of hydrology, influences associated with soil texture (e.g., sand vs. clay) or influences associated with parent material (e.g., depth to sedimentary bedrock) would also be reflected in the species composition. While soil data can be useful to support above-ground observations, it is not anticipated that	Addressed.	Resolved – thank you	Resolved.

				the absence of this data will have a significant influence on overall classification.			
JART Comments (JUNE 2023) **These comments are provided in response to the June 2022 submission regarding the Wetland Characterization Summaries. Additional, new comments may be provided at any time during the JART review process based on additional information provided by the applicant.**							
129.	Changes in water balance analyses are shown as a single number. It is difficult to conceptualize what that number means in relation to the actual hydroperiod of the wetland, as it does not provide information on what time of year the changes in hydroperiod would take place. This is most important when considering changes in hydroperiod of wetlands that support wildlife functions such as amphibian breeding. Reduction of hydroperiod in spring could lead to drying of breeding ponds. Increase in water could lead to erosion. The extent, duration, depth and timing of water is critical for determining wetland function	Wetland characterization summaries	North-South Environmental Inc.				
130.	Results of relevant wildlife surveys (amphibians, turtles and other information specific to the wetland) conducted as part of the earlier application should have been included for wetlands where it was available. In many cases these provide information relevant to the discussion, even if they were conducted in the past. For example, results for wetland 13027 note that there is no information regarding SWH but the information is readily available in the previous reports. The previous reports were used to obtain information on Jefferson's Salamander, and they should have been used to obtain information on SWH. The information that was used to obtain data on JESA for this application (and the wetland summary uses this to say that JESA is based on historical information) also provides data on presence of other amphibians – listing wood frog, green frog, gray treefrog, spring peeper and spotted salamander. The previous wetland information is important because the water in wetlands on the site fluctuates from year to year, and the previous studies may have captured a year that provided better habitat for breeding amphibians than any of the years studied recently. Long-term studies indicate that "good" years are highly important for maintaining breeding amphibians within a landscape. ○ The above comment still stands:	Wetland characterization summaries	North-South Environmental Inc.				

	○ We provide the following further comment on the above point. If the information on amphibian breeding from 2000 to 2007 is omitted from consideration, some of the functions of these wetlands are being treated as if they were only relevant in the past. However, the baseline derived from surveys of wetlands adjacent to the proposed extension in 2000 to 2007, which are still being discussed in the light of the current extension, will provide an accurate picture of the function of the wetlands within the natural heritage system. If the past information on these wetlands is ignored, the future impacts of the quarry are being compared only to a possibly impacted baseline, if they are only being assessed by surveys conducted in 2019 or later. If the wetlands have become less functional due to the current quarry, this provides critical information that informs the future mitigation for the extension. Concern regarding the omission of information from the past is similar to the concern regarding the omission of the past data from groundwater monitoring. ○ In Nelson's June 2022 responses to JART's comments on this point, the following statement was made to justify not including the past results: "SWH criteria and evaluations, along with other applicable policies and regulations, have been updated since the previous application." The criteria used in the present can be applied to the 2000-2007 results, allowing the results of surveys of wetland function in the past to						

	determine whether the present function has declined. Inclusion of the past data shows the results of past amphibian surveys in the wetlands and compares them with present surveys, and indicates whether they would have met the criteria for SWH in 2000 to 2007 and whether they currently meet the criteria for SWH. Amphibian surveys are important because they integrate many variables to show the function of the wetland, because amphibians rely on the presence of water until mid-July. ○ Comments provided in Tab 1 of the June, 2022 responses (by Aurora McAllister, MNRF, dated December 3, 2021), have asked for additional information regarding the wetlands. While they have not specifically mentioned the requirement for the past results of the wetland monitoring their comments suggest more information is required, as follows: ▪ The Ministry would appreciate more details on the hydroperiods for all surveyed ponds and the ponds that were monitored within the adjacent Jefferson Salamander regulated habitat. Specifically: which ponds were monitored, how many years they were monitored for, the hydroperiod for each of the ponds for each year, etc. ▪ At this time, the Ministry does not have enough information to agree or disagree with the conclusion that there						

	will be no direct or indirect impacts to adjacent endangered salamander habitat. The Ministry will rely on the professional opinion of the hydrogeologists reviewing the relevant details to assess whether there will be any impacts to the natural features including the wetlands that support Jefferson Salamander and Unisexual Ambystoma (Jefferson Salamander dependent population).						
131.	• Wetland 13015 is omitted from the discussion. Since this wetland provided SWH for woodland amphibians, based on the results of earlier surveys conducted as part of the previous application, the impacts on this area should be understood (wetland 13016 is characterized but it does not include wetland 13015). ○ This comment still stands. Further information on impacts and mitigation for wetland 13015 has not been provided.	Wetland characterization summaries	North-South Environmental Inc.				
132.	For some wetlands (e.g. the pond where amphibian station ACC10 is located in wetland 13203, which is a wetland that is SWH for amphibians as well as an area where turtles were observed) there will be changes in groundwater inputs and outflows, and we would like the opportunity to discuss with the groundwater review team whether these would likely mean changes to the hydroperiod. As another example, the wetland characterization summary for wetland 13204 (the wetland in the Medad Valley) predicts that the wetland will lose 18.6 ha of catchment area as well as some groundwater seepage. The infiltration pond is proposed partly to provide groundwater recharge to maintain seepage in the Medad Valley but JART	Wetland characterization summaries	North-South Environmental Inc.				

	groundwater experts have expressed concerns that the infiltration pond may be ineffective to maintain seepage. ○ Comments related to wetland 13203 and the pond within the wetland are addressed further in Comment 26. It is understood that the wetland and pond are intended to be maintained (as they are at present) by pumping from existing Sump 0100. However, additional discharge is proposed to this pond, which will be pumped from dewatering the floor of the southern extension. The pond has important functions to support overwintering turtles and breeding amphibians, and the additional water has the potential to impair those functions. The mitigation for this impact should be described.						
133.	It is difficult to understand the ecological implications of the wetland characterization summaries. ○ This comment still stands. Ecological implications should be described in full, and incorporated into mitigation.	Wetland characterization summaries	North-South Environmental Inc.				

Proposed Burlington Quarry Expansion
JART COMMENT SUMMARY TABLE – Noise

Please accept the following as feedback from the Burlington Quarry Joint Agency Review Team (JART). Fully addressing each comment below will help expedite the potential for resolutions of the consolidated JART objections and individual agency objections. **Additional, new comments may be provided once a response has been prepared to the comments raised below and additional information provided**.

	JART Comments (May 2021)	Reference	Source of Comment	Applicant Response (November 2021)	JART Response (May 2022)	Applicant Response (June 2022)	JART Response (June 2023)
Report/Date: Noise Impact Assessment, April 2020 **Author: HGC Engineering** **Report/Date: Acoustic Assessment Report – Halton Asphalt Supply, February 2020** **Author: HGC Engineering**							
1.	Provide a copy of the HGC report for MECP environmental compliance approval to confirm how the height of the berms was determined and what mitigation they provide to the nearby residential noise sensitive receptors.	General	City of Burlington	An updated Acoustic Assessment Report dated April 27, 2021 was submitted to the MECP in support of an ECA amendment application for the Halton Asphalt Supply hot-mix asphalt plant located on the quarry lands. A copy of the updated AAR is included as an Appendix to the updated Noise Impact Assessment (NIA) enclosed with this response. Determination of existing berm heights is detailed in Section 6 of the AAR and Section 5 of the NIA.	HGC Limited confirmed an ECA is not required for the quarry extension, but is required for the on-site hot mix plant. Please provide a copy of the ECA for the hot mix plant, it was applied for on 2021/04/27, almost a year ago, when is it expected to be received?	The MECP has completed their review of the Acoustic Assessment Report, as evidenced by email communication from the MECP noise reviewer, included as **Tab 1** to this letter. We understand that issuance of the ECA is pending the MECP completing review of other aspects of the application.	Not resolved.
2.	Provide a copy of the MECP ECA. This information is required for the City's records to confirm there is an ECA for the existing quarry and asphalt plant operations.	General	City of Burlington	A copy of the existing ECA for the hot-mix asphalt plant is enclosed with this response. The MECP has not yet issued the amended ECA referenced in Comment 1. However, as noted in Section 1 of the NIA, the MECP Senior Noise Engineer assigned to the application has confirmed the noise review is complete. With the exception of the hot-mix asphalt plant, the equipment operated within the quarry is exempt from requiring an ECA per Ontario Regulation 524/98.	A copy of the existing 1982 ECA was provided. They applied for a new ECA on 2021/04/27. Please provide a copy of the new ECA.	See Applicant Response (May 2022) to Comment 1.	Not resolved.
3.	Provide a clear figure/map summary of stationary source noise levels for each receptor and sample calculations.	General	City of Burlington	The updated NIA includes sound level contours for worst-case operating scenarios in Figures 4a through 4i, and detailed source sound level contributions at points of reception, included as Appendix D.	Addressed.	No further comment required.	
4.	Provide OLA receptors for nearby residential, and clearly identify on a figure/map, if possible, noise contour mapping would be appreciated so that it is clearly demonstrated which receptors could be most affected.	General	City of Burlington	The updated NIA includes OLA receptors associated with each assessed residential property and sound level contours for worst- case operating scenarios in Figures 4a through 4i.	Addressed.	No further comment required.	

5.	For STAMSON calculations there may be multiple segments needed for different receptors, i.e. RO4 may need No. 2 Side Road and Guelph Line, same for RO2 maybe Colling and Guelph Line. Please provide sample calculations to demonstrate.	General	City of Burlington	The updated NIA and AAR do not rely on predictions of road traffic sound to establish noise criteria. Rather, the Class 2 exclusionary minimum limits stipulated in MECP guideline NPC-300 have been adopted.	It is our understanding that the MECP has issued a certificate of approval confirming the plant is within a Class 2 area. This comment is conditionally addressed upon JART receipt of the Certificate of Approval for the Hot Mix Plant.	See Applicant Response (May 2022) to Comment 1.	Not resolved.
6.	Does not include traffic counts confirmed by Halton and Burlington and copies of the correspondence with the agencies. It looks like private traffic counts were undertaken and utilized in calculations. Please provide traffic data from Burlington and Halton, including a copy of the correspondence, for comparison.	General	City of Burlington	The updated NIA and AAR do not rely on predictions of road traffic sound to establish noise criteria. Rather, the Class 2 exclusionary minimum limits stipulated in MECP guideline NPC-300 have been adopted.	It is our understanding that the MECP has issued a certificate of approval confirming the plant is within a Class 2 area. This comment is conditionally addressed upon JART receipt of the Certificate of Approval for the Hot Mix Plant.	See Applicant Response (May 2022) to Comment 1.	Not resolved.
7.	Confirm responsibility for the implementation and maintenance of required noise control measures.	General	City of Burlington	The implementation of noise control measures is the responsibility of the two respective entities operating within the site, Halton Asphalt Supply (via an ECA) and Nelson Aggregate (via an ARA license).	Please clearly state this in Appendix C of the NIA. We note that appendix C in the November 21, 2021 NIA may be mislabeled. Table of contents suggests this appendix is to address proposed noise control measures; the body of the report labels the appendix as *zoning maps* and does not appear to reference noise control measures.	The parties responsible for each noise control measure are stated in Appendix C of the NIA (pages 38/39 of the NIA pdf document). A copy of the latest AAR is embedded within the NIA, with Appendix C of that document (pages 93-97 of the "parent" NIA pdf document) including zoning information. See **Tab 2** for NIA.	Not resolved.
8.	Need an estimate from the Quarry regarding truck traffic. There will be at grade quarry truck traffic crossing NO. 2 Side Road when the east section opens, their calculations only looked to take into consideration Guelph Line. Are there mitigation measures needed here (noise wall?) as the crossing is adjacent to two residential back yards and large trucks will be going up and down a slope, use of air brakes, etc. can be very loud. Please also ensure operating hours are taken into consideration and clearly stated (i.e. 24-hour/7-day operation or 7 to 7 Monday to Saturday. Additionally, please ensure truck traffic is based on license tonnage, i.e. if license is for 2 million tonnes extraction per year, ensure calculations are based on worst case scenario.	General	City of Burlington	Truck traffic activities and operating hours are detailed in Appendix B of the updated NIA and are based on the predictable worst- case activities assuming the maximum yearly production rate of 2 million tonnes, provided by Nelson Aggregate. Noise from haul trucks crossing 2 Side Road to access the South Extension is included, as are recommended berms west/east of the crossing as detailed in Appendix C. Nelson Aggregate has confirmed that the use of Jake-brakes is not permitted on the site (as noted in Appendix C).	Addressed.	No further comment required.	
9.	Provide revised Noise/Acoustical Impact Assessments and Blast Impact Analysis for review and commenting by all vested parties.	General	City of Burlington	The updated NIA is enclosed with this response.	Please see attached memo from the City of Burlington dated March 28, 2022 for comments to be addressed on the revised NIA.	Comments included in the memo, dated March 28, 2022, have been transcribed to this matrix as items 54 through 58, with responses provided for each.	Not resolved.

10.	Please provide a copy of the current MECP Environmental Compliance Approval for the existing quarry operations, and a copy of the noise impact study that was submitted as supporting materials for the approval.	General	City of Burlington	See response to Comment 2.	Provide a copy of the new ECA that was applied for 2021/04/27.	See Applicant Response (May 2022) to Comment 1.	Not resolved.
11.	Please confirm in the report who is responsible for the implementation and maintenance of the required noise measures.	General	City of Burlington	Implementation and maintenance of the noise control measures are detailed in Appendix C of the updated NIA.	Please include a statement in Appendix C about responsibility, as per applicant response to item 7 above.	See Applicant Response (May 2022) to Comment 7.	Not resolved.
12.	Provide noise measurements taken on site during normal working hours in peak construction season	General	City of Burlington	The NIA assesses the worst-case noise impact from the future quarry operation, based on an assumption that it will operate at its maximum yearly production rate of 2 million tonnes. Noise measurements taken during existing operation, which can be significantly different than that of the maximum production, are not relevant for the purposes of this noise assessment.	Addressed.	No further comment required.	
13.	MHBC Burlington Quarry Extension Drawing 2 of 4 dated September 2020, Note I, items 1 to 6, reference “complete a noise audit to ensure the site is meeting NPC-300 Noise Guidelines” with each phase. The HGC Noise Impact Assessment Nelson aggregate Quarry Extension dated April 22, 2020 does not reflect this requirement in their summary or recommendations. The noise report will need to be updated to reflect these statements.	General	City of Burlington	Appendix C of the updated NIA includes a recommendation for periodic noise surveys to confirm that extension operations comply with the limits stipulated in NPC-300.	Appendix C states that at each phase of extraction Nelson will undertake an acoustic survey to confirm compliance with MECP limits. Please provide additional details of the recommended periodic noise surveys, I.e., what is the estimated timing? Is it anticipated they would be undertaken yearly? And by whom, an independent third party? Will the results of the survey be provided to vested agency staff? What mechanisms will be in place, should the noise survey indicate an excess of MECP limits, to mitigate so that MECP requirements are met.	See copy of ARA Site Plans (March 2022) included as **Tab 3**. Page 2 of 4 -Phasing Notes regarding details for the acoustic audit. In general, the noise audit shall be conducted at the commencement of each phase (6 times), to ensure the site is meeting NPC-300 noise guidelines at the nearest sensitive receptor. The acoustic audits are to be kept the licensee and made available to agencies upon request. If the noise audit shows exceedances to NPC-300, adjustments to the operation / equipment will be required to ensure the operation meets NPC-300 noise guidelines. In addition the ARA Site Plans require: “If a noise complaint is received, the noise complaint will be responded to and investigated in a timely manner by the licensee in a manner commensurate to the specific context of the complaint.”	Not resolved.

14.	An Acoustic Assessment Report Halton Asphalt Supply prepared by HGC Engineering (Dated February 27, 2020), was submitted in support of the application. This report (when revised) should be referenced and included in the appendix of the Noise Impact Assessment Nelson Aggregate Quarry Extension.	General	City of Burlington	The most recent version of the AAR, dated April 27, 2021, is included in the updated NIA as Appendix F.	Addressed.	No further comment required.	
15.	This acoustic report should clarify the operating tonnage the assessment is based on. The assessment should be based on the worst-case operating scenario of 2 million tonnes per year. Adjustments to the applicant's noise report may be required, depending on the quantity and how the material is mined.	General	J.E. Coulter Associates Limited	The updated NIA includes a statement in Appendix B confirming that predictable worst- case operation considers trucking activities based on the maximum yearly production rate of 2 million tonnes.	This acoustic report should clarify if the existing quarry and the proposed extension will operate simultaneously until the existing license expires. The report should also outline how truck traffic will be managed when the existing quarry, the proposed extension, and the asphalt plant operate simultaneously. It appears there is no limitation as to when the extension can operate. The additional operations could trigger a 5 dB impact from activity on the property and along some of the access routes for shipping. 5 dB is the measure of significant impact if shipping times are not limited.	The operational plan for the existing quarry includes: 1) a condition that prohibits simultaneous drilling or extraction activities within the existing quarry while extraction activities are taking place in the extension and 2) maximum hourly movements of shipping trucks and onsite haul trucks. Trucking activities associated with the Halton Asphalt Supply hot mix asphalt plant will be limited by the ECA, once issued, as it will reference the AAR that details those trucking volumes.	Comments addressed.
16.	The acoustic reports use two different truck models in their analysis. The ambient sound levels at the receptors surrounding the site are calculated using STAMSON version 5.04. The trucks in STAMSONS data base are rated to sound level of approximately 83 dBA at 15m (acceleration in second gear at ~35Km/h on asphalt). The CadnaA model of the site that is used to predict the sound levels produced by the quarry uses highway truck sound levels of 72 dBA at 15m. This review limits the analysis to twin axle trucks since both models assume truck noise to be the equivalent of ~13 cars. As such, truck noise dominates the ambient noise near roadways. When comparing the sound levels from the quarry to the baseline sound levels at the receptors, the highway trucks modelled in CadnaA should use similar sound levels as the trucks used to calculate the baseline sound levels at the receptors. The CadnaA model has used trucks that are 11 dB quieter than those used in STAMSON and appear to be low.	General	J.E. Coulter Associates Limited	Sound emission levels employed for highway trucks in the acoustic analysis represent an average of trucks measured by HGC Engineering for numerous past projects and are consistent with those used by HGC Engineering in numerous peer reviewed noise impact studies of pits/quarries throughout Ontario. As noted in the response to Comment 5, the updated NIA does not rely on predictions of road traffic sound to establish noise criteria.	The report should clearly state that Jacobs brakes will not be used on site to manage speed when descending.	This JART Response (May 2022) appears to be related to Comment 17. Nevertheless, Appendix C of the NIA includes a statement precluding the use of Jacobs brakes.	Comment pertaining to truck noise and Jacobs brakes addressed.
17.	For modelling purposes, the report used 83 dBA at 15m maximum for the quarry haul when operating in the quarry. The report does not address the sound levels of operations such as the haul trucks climbing the hill to the at- grade crossing when loaded. It also does not model Jacobs brakes used to manage speed when descending.	General	J.E. Coulter Associates Limited	The updated NIA explicitly considers noise from haul trucks crossing 2 Side Road to access the South Extension (including the incline/decline), as detailed in Appendix C. Nelson Aggregate has confirmed that the use of Jake-brakes is not permitted on the site (as noted in Appendix C).	The ambient sound levels calculated in STAMSON are used to justify the use of Class 2 sound level criteria for the receptors surrounding the quarry. Detailed tables of the ambient sound levels should be provided to justify the surrounding area designation as Class 2.	This JART Response (May 2022) appears to be related to Comment 18. Nevertheless, see Applicant Response (November 2021) to Comment 6.	Comments addressed in updated NIS and Comment 18.

18.	The ambient sound levels calculated in STAMSON are used to justify the use of Class 2 sound level criteria for the receptors surrounding the quarry. A review of Table 1 in the Noise Impact Assessment report shows that the calculated ambient sound levels at most receptors are below the exclusion limit. The statement about the analysis being conservative is incorrect. The background sound levels could not be measured in the field as the current sound levels produced by the quarry are significant enough that it would dominate the ambient sound levels. No further field observations were conducted nor was any monitoring data provided.	General	J.E. Coulter Associates Limited	Class 1 through 3 acoustical environments are defined in NPC-300 in terms of the degree to which the background sound level is dominated by the activities of people (e.g. road traffic), not the background sound levels themselves. During multiple visits to the site and surrounding area, as cited in the NIA, HGC Engineering staff observed daytime background sound levels to be dominated by traffic (excluding that to/from the subject site) on surrounding roadways. Where background sound levels in such areas may be dominated by natural sounds at night, they best fit the definition of a Class 2 area, per NPC-300. This classification is supported by an MECP Senior Noise Engineer having recently completed their review of the updated AAR prepared for the onsite hot-mix asphalt plant (see the response to Comment 2), and a previous NIA prepared for the site by Aercoustics Engineering Limited.	The background sound levels could not be measured in the field as the current sound levels produced by the quarry are significant enough that it would dominate the ambient sound levels. No further field observations were conducted nor were any monitoring data provided. The report indicates that the site operations are not meeting the current MECP sound guidelines. The site noise may be louder than the ambient, which puts the existing operations out of compliance with the current guidelines.	Section 7 of the AAR provides information regarding sound levels of the existing operation. Section 8 provides details of additional, proposed noise control measures. Section 9 discusses the future sound levels of the site, including the benefit of existing noise control measures (detailed in Section 6) and proposed noise control measures (detailed in Section 8), which comply with the applicable limits at all points of reception.	It is our understanding that the MECP has issued an Environmental Certificate of Approval confirming the Asphalt Plant is within a Class 2 area. We would like to note that although the area has been classified as a Class 2 by MECP, there is still the strong possibility of complaints from the residents due to the low nighttime ambient sound levels.
19.	The report states that the parts of the quarry and asphalt plant (shipping material in and out) will operate at night. 2nd Line east of Highway 6 is shown as having 0 to 2 trucks per hour during the early morning periods. This will create a Class 3 environment at Receptors R4 to R8 and drop the minimum exclusion limit to 40 dBA. This will result in the sound levels from the Nelson Quarry being above the guideline limits at Receptors R4 to R7. With no additional mitigation recommended, nighttime operation involving shipping is questionable.	General	J.E. Coulter Associates Limited	See response to Comment 18.	The report states that the parts of the quarry and asphalt plant (shipping material in and out) will operate at night. 2nd Line east of Highway 6 is shown as having 0 to 2 trucks per hour during the early morning periods. This will create a Class 3 environment at Receptors R4 to R8 and drop the minimum exclusion limit to 40 dBA. This will result in the sound levels from the Nelson Quarry being above the guideline limits at Receptors R4 to R7 and other receptors along the haul route. With no additional mitigation recommended, nighttime operation involving shipping is questionable.	See Applicant Response (November 2021) to Comment 18.	Addressed in Comment 18.
20.	Broadband backup beepers (hiss) can be used as an alternative to the tonal beepers currently used. They are noticeably quieter than the standard beepers when heard indoors and cost ~$200 to equip the construction vehicle. Not every vehicle will be captive to the operation, so a complete changeover will take several years. They have been used successfully on the Toronto Eglinton LRT construction project.	General	J.E. Coulter Associates Limited	The updated NIA includes a recommendation in Appendix C to equip all mobile equipment operating in the extension with broadband back-up alarms.	Broadband backup beepers (hiss) should be used as an alternative to the tonal beepers currently being used. They are noticeably quieter than the standard beepers when heard indoors and cost ~$200 or so to equip each construction vehicle. Not every vehicle will be captive to the operation, so a complete changeover will take some time. They have been used	See Applicant Response (November 2021) to Comment 20.	Broadband backup beepers (hiss) should be used as an alternative to the tonal beepers currently being used. They are noticeably quieter than the standard beepers when heard indoors and cost ~$200 or so to equip each construction vehicle. Not every vehicle will be captive to the operation, so a complete changeover will take some time.

					successfully on the Toronto Eglinton LRT construction project.		
21.	A quiet drill with a sound power of 109 dBA has been used in the analysis and has been assumed to operate at all areas on the quarry. This will require the use of a special drill such as the Atlas Copco ROC D9C silenced drill or similar and should be noted clearly in the report. Standard drills typically have a sound power of 115 to 120 dBA.	General	J.E. Coulter Associates Limited	Comment only, no response required.	A quiet drill with a sound power of 109 dBA has been used in the analysis and has been assumed to operate at all areas on the quarry. This will require the use of a special drill such as the Atlas Copco ROC D9C silenced hydraulic, down-the-hole drill and should be noted clearly in the report. Standard drills typically have a sound power of 115 to 120 dBA. The site plan condition should state that the quiet drill, which is at 109 dBA, be used on site everywhere.	The site plans, included as Tab include conditions limiting the rock drill sound power level to 110 dBA, consistent with the recommendation in the NIA. .	A quiet drill with a sound power of 109 dBA should be used everywhere on site as per Point N.3.d in the Site Plan dated March 2022.
22.	The noise reports discuss briefly the MECP notion of predicable worst case for the analysis. This would be the case when the weather is calm (minimum leaf noise), often at night and during an inversion. The combination of light winds in the evening or early morning often results in the worst-case scenario. It is often the result of idling trucks lining up at the gate of a quarry awaiting opening.	General	J.E. Coulter Associates Limited	Comment only, no response required.	The noise reports discuss briefly the MECP notion of predicable worst case for the analysis. This would be the case when the weather is calm (minimum leaf noise), often at night and during a local temperature inversion. The combination of light winds in the evening or early morning often results in the worst-case scenario. It is often the result of idling trucks lining up at the gate of a quarry awaiting opening.	Comment only, no response required.	The noise reports discuss briefly the MECP notion of predicable worst case for the analysis. This would be the case when the weather is calm (minimum leaf noise), often at night and during a local temperature inversion. The combination of light winds in the evening or early morning often results in the worst-case scenario. Idling trucks lining up at the gate of a quarry awaiting opening should be avoided.
23.	The local noise barrier for the asphalt plant should be designed using the octave band sound values, as we have observed in past projects that the sound emitted from such plants is mostly concentrated in the lower frequency (100– 500 Hz) bands.	General	J.E. Coulter Associates Limited	The updated NIA and AAR no longer include a recommendation for a noise barrier at the hot-mix asphalt plant.	NPC-233, one of the report's references, states in Section 8-4 that the sound level analysis should include mapping of the existing level of road traffic in the vicinity of the proposed site and the increase in such traffic due to the plant's operation, projected for at least 10 years into the future. The truck routes to/from the quarry have not been considered as it is assumed that truck traffic from the extension will replace the current truck traffic and will therefore not cause an increase in sound levels. However, residences along the haul route may have been under the impression that the existing quarry was nearing exhaustion and the sound levels from truck traffic would be reduced once the material in the existing quarry was exhausted.	This JART Response (May 2022) appears to repeat JART Comment (May 2021) 24, which was addressed with Applicant Response (November 2021) to Comment 24.	Nelson Aggregate has applied for a maximum tonnage of 2 million tonnes per year which is an increase from current capacity. As such there would be increased truck traffic along the haul routes leading to an increase in sound levels. *NPC-233,* one of the report's references, states in Section 8-4 that the sound level analysis should include mapping of the existing level of road traffic in the vicinity of the proposed site and the increase in such traffic due to the plant's operation, projected for at least 10 years into the future. The truck routes to/from the quarry have not been considered as it is assumed that truck traffic from the extension will replace the current truck traffic and will therefore not cause an increase in sound levels. Residences along the haul route

							may also be under the impression that the existing quarry was nearing exhaustion and the sound levels from truck traffic would be reduced once the material in the existing quarry was exhausted.
24.	NPC-233, one of the report's references, states in Section 8-4 that the sound level analysis should include mapping of the existing level of road traffic in the vicinity of the proposed site and the increase in such traffic due to the plant's operation, projected for at least 10 years into the future. The truck routes to/from the quarry have not been considered as it is assumed that truck traffic from the extension will replace the current truck traffic and will therefore not cause an increase in sound levels. However, residences along the haul route may have been under the impression that the existing quarry was nearing exhaustion and the sound levels from truck traffic would be reduced once the material in the existing quarry was exhausted.	General	J.E. Coulter Associates Limited	Comment only, no response required.	Ambient sound levels were calculated in STAMSON version 5.04 using traffic data of the surrounding roadways. The ambient sound levels could not be measured as the existing quarry operates throughout the year. Calculated sound levels when the quarry extensions are in operation were within the applicable MECP noise criteria at all receptors. Once either quarry extension is operational, a noise monitoring program should be implemented to corroborate the predicted sound levels at the receptors selected in the report. A monitoring program for the predictable worst-case scenario should be prepared ahead of time and should account for wind direction. The monitoring should be conducted when the quarry is operating at full capacity. A similar monitoring program should be implemented once the other extension is operational	This JART Response (May 2022) appears to repeat JART Comment (May 2021) 25, which was addressed with Applicant Response (November 2021) to Comment 25 and Applicant Response (May 2022) to Comment 13.	Once either quarry extension is operational, a noise monitoring program should be implemented to corroborate the predicted sound levels at the receptors selected in the report as outlined in Point H. Extraction Sequence in the Site Plan dated March 2022. A monitoring program for the predictable worst-case scenario should be prepared ahead of time and should account for wind direction. The monitoring should be conducted when the quarry is operating at full capacity.
25.	Ambient sound levels were calculated in STAMSON version 5.04 using traffic data of the surrounding roadways. The ambient sound levels could not be measured as the existing quarry operates through the year. Calculated sound levels when the quarry extensions are in operation were within the applicable MECP noise criteria at all receptors. Once the south quarry extension is operational, a noise monitoring program should be implemented to corroborate the predicted sound levels at the receptors selected in the report. A monitoring program for the predictable worst-case scenario should be prepared ahead of time and should account for wind direction. The monitoring should be conducted when the quarry is operating at full capacity. A similar monitoring program should be implemented once the west extension is operational.	General	J.E. Coulter Associates Limited	Appendix C of the updated NIA includes a recommendation for periodic noise surveys to confirm that extension operations comply with the limits stipulated in NPC-300.	The noise report states there is no vibration on site. This is a very unlikely during the blasting phase of work. During blasting in close proximity to the residences, we would expect to feel vibration. It may fall within the MECP draft vibration guideline and, as such, not be a concern, but it is very likely that some of the neighbours will sense the pulses in the ground.	This JART Response (May 2022) appears to be unrelated to Comment 25. Nevertheless, assessment of vibration impacts from blasting is outside of the scope of the NIA and is addressed by a separate report prepared by others.	The noise report states there is no vibration on site. This is a very unlikely during the drilling and blasting phase of work. During blasting in close proximity to the residences, we would expect to feel vibration. It may fall within the MECP draft vibration guideline and, as such, not be a concern, but it is very likely that some of the neighbours will sense the pulses in the ground. A statement confirming that the vibration from drilling is being covered should be added to the Site Plan and NIS.
26.	The asphalt plant horn, use of Jacobs brakes, working hours, and low- frequency noise from the asphalt plant burners remain to be dealt with and should be dealt with by direct talks with the quarry owners.	General	J.E. Coulter Associates Limited	Comment only, no response required.	We noted that in the noise model, the quarry is modelled as an intermediate surface for ground absorption. Our experience includes pits and quarries whose	This JART Response (May 2022) appears to be unrelated to Comment 26. Nevertheless, the ground absorption coefficient employed in the acoustical model	Provisions should be made to address truck operators that use Jacob breaks on site.

	JART Comment: These issues will be raised in discussions with the quarry operator.				bases, when covered in fine dust particles and water, act hard acoustically.	was carefully selected to yield the best agreement with sound level measurements at select locations of existing operations at the site.	
27.	Section 1 indicates that the study is required to support an application for a Class “A” license (Category 2) to the MNRF. It is also required to support an Official Plan Designation to “Mineral Resource Extraction Area” in the City of Burlington. Please include the additional purpose of the study in this section.	Section 1	City of Burlington	Section 1 of the updated NIA has been updated accordingly.	Addressed.	No further comment required.	
28.	Section 2 indicates that the extraction activities and processing of aggregate for the proposed quarry extension will occur from Monday to Friday 7:00 to 19:00; therefore, would recommend (if possible) that the language of the Official Plan Designation (if approved) reflect the working hours stated in the Noise Impact Study. Alternatively, if operations could run on a 24-hour basis (including weekends) please revise the report to reflect and clearly state.	Section 2	City of Burlington	Proposed hours of operation are as stated in the NIA and are included on the ARA Site Plans. The ARA Site Plans are the appropriate location to govern hours of operation.	Please include the ARA Site plan in the appendix of the NIA. Appendix A of the NIA contains five plans, Existing Features, Operational Plan, Rehabilitation Plan., Cross Sections and another Operational Plan. Both Operational Plans indicate the working hours as Monday to Friday 7am to 7pm, statutory holidays excepted, and Blasting Monday to Friday 8am to 6pm excluding Statutory Holidays. Is the Operational Plan the same as the ARA Site Plan? If there is a separate ARA Site Plan please include it in Appendix A	The NIA has not been updated to include the current ARA Site Plans. Throughout the course of the agency review there are numerous updates to the ARA Site Plans and it is not necessary to re-issue the NIA each time. When the ARA Site Plans are updated they are circulated to JART and available for review. The current version of the proposed Burlington Quarry Extension ARA Site Plans are dated March 2022, included as **Tab 3**, and the proposed Burlington Quarry ARA Site Plans are dated February 2022.	Not resolved.
29.	Section 3 indicates that the hourly traffic data for No 2 Side Road, Cedar Springs Road and Colling Road were collected by a private firm. Would ask that HGC reach out to the City of Burlington’s Traffic Department to obtain the City’s traffic data and use the most conservative data for calculations. Please include a copy of the City’s correspondence in the appendix of the report.	Section 3	City of Burlington	The updated NIA and AAR do not rely on predictions of road traffic sound to establish noise criteria. Rather, the Class 2 exclusionary minimum limits stipulated in MECP guideline NPC-300 have been adopted.	It is our understanding that the MECP has issued a certificate of approval confirming the plant is within a Class 2 area. This comment is conditionally addressed upon JART receipt of the Certificate of Approval for the Hot Mix Plant.	See Applicant Response (May 2022) to Comment 1.	Not resolved.
30.	Please reference NPC-300 in the title or as a footnote on the table, including class designation.	Section 3 (Table 1)	City of Burlington	Tables 2 and 3 in Section 7 of the updated NIA include reference to NPC-300 and the established Class 2 acoustical environment.	Addressed.	No further comment required.	
31.	Please change the description of “Residential Home” to the individual municipal addresses. All the documents associated with the application are accessible to the public on the City’s website, and the impact to each property should be clear for adjacent homeowners to see in the report.	Section 3 (Table 1)	City of Burlington	The updated NIA includes the municipal address of each point of reception in Tables 2 and 3 of Section 7 and Appendix D.	Addressed.	No further comment required.	
32.	Section 4 references Appendix B, which outlines on-site operations. Appendix B provides Sound Power Levels for equipment/trucks and estimates of truck haul movements, but does not reference noise levels on adjacent receptors.	Section 4 (Appendix B)	City of Burlington	The updated NIA includes noise from haul trucks crossing the 2 Side Road to access the South Extension and assesses the sound levels of the	Addressed.	No further comment required.	

	i.e. the proposed entrance for the No. 2 Side Road south quarry expansion could impact existing residential lots, typically the house can provide protection for rear yard outdoor living areas from road/traffic noise, but if the Quarry and associated vehicles/equipment is operating at the side or rear of existing homes what is the effect on the houses outdoor living areas? Please assess each house in the area on all sides. Specifically, comment if noise/acoustical barriers are required for adjacent/nearby existing residential properties. Please also provide comment in this regard for the other adjacent existing residential properties on the west expansion, i.e. without a new access proposed, combined with the construction of new berms and difference in elevation, the noise from the West expansion may be very different from the noise on the South expansion.			quarry at all façades and in outdoor amenity areas of neighbouring homes. Multiple operating scenarios are presented, representative of “worst-case” impacts at each point of reception.			
33.	Please provide a table summarizing the stationary sources of noise, impact on adjacent residential and allowable limits, exceedances, mitigated level estimates, etc.	Section 4	City of Burlington	The updated NIA includes the sound level contribution of each source at each point of reception, detailed in Appendix D.	Addressed.	No further comment required.	
34.	Section 5 references a separate Acoustical Assessment for the hot-mix asphalt plant. Please provide a copy of this report.	Section 5	City of Burlington	The most version of the AAR, dated April 27, 2021, is included in the updated NIA as Appendix F.	Addressed.	No further comment required.	
35.	Please provide more detail for the noise control measures, i.e. height of berms, reference a plan that shows the location of the berms, etc., and any other noise .control measures.	Section 5	City of Burlington	The updated NIA includes detailed descriptions of the noise control measures in Section 5, Figures 3a through 3c and Appendix C.	Operational Plan drawing 2 of 4 only identifies the proposed berms at the NE entrance, not the berms for the west or south expansions. Please clearly identify all proposed berms on the Operational Plan, and the ARA Site Plan (if that is a different plan from the Operational Plan). Please ensure the deemed right of way widths are identified on the plans and that the berms do not encroach into the deemed right of ways.	The noise berms recommended for the extension are included on the Operational Plan for the extension (whereas the berms recommended for the existing quarry are indicated on the Operational Plan for the existing quarry).	Not resolved.
36.	Please include the quarry/asphalt plant working hours assessed/used for the calculations for predicted worst-case sound levels, i.e. 7am to 7pm Monday to Saturday or 24-hours/7days	Section 7	City of Burlington	The updated NIA details the operating hours of all onsite operations in Appendix B.	Addressed.	No further comment required.	
37.	Appendix B, Table B2, please include the location of the Phases either in the column subtitles or as a footnote to the table, i.e. Phases 1-2 are the south expansion, Phases 3-6 are the west expansion. Also, the MHBC Operation Plan indicates Phase 1A and 1B, what is the difference? The MHBC extraction sequence notes do not delineate between Phase 1A and 1B, the Extraction Sequence section “I” just states Phase 1.	Appendix B (Table B2)	City of Burlington	Table B2 of the updated NIA has been updated accordingly.	Addressed.	No further comment required.	
38.	Appendix C provides a sketch for a 1.0-metre barrier at the asphalt plant mixing tower. How was the height determined, what are the unmitigated noise levels and the	Appendix C	City of Burlington	The updated NIA and AAR no longer include a recommendation for a noise barrier at the hot-mix asphalt plant.	Addressed.	No further comment required.	

	mitigated noise levels on nearby noise sensitive receptors?						
39.	The traffic counts for the municipal roads, Colling, Cedar Springs, No. 2 Side Road, were taken by a private firm in December 2018. We ask that the City's traffic data be obtained from City Staff, for comparison, and include a copy of the correspondence in the appendix.	Appendix D	City of Burlington	The updated NIA and AAR do not rely on predictions of road traffic sound to establish noise criteria. Rather, the Class 2 exclusionary minimum limits stipulated in MECP guideline NPC-300 have been adopted.	It is our understanding that the MECP has issued a certificate of approval confirming the plant is within a Class 2 area. This comment is conditionally addressed upon JART receipt of the Certificate of Approval for the Hot Mix Plant.	See Applicant Response (May 2022) to Comment 1.	Not resolved.
40.	Please ensure the example STAMSON calculations clearly identify the road segment, i.e. is it Colling Road, Guelph Line, No. 2 Side Road, etc. Some STAMSON calculations may require more than one segment, i.e. corner lots would have minimum 2 - one for each road. Provide clearer figures/maps summarizing calculations.	Appendix E	City of Burlington	The updated NIA and AAR do not rely on predictions of road traffic sound to establish noise criteria. Rather, the Class 2 exclusionary minimum limits stipulated in MECP guideline NPC-300 have been adopted.	It is our understanding that the MECP has issued a certificate of approval confirming the plant is within a Class 2 area. This comment is conditionally addressed upon JART receipt of the Certificate of Approval for the Hot Mix Plant.	See Applicant Response (May 2022) to Comment 1.	Not resolved.
41.	Appendix F does not appear to clearly label the total sound level calculation (total) for R01. Please clearly label the total dBA from the quarry vehicles/equipment/trucks/etc. Additionally, R01 looks to be the receptor that may be one of the least impacted by the proposed quarry expansion (as it is located near the middle of Colling Road between Guelph Line and Cedar Springs Road). Please provide sample calculations, including a clear total dBA for each receptor for at minimum R10, R09, and R15, additional calculations may be asked for after review of the revised report.	Appendix F	City of Burlington	Appendix D of the updated NIA includes a table showing sound level contributions from all equipment at each point of reception. Detailed calculations showing attenuating parameters determined by the ISO 9613-2 standard have been included for locations R10 and R15. Location R09 has been excluded from assessment as it does not represent a noise sensitive use (a barn associated with the home represented by R08).	Addressed.	No further comment required.	
42.	There were supplemental pages submitted in October's circulation, STAMSON calculations for R03-Morning, RO4-Morning, R05-Morning, R06-Morning, R07Morning, and R14-Morning, there was also Table 1 that had rows for R01 through R18, but the aforementioned individual STAMSON calculations do not appear to correspond with Table 1. Do these supplementary tables reference the Acoustic Assessment Report Halton Asphalt Supply, or another report? If another report, which one?	General	City of Burlington	The updated AAR does not rely on predictions of road traffic sound to establish noise criteria. Rather, the Class 2 exclusionary minimum limits stipulated in MECP guideline NPC-300 have been adopted.	It is our understanding that the MECP has issued a certificate of approval confirming the plant is within a Class 2 area. This comment is conditionally addressed upon JART receipt of the Certificate of Approval for the Hot Mix Plant.	See Applicant Response (May 2022) to Comment 1.	Not resolved.
43.	There was a calculation summary provided for R01, R02, R03, R04, R05, R06, R07, R08, R09, R10, R11, VL1, and VL2. Figure 2 provides general locations of receptors but the report does not clearly identify the municipal addresses of the receptors. Would ask that the municipal addresses of the receptors be provided in a separate table (or on Table 2 & 3) so that they can be clearly identified by the general public, as all reports submitted in support of the OPA are public information and available for view on the City's website.	General	City of Burlington	An updated AAR (included as Appendix F to the updated NIA) has been submitted to the MECP in support of an application to amend the ECA for the onsite hot-mix asphalt plant. As noted in the response to Comment 2, the MECP Senior Noise Engineer has completed their review of the AAR. Therefore, the AAR cannot be further updated. Nevertheless, the updated NIA includes the municipal address of	Addressed.	No further comment required.	

				each point of reception in Tables 2 and 3 of Section 7 and Appendix D.			
44.	The executive summary states the purpose of the report is to support an application to the Ontario Ministry of Environment Conservation and Parks for an Environmental Compliance Approval for a Hot Mix Asphalt Plant. Is this for a renewal of an existing MECP Compliance Approval? The Halton Asphalt Supply Ltd. (Steed & Evans) is existing. Has the Compliance Approval from the MECP been received? Is this report also in support of the OPA?	General	City of Burlington	The AAR was prepared in support of an ECA amendment application for the hot-mix asphalt plant. A copy of the existing ECA for the hot-mix asphalt plant is enclosed with this response. The amended ECA has not yet been issued by the MECP. However, as noted in Section 1 of the NIA, the MECP Senior Noise Engineer assigned to the application has confirmed the noise review is complete. The NIA enclosed with this response has been prepared in support of the OPA.	Please provide a copy of the email/memo from the MECP Senior Noise Engineer confirming they have no further requirements for the AAR, or provide copy of the updated ECA.	A copy of the email communication is included a **Tab 1**.	Not resolved.
45.	Tables 2 and 3 are for the applicable (allowable) sound level limits. Please provide additional columns or additional tables for the calculated and mitigated sound level limits at the receptors. Figure 5a, 5b, 5c, 5d, and 5e show contour lines for mitigated noise levels, and Appendix A and B have tables/calculations for unmitigated and mitigated values. Please also provide a summary (of just dBA for each receptor) table in the body of the report.	General	City of Burlington	The AAR has been submitted as part of an ECA application to the MECP and has been since reviewed and accepted by the Ministry review staff, as confirmed by email communication included in Appendix F of the updated NIA. For this reason, it is no longer possible to make changes to the AAR. Nevertheless, detailed information is included in Appendix F.	Appendix F did not have an email from the MECP Senior Noise Engineer, please provide.	A copy of the email communication is included as **Tab 1**.	Not resolved.
46.	Figure 4a identifies a 1.0-metre high barrier above the mixing tower. Please provide details, material, density, etc., will this need a building permit? Please reach out to the City's Building Department to confirm. Usually building permits are required for only permanent structures	General	City of Burlington	Based on results of the updated acoustic analysis, the noise barrier for the mixing tower is no longer required.	Addressed.	No further comment required.	

47.	Section 8.2 indicates that noise control measures will be installed within 24 months following receipt of approval from the MECP. If the hot mix plant is currently in operation should not the noise control measures already be in place?	General (Photograph)	City of Burlington	Per Section 9 of the Environmental Protection Act, the operator of the hot-mix asphalt plant is not permitted to install the noise control measures recommended in the AAR until approval is granted by the MECP in the form of an amended ECA. Typically, ECA conditions relating to proposed noise control measures provide a timeline for implementation based on a proposal from the proponent and approved at the discretion of the MECP.	Please provide a copy of the updated ECA and conditions to confirm the timeline for installing the noise control measures.	See Applicant Response (May 2022) to Comment 1.	Not resolved.
48.	Figure 4b identifies a 5.0-metre high barrier around the drill. Please provide details, material, density, etc., is it a portable barrier, will this need a building permit? Please reach out to the City's Building Department to confirm.	Section 2.2 (Page 4) Last Sentence	City of Burlington	The updated NIA and AAR no longer include a recommendation for a noise barrier at the hot-mix asphalt plant.	Please include in Appendix C of the NIA and on the Sound Power Level table on the Operations Plan and/or the ARA Site Plan that the "quiet drill (110dBA) is to be utilized on site.	Referring to this equipment as a "quiet drill" offers no technical specificity; only the maximum allowable sound power level of the equipment is of technical relevance and is referenced in both the NIA and on the ARA Site Plan.	Not resolved.
49.	Appendix F, Tables F1 and F1 - Please indicate which values are NPC-300 and which values are calculated background sound levels. Please also note at the bottom of the tables that they are also identified as Tables 2 and 3 in section 5 of the report.	Section 3.1	City of Burlington	The updated AAR does not rely on predictions of road traffic sound to establish noise criteria. Rather, the MECP exclusionary minimum limits (NPC-300) have been adopted.	It is our understanding that the MECP has issued a certificate of approval confirming the plant is within a Class 2 area. This comment is conditionally addressed upon JART receipt of the Certificate of Approval for the Hot Mix Plant.	See Applicant Response (May 2022) to Comment 1.	Not resolved.
50.	Please confirm in the report who is responsible for the implementation and maintenance of the required noise measures.	Section 3.2	City of Burlington	The implementation of noise control measures at the hot-mix asphalt plant will be the responsibility of Halton Asphalt Supply, which will be stipulated in the ECA upon issuance.	Please provide a copy of the ECA to confirm.	See Applicant Response (May 2022) to Comment 1.	Not resolved.
51.	Appendix G - Please also provide the correspondence from the City and Region that accompanied the traffic data. Appendix F indicates that the Region of Halton supplied traffic counts, but did not indicate that the City of Burlington supplied traffic counts. Ask that the City of Burlington Traffic Department be contacted for traffic counts so that City information can be compared to the consultant's counts. As mentioned, provide copies of the correspondence with the agencies as well in the appendix.	Section 3.2 (Page 11) Last Sentence	City of Burlington	The updated AAR does not rely on predictions of road traffic sound to establish noise criteria. Rather, the MECP exclusionary minimum limits (NPC-300) have been adopted.	It is our understanding that the MECP has issued a certificate of approval confirming the plant is within a Class 2 area. This comment is conditionally addressed upon JART receipt of the Certificate of Approval for the Hot Mix Plant.	See Applicant Response (May 2022) to Comment 1.	Not resolved.
52.	Appendix H - The sample STAMSON calculation did not identify the road name. Please provide additional sample STAMSON calculations and ensure the roads and receptors are clearly identified.	Section 3.2 (Page 12)	City of Burlington	The updated AAR does not rely on predictions of road traffic sound to establish noise criteria. Rather, the MECP exclusionary minimum limits (NPC-300) have been adopted.	It is our understanding that the MECP has issued a certificate of approval confirming the plant is within a Class 2 area. This comment is conditionally addressed upon JART receipt of the Certificate of Approval for the Hot Mix Plant.	See Applicant Response (May 2022) to Comment 1.	Not resolved.

53.	The NEC is undertaking review of the second submission regarding Visual Impact Assessment (VIA) and notes that there is a relationship between berm location and height in terms of visual impact. Any modifications to berming and landscaping will need to also be considered in terms of visual impact.	General	Niagara Escarpment Commission	Comment only, no response required.	The NEC has since commented in detail on the second VIA submission: the NEC's May 2021 interests identified here are reflected in our response to the second VIA submission.	Comment only, no response required.	
	Additional comments included in a letter from the City of Burlington, Engineering Services, March 28, 2022. **Only comments already not addressed above are included.**						
54.			City of Burlington		The "Limitations" section excludes reliance on the document for anyone except Nelson Aggregate Co. Please provide a letter of reliance from HGC Engineering, confirming the City of Burlington and other vested review agencies and the peer reviewer, J. E. Coulter Associates Limited, can rely on the information in the same manner as Nelson Aggregate Co.	A reliance letter is included as **Tab 4**.	Not resolved.
55.			City of Burlington		Section 2 indicates "the site hosts a hot-mix asphalt plan owned by a third-party; sound emissions from the hot-mix plant have been jointly assessed with the quarry." Table 1 outlines the predicted "Worst-Case" Sound Levels. Appendix F contains the Acoustic Assessment Report (AAR) Section 3.2 indicates. Table A3 of the AAR outlines the "Existing Worst Case Operation". The hot- mix plant is proposed to continue to operate after the quarry extension. Will the ECA for the hot-mix plant need to be updated again if the quarry expansion is approved? We do note that the AAR existing worst case operation sound levels are worse than the predicted NIA worst case sound levels.	The ECA, when issued, will pertain only to the Halton Asphalt Supply facility (i.e. the hot mix asphalt plant), as the quarry does not require an ECA and has only been included in the AAR given the symbiotic relationship with the hot mix asphalt plant. Therefore, the ECA will not require updating to address the quarry expansion.	Not resolved.
56.			City of Burlington		Is Figure 3a mislabeled as Figure 5? Noise Barriers/Berms Near Site Entrance	Yes, Figure 3a of the NIA is mislabeled as "Figure 5".	Not resolved.

57.			City of Burlington		Appendix F, Acoustic Assessment Report (AAR) prepared by HGC Engineering dated April 27, 2021, section 7 indicates “These levels are generally within the applicable criteria but can exceed the noise limits at locations R01, R04 through R08 and VL1”, approximately a third of the receptor locations exceed noise limits. Section 8 of the same report states “with the noise control measures outlined in Sections 6 and 8, the worst-case sound levels of the site are predicted to be within the applicable limits set out in MECP publication NPC-300” Section 8 and Section 7 seem to state two different conclusions, please clarify.	Section 7 and 8 of the AAR include different conclusions, since Section 8 provides for additional noise control measures. With those additional noise control measures, the site will comply with the applicable limits at all points of reception.	Not resolved.
58.			City of Burlington		Section 8.3 of the AAR indicates that “the measures detailed in Sections 8.1 and 8.2 will be implemented within 24 months following receipt of Approval from the MECP”, the measures include both the acoustic silencers at the hot mix plant and the noise berms. Appendix B of the NIA states “Prior to commencement of quarrying activities in the two extensions, berms will be constructed at the perimeter of the site as discussed in Appendix C,” Please confirm the latter is true, that the berms will be constructed prior to extraction activities in the west or south expansions of the quarry, even if that timeline is less than 24 months after MEC approval.	The AAR pertains to noise emissions from equipment that requires an ECA, namely the Halton Asphalt Supply hot mix asphalt plant (noise emissions from the existing quarry are included in the AAR given the symbiotic relationship with the hot mix asphalt plant). Therefore, the noise control measures (and implementation timeframe) proposed in the AAR pertain only to the hot mix asphalt plant and existing quarry operations. Noise control measures related to the extension are stipulated within the associated site plans and are only required to be in place before operations commence in the extension (as they are intended to mitigate noise from the extension, not from the hot mix asphalt plant or existing operations).	Not resolved.

Proposed Burlington Quarry Expansion
JART COMMENT SUMMARY TABLE – Progressive and Final Rehabilitation Monitoring Study

Please accept the following as feedback from the Burlington Quarry Joint Agency Review Team (JART). Fully addressing each comment below will help expedite the potential for resolutions of the consolidated JART objections and individual agency objections. **Additional, new comments may be provided once a response has been prepared to the comments raised below and additional information provided**.

	JART Comments (February 2021)	Reference	Source of Comment	Applicant Response (June 2021)	JART Response (June 2023)
Report/Date: Progressive and Final Rehabilitation Monitoring Study, April 2020				**Author: MHBC**	
1.	Among other impacts, the proposed after-use should address whether the use generates vehicular traffic impacts, demands for additional water and wastewater services, and demands parking on site or nearby.	General	City of Burlington	The proposed Burlington Quarry Extension application only proposes to create a land form as part of the rehabilitation plan for the site. The rehabilitation plan does not permit any after uses, however the site has been designed to be suitable for recreation, conservation and water management after uses. Any future after uses would be determined after the Aggregate Resources Act license is surrendered. The proposed after use would be proposed by the owner of the site following surrender of the license. As required by the Niagara Escarpment Plan, Region of Halton Official Plan and City of Burlington Official Plan future approvals will be required to permit after uses on the site (e.g. NEPA, ROPA, LOPA and NEC DP). As part of these applications any potential impacts will be evaluated as part of that process.	Not resolved.
2.	Both the AIA and the Rehabilitation and Monitoring Study should assess the impact of the future use of the subject lands, once proposed extraction activities have been exhausted. How would compatibility with surrounding agricultural operations and normal farm practices be achieved? How would it impact MDS requirements?	General	City of Burlington	See response to Comment # 1.	Not resolved.
3.	Reliance on ongoing dewatering should be further detailed with respect to the financial and operational impacts of such a plan, as well as costs and other potential risks in the event of system failure.	General	City of Burlington	The Burlington Quarry Extension application does not rely on ongoing dewatering of the site. As JART is aware the existing approved rehabilitation plan for the Burlington Quarry requires dewatering to stop and the site to naturally flood to a lake with no off-site discharge. As part of the Burlington Quarry Extension application, Nelson has agreed to modify the existing quarry rehabilitation plan to maintain off-site pumping to improve conditions for surrounding lands compared to existing approvals and maximize land area for future after uses. The proposed modification to the existing quarry rehabilitation also results in the West extension being maintained in a dewatered state. The proposed South Extension will not be maintained in a dewatered state and will be	Not resolved.

				rehabilitated to a lake. The operation of the existing quarry and west extension in a dewatered state is straight forward and consistent with current operations. Water is discharged to the north and south of the site at the existing approved discharge points by two pumps. The costs associated with dewatering will be maintained by Nelson until such time as the license is surrendered. Following license surrender the cost of operating two pumps will be the responsibility of the owner at the time. There is no safety risk to off-site properties in the event of a system failure. Due to the topography all water would be maintained on-site if the pumps were to fail.	
4.	While it is understood that it is a requirement to plan for after use of the subject lands, there is no interest by Burlington, at this time, to entertain discussions of future transference of ownership to a public authority.	General	City of Burlington	Comment noted.	Not resolved.
5.	It is noted that a property not currently in agricultural use does not restrict it from such a use in the future, especially if it is located within a prime agricultural area.	General	Niagara Escarpment Commission	Comment noted.	Response acknowledged.
6.	Whether or not the proposed after-uses are appropriate or possible will be predicated on the effectiveness of the progressive rehabilitation program. As the report notes once a quarry license is surrendered it must be re-designated through a subsequent NEPA application. It is at this time that the lands are assessed against the criteria for designation found under Part 1 of the NEP and an appropriate designation applied.	General	Niagara Escarpment Commission	Comment noted. Also see response # 1.	Response acknowledged.
7.	The report notes that it is anticipated by the applicant that the lands resulting from the rehabilitation would achieve a mix of land uses designations (ENA, EPA, ERA). It is noted that a number of uses proposed within the after-use plan would not be permitted within these designations. While inclusion within NEPOSS and the submission of a Park Management Plan could be a path to address this, it is noted that NEPOSS lands must be within the public realm necessitating ownership of the lands by a public body. On-going discussions and assessment of the rehabilitation would be required throughout the foreseeable future; the after-uses will be reasonably considered through this work and once the license has been abandoned.	General	Niagara Escarpment Commission	Comment noted. Also see response # 1.	Response acknowledged.
8.	Staff recommends the Progressive and Final Rehabilitation/Monitoring Study be revisited and updated once significant issues with the Level 1 and Level 2 Natural Environment Technical Report, Surface Water Assessment, Phase 1 and 2 Hydrogeological and Hydrological Study, other reports and After Use have been resolved.	General	Conservation Halton	Comment noted. If changes are required to the monitoring program or proposed rehabilitation land form these revisions will be reflected on the ARA Site Plans and the AMP since these documents will ultimately govern montoring and rehabilitation of the site.	On January 1, 2023, Ontario Regulation 596/22 came into effect. As a result, technical review services for planning and development applications previously provided by Conservation Halton (CH) under Memorandums of Understanding with municipalities (e.g., technical reviews related to natural heritage and select aspects of stormwater management) can no longer be provided. O. Reg. 596/22 does not affect CH's mandatory programs or services. CH has only reviewed this comment based on natural hazard, and wetland matters, per Ontario Regulation 686/21 and Ontario Regulation 162/06. CH has no further comment from a regulatory perspective. We defer any remaining natural

					heritage related comments to the other JART members to confirm whether it has been addressed. Halton Region staff have reviewed Nelson's response and provided the following JART response: The original comment still stands as the significant issues remain and the Progressive and Final Rehabilitation/ Monitoring Study should be revisited and updated when these issues are resolved.
9.	Ecological monitoring should be undertaken to ensure that mitigation measures are working as proposed and to ensure that the quarry is not impacting the natural environment. As per the Region's Aggregate Resources Reference Manual, monitoring of the NHS should be included. Current monitoring of ecological features that may be impacted and mitigated for by the proposed development is not included. Recommend that this be incorporated into the report.	General	Conservation Halton	The ecological monitoring is focussed on water based impacts since the adjacent features that have the potential to be impacted are water dependant features. Other ecological features (e.g. woodlands) include the required buffers / setbacks to ensure no negative impact to adjacent features. If there are any monitoring requirements that the agencies would like included please provide the specific monitoring note for Nelson's consideration and the rationale for inclusion. If appropriate, these monitoring requirements can be included on the ARA Site Plan or the AMP since these documents will ultimately govern the monitoring of the site.	On January 1, 2023, Ontario Regulation 596/22 came into effect. As a result, technical review services for planning and development applications previously provided by Conservation Halton (CH) under Memorandums of Understanding with municipalities (e.g., technical reviews related to natural heritage and select aspects of stormwater management) can no longer be provided. As such, we defer this comment to the other JART members to confirm whether it has been addressed. Sarah Mainguy, NSE, has reviewed Nelson's response and provided the following JART response: Amphibian monitoring, for frog and salamander species, should be conducted in the wetlands since the focus is on maintaining this function.
10.	The report identifies Conservation Halton as a potential future landowner for the rehabilitated site. No formal discussion has taken place with Conservation Halton on future land ownership, and consideration for any future CH park land has no bearing on Conservation Halton's review role as a member of the JART team.	General	Conservation Halton	Comment noted. Nelson believes Conservation Halton is an ideal partner for long term ownership of the site for numerous reasons. Nelson understands that any future conveyance of the site to Conservation Halton has no bearing on Conservation Halton's review role as a member of the JART team. Regardless of Conservation Halton's position on the application, if the application is ultimately approved Nelson commits to convey the land to Conservation Halton if Conservation Halton has a long term interest in the site.	Acknowledged.

11.	Recommended rehabilitation option RHB1, as shown on the Site Plan, requires perpetual pumping to maintain artificially low groundwater levels. An alternative (RHB2) has been proposed with resulting fish habitat impact concerns. No cost benefit analysis of impacts of the alternative rehabilitation scenario has been provided. The overall impact of the two rehabilitation scenarios on the subwatershed does not appear to have been considered in this analysis nor has the cumulative impact of the existing quarry been considered.	General	Norbert M. Woerns	Disagree. The overall impact of the two rehabilitation scenarios on the watershed have been considered. Based on this impact analysis RHB1 has been recommended to maintain discharge off-site since the existing approved rehabilitation plan discontinues off-site discharge. As part of the Burlington Quarry Extension application, Nelson has agreed to modify the existing quarry rehabilitation plan to maintain off-site pumping to improve conditions for surrounding lands compared to existing approvals.	The comparative impact analysis of the two rehabilitation scenarios is not complete. The cumulative impact of the existing quarry has not been considered in this analysis. RHB1 relies upon an unproven infiltration pond whose function has not been demonstrated nor have water quality impacts on down gradient wells been addressed.
12.	No discussion on the need to integrate the rehabilitation and closure plan of the proposed expansion with that of the existing quarry. The Progressive and Final Rehabilitation Monitoring Study provides detailed information on the rehabilitation of the proposed extension. Information is lacking on the relationship of the proposed extensions to the approved rehabilitation plan for the existing quarry.	General	Norbert M. Woerns	As noted in the application an amendment to the existing quarry rehabilitation plan will be required to integrate the proposed extension. Nelson has now submitted this application to MNRF. Attached is a copy of the revised rehabilitation plan that has been submitted to MNRF.	The proposed Rehabilitation Plan requires a change to the approved existing quarry rehabilitation plan. There is no discussion of the conformity between the two rehabilitation plans and the justification for changing the approved rehabilitation plan.
13.	There is no discussion of the maintenance requirements of the proposed land use for the preferred recommended rehabilitation option and the potential affects on surface water and groundwater quality.	General	Norbert M. Woerns	See response to Comment # 1.	The maintenance requirements of the rehabilitation scenario and resulting water quality impacts on surface water and groundwater have not been discussed.
14.	The rehabilitation plan does not explain how the West Extension area will be integrated with the existing quarry to achieve the preferred rehabilitation Scenario 1 (RHB1).	General	Norbert M. Woerns	See response to Comment # 12. A revised rehabilitation plan for the existing quarry has been submitted to MNRF to achieve the preferred rehabilitation scenario.	Since the proposed rehabilitation plan RHB1 for the proposed quarry extensions relies upon modifying the approved rehabilitation plan for the existing quarry, the integrated rehabilitation plan for both the existing quarry and the proposed expansion should be shown on the rehabilitation plan.
15.	The rehabilitation monitoring plan includes only monitoring of surface and ground water – no terrestrial monitoring of habitat or monitoring of wildlife to determine if the rehabilitated wildlife habitat features are functioning according to their specified purposes. Monitoring of biota should be included.	General	North-South Environmental Inc.	Monitoring of the site will be completed in accordance with the AMP until rehabilitation is complete and the license is surrendered. The license cannot be surrendered until MNRF is satisfied that the proposed land form as shown on the ARA Site Plans have been created which includes the required terrestrial habitat. The monitoring being referenced by North-South Environmental Inc. is not typically required for rehabilitated aggregate sites. If there are any monitoring requirements that the agencies would like included please provide the specific monitoring note for Nelson's consideration and an example where it has been included on other sites. If appropriate, these monitoring requirements can be included on the ARA Site Plan and / or the AMP since these documents will ultimately govern the monitoring of the site.	The focus of the report is the maintenance of the amphibian breeding function of the ponds. Therefore, amphibian monitoring is required to ensure mitigation can be directed to this function.

16.	The Plan relies heavily on pumping of water from the quarry to replace any surface water deficits that may affect wetlands in the future. This is discussed in the Adaptive Management Plan comments.	General	North-South Environmental Inc.	Comment noted. The AMP is the appropriate document to address any comments since the AMP includes the mitigation and monitoring requirements to prevent negative impacts to surrounding wetlands.	This comment still stands.
17.	Unclear on why the revision of the current rehabilitation plan is contingent on the approval of the extension- further details regarding this connection would be appreciated. Neither the current nor the proposed rehabilitation plans include any agricultural lands- please provide an explanation. For example, there are 162.0 hectares of grasslands proposed- why isn't this proposed for agricultural use? A number of the uses proposed in the after-use vision in Figures 6 to 9 are active, not passive, recreational uses (i.e. soccer/baseball fields, amphitheatre, volleyball courts, skate park etc.) and would not be considered compatible with the City's land use objectives for the Rural Area. For example, subsection 2.1.2 e) of the Burlington Official Plan, 1997: To allow only passive recreational uses that are compatible with rural land uses and the preservation of natural features and prime agricultural areas.	Page 4 Section 2.0. Overview of the Burlington Quarry Extension, Last 2 Paragraphs	City of Burlington	The existing approved quarry has an approved rehabilitation plan (e.g. lake with no off-site discharge). If the Burlington Quarry Extension is not approved Nelson will be completing rehabilitation in accordance with the approved rehabilitation plan. As per our recent meeting with JART, Nelson is exploring the possibility of restoring a portion of the existing quarry to agricultural with the agricultural soils from the proposed South Quarry Extension. This will be confirmed as part of Nelson's response to JART's agricultural comments. Regarding potential after uses please see response to Comment # 1.	Not resolved.
18.	The report notes that the 4.0 hectares proposed for an off-site ecological enhancement plan are currently in active agricultural production. Are these lands within a prime agricultural area? If they are to be permanently taken out of production through the creation of habitat for endangered species, these lands should be included within the Agricultural Impact Assessment. Given the lack of proposed agricultural uses within the rehabilitation plan, why are there no proposed off-site agricultural enhancements to mitigate the adverse impacts to the Agricultural System?	Page 17 Section 4.0. Rehabilitation and After Use Policy Analysis, 2nd Bullet	City of Burlington	Map 1 of the Region of Halton Official Plan designates the 4.0 ha area as part of the Regional Natural Heritage System and the area is also mapped by MNRF as habitat for Jefferson Salamander. While the area is also considered a prime agricultural area, the lands have a planned function to provide for natural heritage uses. In addition the ecological restoration does not remove the agricultural soils within this area and there are numerous areas mapped as prime agricultural area that also contain key natural heritage features. As per our recent meeting with JART, Nelson is exploring the possibility of restoring a portion of the existing quarry to agricultural with the agricultural soils from the proposed South Quarry Extension. This will be confirmed as part of Nelson's response to JART's agricultural comments.	Not resolved.

19.	The rehabilitation plan notes that rehabilitation back to an agricultural use is not required based on the applicable policies, but does not speak to the following Niagara Escarpment Plan policy: in prime agricultural areas, where rehabilitation to the conditions set out in (g) and (h) above is not possible or feasible due to the depth of planned extraction or due to the presence of a substantial deposit of high quality mineral aggregate resources below the water table warranting extraction, agricultural rehabilitation in the remaining areas will be maximized as a first priority. The report only quotes the amount of prime agricultural land in production (12.7 hectares). The policy framework for the protection of prime agricultural lands is not contingent on whether the lands are in active production. In the absence of a refinement to the Provincial and Regional prime agricultural area mapping, the City continues to consider the golf course lands in the Western Extension as prime agricultural, regardless of their current use. Further, it has not been established that the golf course lands are beyond rehabilitation to an agricultural use in future. The full amount of prime agricultural lands being removed should also be referenced here, for complete context.	Page 17 Section 4.0. Rehabilitation and After Use Policy Analysis, 1st Paragraph (after bullets)	City of Burlington	As per our recent meeting with JART, the agencies do not dispute that rehabilitation to agricultural in the West Extension and South Extension is not feasible based on the policies of the Niagara Escarpment Plan. The agencies determined that rehabilitation in the “remaining areas” refers to rehabilitation to agricultural in the existing quarry since the rehabilitated land form is proposed to change from a lake to also include areas of terrestrial habitat. As per our recent meeting with JART, Nelson is exploring the possibility of restoring a portion of the existing quarry to agricultural with the agricultural soils from the proposed South Quarry Extension. This will be confirmed as part of Nelson’s response to JART’s agricultural comments. Regarding the West Extension it is Nelson position that the West Extension does not contain prime agricultural land and therefore that portion of the application does not remove prime agricultural land.	Not resolved.
20.	This section indicates that during operations and until surrendering the licence, the licensee is required to operate in accordance with the Adaptive Management Plan, prepared by EarthFX Inc., Savanta and Tatham Engineering, dated April 2020, as may be amended from the time to time with approval from MNRF, in consultation with NEC, Region of Halton, City of Burlington and Conservation Halton. It is being noted that all JART comments related to natural environment, surface water, hydrologic, hydrogeologic and related assessments, and all respective comments concerning adaptive management plan (AMP) and site plan would need to be addressed first. As such, tables included in Section 6 of this report are considered preliminary/incomplete [refer to some comments/examples below].	Page 22 Section 5.1.6. Adaptive Management Plan	Halton Region	Comment noted. If changes are required to the monitoring program or proposed rehabilitation land form these revisions will be reflected on the ARA Site Plans and the AMP since these documents will ultimately govern monitoring and rehabilitation of the site.	Please see JART response to Comment #8. The Progressive and Final Rehabilitation/ Monitoring Study should be revisited and updated when these issues are resolved.
21.	There is no discussion on how the applicant will provide ‘confirmation that any long-term monitoring, pumping or mitigation will not result in a financial liability to the public.’ This appears to be a requirement of surrendering the ARA Aggregate Licence. Given uncertainties of the effectiveness of proposed mitigation measures this should be demonstrated prior to approval of the licence application for quarry expansion.	Page 22 Section 5.2. Final Rehabilitation, Point 8	Norbert M. Woerns	See response to Comment # 3.	The financial implication of maintaining, in perpetuity, the proposed quarry Western Extension dewatering, the existing quarry dewatering, infiltration pond system and associated pumping system to maintain wetlands, as well as seepage management beneath Side Road No.2 between the proposed South Extension and the existing quarry have not been addressed. In addition, possible future well complaints may need to be addressed and a cost assigned to this possibility. Ongoing responsibilities to supply water to impacted residences will need to be accounted for.

22.	The groundwater monitoring (Table 2) corresponds to Table 10: On-Site Groundwater Monitoring and Evaluation Program in Section 7.1 of the AMP (April 2020); both tables itemize proposed monitoring locations for the proposed South and West Extension areas. Any comments related to groundwater monitoring program in the assessment studies, AMP, and site plan should be addressed and applied accordingly to respective tables and text in this study.	Page 26 Section 6.1 Groundwater Monitoring Program, Table 2	Halton Region	Comment noted. If changes are required to the monitoring program or proposed rehabilitation land form these revisions will be reflected on the ARA Site Plans and / or the AMP since these documents will ultimately govern monitoring and rehabilitation of the site.	Please see JART response to Comment #8. The Progressive and Final Rehabilitation/ Monitoring Study should be revisited and updated when these issues are resolved.
23.	Table 3 in this study correspond to Table 11 - Groundwater Quality Parameters in the AMP (April 2020). Any comments related to groundwater monitoring program in the assessment studies, AMP, and site plan should be addressed and applied accordingly to respective tables and text in this study.	Page 27 Section 6.1 Table 3	Halton Region	Comment noted. If changes are required to the monitoring program or proposed rehabilitation land form these revisions will be reflected on the ARA Site Plans and / or the AMP since these documents will ultimately govern monitoring and rehabilitation of the site.	Please see JART response to Comment #8. The Progressive and Final Rehabilitation/ Monitoring Study should be revisited and updated when these issues are resolved.
24.	Information contained in Section 6.2 and Tables 4, 5, 6 of this study reflect information in Section 7.2 –Surface Water Monitoring Program and Tables 13, 14, 15 in the AMP (April 2020). Both sets of tables are essentially the same as the AMP's Tables 4, 5, 6 concerning the existing monitoring program. In designing monitoring programs for natural features, there should be close interlinkage between a receptor [specific wetland, stream, creek, spring, vernal pool, etc.] and designated surface water monitoring location. As such, any comments related to surface water monitoring program in the applicable assessment studies, AMP, and site plan should be addressed and applied accordingly to respective text in this study. Ecological/biological-type monitoring is missing in the proposed monitoring plan and is considered a major gap. Any monitoring associated with natural environment should be linked to its features and functions and should include monitoring of efficacy of any potential/acceptable water management system designed to protect or provide support to key natural systems components as per relevant comments concerning the applicable assessment studies, AMP, and site plan.	Pages 27-28 Section 6.2 Surface Water Monitoring Program Tables 4, 5, 6	Halton Region	The ecological monitoring is focussed on water based impacts since the adjacent features that have the potential to be impacted are water dependant features. Other ecological features (e.g. woodlands) include the required buffers / setbacks to ensure no negative impact to adjacent features. If there are any monitoring requirements that the agencies would like included please provide the specific monitoring note for Nelson's consideration and the rationale for inclusion. If appropriate, these monitoring requirements can be included on the ARA Site Plan or the AMP since these documents will ultimately govern the monitoring of the site.	As noted above, the focus is on maintaining the function of these wetlands as amphibian breeding ponds for Ambystomatid salamanders and frogs. Monitoring of these biota is required.
25.	It is also noted that Streamflow and Water Temperature Thresholds (AMP's Table 7) and Wetland Hydroperiod Thresholds (AMP's Table 8) are not included in AMP's Section 7 - Compliance Monitoring and Assessment or Section 6.2 of this study.	Pages 27-28 Section 6.2 Surface Water Monitoring Program Tables 4, 5, 6	Halton Region	Comment noted. If changes are required to the monitoring program these revisions will be reflected in the AMP since this document will ultimately govern monitoring of the site.	It is appreciated that according to the revised (2022) AMP, streamflow, water temperature and wetland hydroperiod thresholds are to be included, though the actual thresholds are to be determined later.
26.	Information contained in Section 6.3 in this study corresponds to Section 7.3 – Post-Extraction Monitoring Program in the AMP (April 2020). Any comments related to post-extraction monitoring program in the assessment studies, AMP, and site plan should be addressed and applied accordingly to respective text in this study.	Page 29 Section 6.3 Post-Extraction Monitoring Program Page 29	Halton Region	Comment noted. If changes are required to the monitoring program or proposed rehabilitation land form these revisions will be reflected on the ARA Site Plans and / or the AMP since these documents will ultimately govern monitoring and rehabilitation of the site.	There is no mention of post-extraction monitoring in the revised AMP. However, pumping is now proposed in perpetuity throughout the AMP. Monitoring is proposed until 3 years after rehabilitation is complete.

HYDROGEOLOGIST COMMENTS

Proposed Burlington Quarry Expansion
Interim JART COMMENT SUMMARY TABLE – Surface Water

Please accept the following as interim feedback from the Burlington Quarry Joint Agency Review Team (JART). Fully addressing each comment below will help expedite the potential for resolutions of the consolidated JART objections and individual agency objections. **Additional, new comments may be provided once a response has been prepared to the comments raised below and additional information provided**.

	JART Comments (February 2021)	Applicant Response (July 2021)	Interim JART Response (February 2022)	Applicant Response (June 2022)	JART Response (June 2023)
1.	Lacking details on groundwater monitor construction in or near surface water features. No monitor details or borehole logs in Appendices. Subsequent drive point information has been provided with no information on the soil units encountered.	The groundwater monitoring wells and mini- piezometers near each surface water feature are identified in the Watercourse and Wetland Characterization Tables enclosed as Schedule B and Schedule C of this submission. Appendix A: Hydrogeological Field Investigations of the Level 1 and 2 Hydrogeological and Hydrological Impact Assessment Report (Earthfx, April 2020) includes further details regarding the groundwater monitoring wells and mini-piezometers.	Additional background borehole information from the Golder studies and the shallow monitors completed by Tatham has been provided. See comment 11 above. It is noted that the shallow monitors completed by Tatham do not have descriptions of soil materials penetrated.	Drive point wells were selected to monitor the shallow groundwater levels beneath each wetland to minimize the disturbance to each wetland during installation. The drive point wells were driven into the overburden in each wetland without removing soil. As such, soils information was not collected at each drive point well installation.	Clarification provided on the lack of a soil log for Tatham shallow groundwater monitors.
2.	Only five wetlands of the 22 wetlands in the vicinity were instrumented with piezometers to assess vertical hydraulic gradients for water budget purposes. Water budget conclusions regarding the wetlands that have not been instrumented by Tatham therefore cannot be verified against measured data.	The key larger wetlands were instrumented. Matching the dynamics of these features with the integrated surface and groundwater model gave us confidence in our ability to represent the remaining wetlands correctly. The models considered key components of the water budget including, precipitation, canopy interception, overland runoff into and out of the wetlands, ET, infiltration, interflow, groundwater recharge, streamflow in and out of the riparian wetlands, groundwater interaction with the streams, and groundwater interaction with the perennially ponded areas. Detailed water budgets were prepared using simulation period averages of all PRMS and MODFLOW inflows and outflows. The flows were averaged over all cells falling within the polygons defined by the wetland area. The purpose was to compare the flow terms under each scenario to see how they change and re-balance under the different conditions. Quantitative model comparisons were made against observed shallow groundwater levels and ponded water levels. Simulated values of soil moisture were compared against these observations to determine how well the model approximated hydro period. It needs to be kept in mind that the simulation compares proposed conditions to existing to evaluate any potential adverse impacts caused by the proposal.	The lack of instrumentation of some of the wetlands results in uncertainty with respect to the model predictions. The model relies upon extrapolated or assumed site specific wetland conditions where instrumentation is lacking. Quantification of uncertainty with respect to model predictions because of extrapolations of data should be provided. Applicant could consider a sensitivity analysis for those wetlands not instrumented to determine parametric influence in the modelling.	A feature-based water balance was completed by Tatham to validate the results of the integrated surface and groundwater model. The results of the feature-based water balance are included in the Surface Water Assessment (Tatham Engineering Limited, April 2020). Through the development of the AMP, additional wetlands have been instrumented to confirm our understanding of the shallow overburden aquifer, groundwater/surface water interactions and wetland hydro periods. The additional instrumentation is documented in the MNDMNRF approved AMP (June 2022).	Additional wetlands are to be instrumented. There remains reliance on a few select wetlands for calibration purposes of the model predictions and water budget calculations.
82.	'The portion of the quarry discharge assigned to Spring J is determined through numerical analysis within the integrated surface water groundwater model. The balance of the quarry discharge resurfaces at Spring K which drains to Willoughby Creek downstream of SW7.' There are no flow measurements of Spring J and K except for one occasion April 10, 2006 by Worthington, 2006. There are no field data to confirm flow conditions from these two springs and consequently flow from the tributary of Willoughby Creek which feeds these two springs. It is known that a minimum of 2.0 liters/second of pump discharge from quarry sump 100 is diverted to the tributary of Willoughby Creek but the total flow characteristics of quarry sump discharge into the tributary to Willoughby Creek are not known. It is also not known how much water is diverted from Sump 100 discharge to the existing irrigation ponds on the golf course property. An assessment of impact on this tributary therefore relies upon computer simulations in the absence of critical streamflow information and without the benefit of verification of existing conditions with field measurements.	The discharge to the Unnamed Tributary of Willoughby Creek through the weir structure is monitored at surface water monitoring station SW1. The total flow is the sum of the weir discharge plus the 2 L/s discharge from the head box diversion. Refer to response to Comment 51.	The lack of spring flow data provide uncertainty with respect to the model predictions of impact from the proposed quarry expansion. The resulting uncertainty with respect to model predictions should be quantified.	Surface water monitoring station SW1 is maintained year-round (continuously recording monitoring device is not removed in the winter at this location as sufficient water depth prevents the device from freezing) and spring streamflow data is available for spring 2016 and spring 2018 through 2022. Also, the quarry discharge rate is monitored, recorded and available as required by the quarries PTTW. The monitoring data and quarry discharge rate were used in the calibration of the integrated surface and groundwater model.	The lack of spring monitoring data at Spring J results in uncertainty of the model predictions which are based upon an arbitrary allocation of water to Spring J.

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127.	'The Willoughby Creek watershed will be reduced in area at SW7 through extraction in the west extension. The overall watershed will be reduced by approximately 19 ha or 6% at SW7. As illustrated in the previous table, the proposed condition integrated surface water groundwater model predicts a minor reduction in Willoughby Creek average monthly streamflow through the Medad Valley due to the reduction in in watershed area, and consequently reduction in surface runoff, and the lowering of the groundwater table in the area through extraction and quarry dewatering. A reduction of 1.1 – 2.9 L/s is predicted at surface water monitoring location SW7. The reduction in streamflow is predicted to be greater in the fall, winter and spring (when more water is available in Willoughby Creek) and less during the summer months. The monitoring data collected to date shows a continuous base flow of approximately 4 L/s in Willoughby Creek at SW7. However, the quarry discharge contributes to the base flow at SW7 and it is expected that Willoughby Creek would run dry at SW7 if the quarry discharge were to cease. As proposed, the quarry discharge from Quarry Sump 0100 will be maintained during operations and long-term post rehabilitation. Maintaining the off-site discharge will maintain base flows in Willoughby Creek downstream of its confluence with its tributary.' Why is it expected that Willoughby Creek at SW7 will dry up by stopping pumping into the creek? See Earthfx, page 252, 1st paragraph where the model shows a net reduction in seepage at SW7 of 2.1 liters/second from phases 3456 extraction. This represents over 50.0% of measured base flow of 4.0 liters/second at SW7. By turning off the pumps in rehabilitation scenario 2 (RHB2) the model shows increased surface water flows in adjacent creeks not currently receiving sump discharge from the quarry (see Earthfx Figure 8.106, page 284)). There does not appear to be a complete cost benefit analysis with respect to the two rehabilitation scenarios.	In the interim condition, between the cessation of off-site discharge and full quarry lake, there is a potential for Willoughby Creek to dry out at surface water monitoring location SW7. As per the results of the integrated surface and groundwater model, leakage from the quarry lake, once filled, will help maintain streamflow in the Medad Valley and Willoughby Creek.	The conclusion that 'it is expected that Willoughby Creek would run dry at SW7 (unfortunately we understand that access to SW7 has been lost and this will be a significant gap for ongoing monitoring) if the quarry discharge were to cease' misrepresents the results of the computer model which shows a reduction in flow in Willoughby Creek. The potential for stream flow during rain events has been ignored. It is highly unlikely that flow in the Tributary to Willoughby Creek would cease except perhaps intermittently during seasonally dry periods. The intermittent nature of flow in the Tributary to Willoughby Creek is anticipated to be a natural condition due to its limited drainage area. The elevation of the final west lake needs to be assessed vs known fractures in the aquifer in order to determine the potential insignificance of any leakage to the Medad Valley.	As presented during the meetings held the week of May 16, 2022, additional analysis has been completed to assess the potential impacts the proposed quarry extension will have on the Medad Valley and Willoughby Creek. The analysis also assessed the proposed infiltration pond's ability to mitigate these potential impacts. The supplemental material prepared in support of the meetings should be reviewed for additional clarification regarding comment 127. Additional instrumentation (both shallow groundwater and streamflow monitoring stations) is proposed as part of the revised AMP to confirm our understanding of the surface water and groundwater regimes through the Medad Valley and confirm the results of the integrated surface and groundwater model.	The potential loss of flow to the Unnamed Tributary to Willoughby Creek can be managed and spread over a period of time to minimize the change in flow due to cessation of the quarry Northwest Sump discharge. The benefits of continuing pumping of quarry discharge have not been demonstrated. The assumption that the Tributary to Willoughby Creek will run dry is contradicted by the modelling results which show predicted average streamflow (Figure 8-105; Earthfx 2020) and a decrease in flow (Figure 8-106; Earthfx 2020). See comment 254 above.
130.	'The predicted average lake water level (269.00 m) is below the existing sill elevation (269.08 m) of the weir structure constructed by the BSGCC in the weir pond (wetland 13202) which created the weir pond (wetland 13202), maintains water levels in the wetland and controls discharge to the tributary of Willoughby Creek and consequently Willoughby Creek. When the lake water level drops below an elevation of 269.08 m, gravity discharge to the tributary of Willoughby Creek will not occur. Also, the average water level in the weir pond (wetland 13202) is 269.27 m. The wetland water level will drop in response to the lake water levels and cessation of off-site discharge.' Have modifications to the weir been considered to maintain gravity flow to the Tributary to Willoughby Creek?	Refer to response to Comment 34.	The wetland upstream of the weir outlet is considered to be a direct result of the quarry sump discharge and the construction of the weir. The proposed Collins Road diversion of surface drainage north of Collins Road to the Tributary of Willoughby Creek will contribute flow to the Tributary to Willoughby Creek. In addition, the eventual filling of the quarry excavation will ultimately restore groundwater levels to approaching pre-quarry conditions resulting in higher groundwater levels and increased base flow to local drainage channels as predicted in the model. The option of continuing pumping to maintain artificially low groundwater levels appears to have fewer advantages from a groundwater and surface water perspective than allowing groundwater levels to rebound with the filling of the quarry following closure of the quarry operations. Due to the relatively small surface water catchment of the Tributary to Willoughby Creek it is anticipated that this drainage tributary would have seasonal flow. The quarry pump discharge has altered the flow in this drainage tributary to an artificially high level creating surface water characteristics that previously did not exist naturally.	The proposed surface water mitigation strategy for the quarry aims to maintain the existing form and function of the natural heritage features, specifically the unnamed tributary of Willoughby Creek and Willoughby Creek, which have received quarry discharge for over 60 years. The cessation of the quarry discharge from sump 0100 as approved under the current quarry ARA license will alter the streamflow rates and patterns through the unnamed tributary of Willoughby Creek and Willoughby Creek, altering the form and function of these natural heritage features. Given these potential negative impacts, we support pumping in perpetuity from sump 0100 to maintain these features.	The approved ARA License requires cessation of pumping as part of the existing quarry rehabilitation This will alter the natural heritage features that have been artificially created by the quarry discharge. The rationale for the approved quarry rehabilitation has not been provided. From a water resource perspective, the benefits of the approved cessation of quarry pumping on the local groundwater system and consequent net benefits to associated surface water features have not been fully evaluated. The significance of these changes on the natural heritage features has also not been fully explained, to allow reviewers to evaluate the pros and cons of pumping vs no pumping scenario. The rationale for the decision to continue pumping in perpetuity should be supported by evidence that integrates groundwater, surface water and ecological interpretation.

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131.	'This is an important consideration as Willoughby Creek and the West Arm have been identified as fish habitat. Base flow and water temperature are critical to the form and function of these watercourses from a natural heritage, habitat and spawning perspective. Rehabilitating the Burlington Quarry as approved will negatively impact Willoughby Creek and the West Arm as flows will be reduced and/or eliminated. Similarly, the weir pond (wetland 13202) and the wetland 13203 (located along the West Arm adjacent to the south extension) are currently identified as natural heritage features. These features are dependent on the quarry discharge to maintain their hydro period and may dry out under the approved rehabilitation plan.' Has drying out of features been established with supporting field evidence and analysis. The lack of understanding of the critical flow characteristics of the tributary of Willoughby Creek brings into question the validity of the conclusions regarding the impact from the quarry and quarry discharge on Willoughby Creek.	As illustrated in the streamflow monitoring summaries provided for surface water monitoring location SW1, the depth of water in the wetland has reached 0 m when the quarry discharge ceases for an extended period of time. At the same time, the discharge downstream into the Unnamed Tributary of Willoughby Creek ceases when discharge from the quarry ceases for extended periods of time.	Clarification provided although questions remain. 'SW1 measures the flow through the weir structure to the tributary to Willoughby Creek downstream. The quarry discharge occurs year round, maintaining sufficient water depth and flow at SW1 to prevent freezing of the pressure transducer at SW1' (Tatham Page 9, 3rd paragraph). This appears to contradict the contention that 'the depth of water in the wetland has reached 0 m when the discharge ceases for an extended period of time.	Since monitoring station SW1 was established, there have been extended periods (5+ consecutive days) where quarry discharge has ceased during the year (not restricted to winter months). During these periods, the discharge through the weir structure to the unnamed tributary of Willoughby Creek ceased. This is further substantiated by complaints received from downstream property owners claiming a lack of flow through Willoughby Creek during these periods.	Given the limited surface water catchment of the Unnamed Tributary to Willoughby Creek, it would be reasonable to assume that periods of no flow would be experienced during dry periods prior to the quarry sump discharge. Tatham has recommended diversion of external drainage north of Colling Road to a drainage ditch discharging directly to the Northwest Sump discharge point at SW1, thus bypassing the existing quarry. This would have the effect of contributing flow to the Unnamed Tributary to Willoughby Creek. This is expected to have a mitigating impact on the reduction of flow with cessation of the Northwest Sump Discharge. It is unclear that this was accounted for in the model simulations.
147.	Preliminary base flow and temperature thresholds are recommended. Water quality thresholds for total suspended solids, pH, and oil and grease for discharge waters are part of the existing quarry Environmental Compliance Approval (ECA). Tatham recommended that these be maintained for the proposed expansion. No threshold or target water quality levels for the remaining water quality parameters included in the monitoring program, currently exist. 'It's recommended that the water quality thresholds be established from the results of the historic water quality sampling completed in support of the proposed quarry extension. Specifically, maximum and minimum concentration limits should be established from the sample results collected while considering the Provincial Water Quality Objectives (PWQO) and role water quality plays in the Natural Heritage Features.' (Tatham, page 88, 3rd paragraph.) No such recommendation has been made for groundwater quality parameters.	The AMP will be refined moving forward in collaboration with the review agencies and additional water quality thresholds will be established, if necessary.	The proposed rehabilitation Scenario RHB1 proposes to infiltrate quarry sump discharge to maintain groundwater levels in support of down gradient water well supplies. Drinking water quality standards should be applied to the infiltrated sump water as this infiltrated water is intended to provide drinking water supplies for down gradient private wells. See JART Hydrogeology Table comment 7, 8, 18, 193, 208, 269, and 298.	The revised AMP outlines the proposed water quality sampling and water quality thresholds for the quarry extension. The water quality sampling, including testing parameters and objective limits, will be further refined through the necessary amendment to the quarries MECP Environmental Compliance Approval to protect the downstream natural heritage features and groundwater resources.	The AMP recommends continuing the water quality sampling of the sump discharge as per the existing ECA. The existing ECA has specified threshold levels for three water quality parameters including Total Suspended Solids, PH and Oil and Grease. It appears as though no consideration has been given to the Northwest Sump discharge as a source of drinking water as it is intended to recharge this water to sustain down gradient groundwater drinking water supplies to private wells. Water quality monitoring of the Northwest Sump water should be increased to address potential drinking water quality concerns in down gradient wells.
148.	'Extraction will reduce the drainage area to wetland 13201 northwest of No. 2 Side road forming the headwaters of the unnamed tributary of Lake Medad. Reducing the drainage area of the wetland has the potential to adversely impact the wetlands hydro period. As such, a mitigation strategy has been developed to supplement the flow into the wetland during operations as required. A bottom draw outlet will be constructed in the southeast corner of the proposed replica pond and an outlet pipe complete with a control valve will be installed to discharge water into the roadside ditch along No. 2 Side road feeding the wetland. The wetland hydro period will be monitored and water will be discharged to the wetland as required to maintain the wetland hydro period.' What are the threshold levels for the hydro period for this wetland?	The wetland threshold values will be developed from the wetland hydro period monitoring data currently being collected and the results of the integrate surface and groundwater model and wetland water balance moving forward as part of the refinement of the AMP.	No shallow groundwater monitor existed within this wetland for the water balance analysis although Tatham has recommended installation of monitor SW36 at this location. The wetland water balance analysis relied upon data from nearby areas for groundwater information. The wetland water balance may therefore not be representative of conditions at this wetland. Threshold levels should be established for this wetland prior to quarry expansion and based upon sufficient monitoring data to characterize both surface water and groundwater baseline conditions at this wetland.	Both wetland hydro period and shallow groundwater monitoring stations were established in wetlands 13200 and 13201 in the spring of 2020. The wetland hydro period thresholds will be established in accordance with the revised AMP prior to any site preparation and alteration to surface catchments in the west extension after at least 9 more years of baseline monitoring data is collected.	The AMP proposes to establish wetland hydroperiod for wetland 13201 from monitoring data collected beginning in 2020. The hydroperiod and threshold levels should be established prior to the issuing of an ARA licence.

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149.	Mitigation measures are described with respect to meeting thresholds and triggering mitigation for streamflow, stream temperature, wetland hydro period, effluent limits, and water quality. Changes to surface water regime can change rapidly in response to precipitation events. How will the trigger levels be responded to and mitigative measures be implemented? The current monitoring program consists of continuous data logger recordings plus monthly manual flow measurements, quarterly water quality sampling, and weekly field visits to monitor wetland hydro periods during the seasonal wetland hydro period.	The AMP will be refined moving forward in collaboration with the review agencies providing clear direction on how the triggers will be responded to and mitigative measures will be implemented.	Discharge water quality limits for three parameters, total suspended solids, oil; and grease and pH, are to be continued from the requirements of the existing Environmental Certificate of Approval. Surface water quality maximum and minimum limits have been recommended by Tatham although not yet established with the exception of water temperature thresholds. The are no recommendations for groundwater quality thresholds or maximum limits. These should be established if the proposed infiltration ponds are to receive sump discharge.	The revised AMP outlines the proposed water quality sampling and water quality thresholds for the quarry extension. The water quality sampling, including testing parameters and objective limits, will be further refined through the necessary amendment to the quarries MECP Environmental Compliance Approval to protect the downstream natural heritage features and groundwater resources.	The AMP specifies a statistical approach for establishing threshold levels for groundwater levels. A percentile method will be employed to establish percentiles which will be used to establish threshold water levels. This presumably involves all of the groundwater level monitoring data available at a particular monitoring location. Once the threshold levels have been established and reached at a particular monitoring location, the approach involves a detailed trend analysis comparing groundwater levels for the same month each year in order to establish a trend through a statistical trend analysis. Threshold groundwater levels will be established over a three (3) year period of monitoring groundwater levels. Once a declining trend has been established in a domestic water well a date will be determined of when the water level is predicted to reach a minimum of 5 metres of available drawdown in a domestic well. The slope of the declining water level trend will be used to predict the timing of when mitigation measures will need to be implemented to avoid a water shortage. It is not clear how this analysis for monitoring or sentry wells will be applied to nearby domestic wells. The AMP does not address groundwater quality threshold levels and mitigation approaches to groundwater quality impacts. It is also not clear whether the resident or the applicant will be responsible for the operation, maintenance, and replacement costs of a water treatment system if required, due to impacts from quarry operations.
153	Manual water level readings are shown on hydrographs in Appendix G. Appendix F summarizes manual shallow groundwater levels although it is not clear what the measuring point was and the significance of negative values.	The datum (existing grade) is provided on the graphs. As the datum is set at existing grade, positive values mean water levels are above existing grade and negative values mean water levels are below existing grade.	Comment noted.	RESOLVED	Clarification is provided with respect to water level measurements on the Table in Appendix F.
154.	Water quality results are presented in Appendix H, however there is no discussion of water quality in the report with respect to drinking water quality standards. Infiltration of surface water is proposed to maintain down-gradient private well water supplies. Emphasis is focused upon the threshold values of selected parameters included in the Environmental Compliance Approval (ECA) for the existing quarry.	Refer to the Level 1 and 2 Hydrogeological and Hydrological Impact Assessment Report for discussion regarding water quality and the impact the infiltration pond will have on down- gradient wells.	The Level 1 and Level 2 Hydrogeological and Hydrological Impact Assessment Report assumes that the infiltration ponds will have no negative impact on down gradient wells. This is not supported with a detailed analysis of surface water and groundwater quality. An examination of water quality with respect to the Ontario Drinking Water Standards is required. The existing Environmental Certificate of Approval has water quality limits for three parameters, total suspended solids, oil and grease and ph. The limits for these parameters are surface water limits and do not reflect Ontario Drinking water standards with the exception of ph.	The infiltration pond will intercept direct rainfall and runoff and receive discharge from the existing quarry of the same quality as the existing irrigation ponds constructed on the Burlington Springs Golf and Country Club property, which the infiltration pond has been designed to simulate. The discharge water quality sampling, including testing parameters and objective limits, will be further refined through the amendment to the quarries MECP Environmental Compliance Approval to protect the downstream natural heritage features and groundwater resources.	The AMP does not address water quality sampling of the Northwest Sump discharge beyond the existing ECA requirements which stipulates threshold levels of only three water quality parameters. The existing ECA does not appear to recognize the discharge water as a source of drinking water to down gradient private wells through the proposed infiltration ponds. No water quality thresholds related to drinking water standards have been proposed for the Northwest Sump discharge water. Bacteriological testing of the discharge water was also not considered to ensure safe drinking water in the infiltration pond water.

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	JART Comments (February 2021)	Applicant Response (July 2021)	Interim JART Response (February 2022)	Applicant Response (June 2022)	JART Response (June 2023)
3.	Nelson Quarry obtained ECA from MECP in June 2017 that permits collection, transmission, treatment and off-site disposal of surface water and quarry water. Will the current PTTW and the ECA revised if the quarry expansions extend southward and westward?	The current PTTW and ECA will have to be amended for the proposed south and west extensions, specifically for the new water taking and discharge from the south extension and discharge into the wetlands associated with the west extension.	Noted. No further comments.	RESOLVED	
4.	What is the rate at which Quarry Sump 0100 pumps water to the Colling Road roadside ditch? Will this rate be altered under the future conditions? If so, the conveyance features along Colling Road should be assessed for capacity and erosion potential.	The current PTTW allows a maximum discharge rate of 4,090 L/min (~68 L/s) from Sump 0100 into the roadside ditch along Colling Road. There are currently no plans to increase this discharge rate.	If Nelson constructs a conveyance system alongside Colling Road to redirect external drainage, the combined discharge (external drainage plus the Quarry Sump 0100) could exceed the ditch capacity.	If Nelson elects to proceed with the diversion of flow along Colling Road, the conveyance system will be reviewed or improved to ensure it has adequate capacity from Blind Line to the unnamed tributary of Willoughby Creek.	Nelson (through Tatham) provided a Technical Memorandum (April 13, 2023) to Conservation Halton which outlined that Nelson is now abandoning the proposal to divert flows along Colling Road in favour of maintaining the existing flow paths whereby the subject catchments would continue to discharge to the quarry and then be pumped to the Willoughby Tributary. Tatham states that the proposed on-site lake has been designed to have sufficient storage to accommodate the system requirements in the absence of this diversion; calculations will be required to confirm this perspective, along with the requisite updates to the AMP
5.	Similarly, will the pumping rate of Quarry Sump 0200 be maintained in compliance with the ECA? Is there an intention to apply for an amendment of the ECA which was issued in 2017?	The current PTTW allows a maximum discharge rate of 945 L/min (~16 L/s) from Sump 0200 into the West Arm of the West Branch of the Mount Nemo Tributary of Grindstone Creek. The PTTW and ECA will have to be amended as described under response to Comment 3. However, there are currently no plans to increase the discharge rate from Sump 0200.	Clarification provided.	RESOLVED	
6.	Did Nelson Quarry encounter a spill incident during any of the effluent monitoring periods?	Minor spills have occurred on-site and they have been addressed through the Quarry's Spills Management Plan. The MECP has been notified of all spills. The water quality sampling program completed under the ECA confirms contaminants from the minor spills have not entered the on- site settling ponds or been discharged off-site.	No further comments.	RESOLVED	
7.	The surface water monitoring program has been implemented for the last 6 years. Were any of the public agencies (Conservation Halton, Region of Halton or the City of Burlington) involved in equipment installation and the review of the monitoring observations?	The public agencies listed have not been involved in the monitoring program to date. Several of the surface water monitoring stations were installed in support of the PTTW and ECA. The remainder have been installed in support of the proposed expansion. The monitoring locations were selected to provide a comprehensive surface water monitoring network of the Quarry and its surrounding area based on experience on similar projects and considering the results from previous studies/applications.	Acknowledged. No further comments.	RESOLVED	
8.	What steps did the proponent take to ensure quality of the collected data from the monitoring stations? What QA/QC practices was in place to ensure proper functioning of the monitoring equipment. Were any outliers encountered?	Monthly field visits are conducted to each monitoring station to collect in-situ calibration data (water depths, temperatures, flow rates) and confirm the monitoring devices are functioning properly. The continuous monitoring data collected by the data loggers at each monitoring station is adjusted to the monthly in-situ calibration data collected to ensure the data matches field observations. Over the course of the monitoring program, data loggers have malfunctioned, and the loggers were repaired or replaced as expediently as possible to ensure data loss is minimized.	No further comments.	RESOLVED	
9.	The Burlington Springs Golf and Country Club has constructed a weir structure which maintains water levels in the wetland, maintains flow downstream to a tributary of Willoughby Creek and diverts flow to a series of constructed irrigation ponds on the golf course via a diversion channel. Will this weir continue to exist under the future conditions or will its function be replicated through another structure?	It is the intent to utilize the existing weir structure and the stop logs employed by the Burlington Springs Golf and Country Club to maintain water levels in the upstream wetland and divert a portion of the quarry discharge to the proposed infiltration pond.	More information is required, and a conceptual design should be included in the AMP. Measure of infiltration ponds discussed separately.	The proposed surface water management strategy for the quarry includes utilizing the existing weir structure and stop logs constructed and used by the Burlington Springs Golf and Country Club. We are not proposing to construct a new weir structure. Please clarify what additional information is required.	Not resolved.
10.	Could not locate monitoring station SW11A, SW12A, SW13A and SW16A on the drawings. Please make sure the monitoring station names are consistent in the report and the drawings.	The Existing and Proposed Surface Water Monitoring Locations Plans (Drawings SW-1 and SW-2) have been revised accordingly and are enclosed for reference. It's noted, the wetland hydro period and shallow groundwater monitoring stations are located at the same location. As such, we have not differentiated between the wetland hydro period and shallow groundwater monitoring stations on the plan. The wetland hydro period and shallow groundwater monitoring stations are identified as SW5, SW11, SW12, SW13, SW16, SW36, SW37 and SW38 on the revised drawings.	Comment addressed.	RESOLVED	

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11.	An assessment of the existing roadside ditches will be required to confirm enough capacity, or the existence of potential capacity to carry flow during design events.	An assessment of the existing roadside ditches downstream of the discharge locations is enclosed for reference. The assessment confirms the roadside ditches have adequate capacity to convey the proposed flows.	Comment addressed.	RESOLVED	
12.	Will the new conveyance system which will carry external flows, and which will be located within Nelson property, replace the existing drainage channel that runs roughly parallel to Colling Road within the quarry?	The proposed Colling Road diversion will not replace the existing drainage channel within the Quarry. The existing drainage channel will remain.	More details required to confirm the response.	The existing channel is constructed in the quarry floor from the rehabilitated wetland in the northeast corner of the quarry to sump 0100. The proposed Colling Road diversion will be constructed at grade parallel to Colling Road from Blind Line to the existing quarry discharge location. The intent is to intercept external drainage and convey it around the quarry to the existing outlet reducing the surface water management requirements of the quarry while improving the streamflow hydrograph in the unnamed tributary of Willoughby Creek. The only way to accomplish this is to intercept external runoff at grade through the Colling Road diversion, separating it from the existing channel constructed across the quarry floor. Please clarify what additional information is required.	Nelson (through Tatham) provided a Technical Memorandum (April 13, 2023) to Conservation Halton which outlined that Nelson is now abandoning the proposal to divert flows along Colling Road in favour of maintaining the existing flow paths whereby the subject catchments would continue to discharge to the quarry and then be pumped to the Willoughby Tributary. Tatham states that the proposed on-site lake has been designed to have sufficient storage to accommodate the system requirements in the absence of this diversion; calculations will be required to confirm this perspective, along with the requisite updates to the AMP.
13.	There are several drainage features within the existing quarry. Will those features undergo any changes and realignments after the extraction operations cease?	Yes, some of the current drainage features will be modified as part of the proposed rehabilitation plan for the existing quarry. The proposed site amendment for the existing quarry rehabilitation plan has been provided to the agencies under separate cover. Tatham assisted with the water management components of the rehabilitation design for the existing quarry and proposed extension.	No further comments.	RESOLVED	
14.	Will the proposed new conveyance system along Colling Road only carry flow from S100 (84.0 hectares) or will the catchments S113 through S116 (a total of 58.0 hectares) also drain into the new conveyance feature.	The proposed Colling Road diversion will convey surface runoff from Catchment S100 and Colling Road only. The surface runoff from Catchments S113 through S116 currently drain onto the existing quarry floor and will continue to do so if the Colling Road diversion is constructed.	Acknowledged. More information is required to confirm how this would be achieved.	See response to CH comment 12.	Nelson (through Tatham) provided a Technical Memorandum (April 13, 2023) to Conservation Halton which outlined that Nelson is now abandoning the proposal to divert flows along Colling Road in favour of maintaining the existing flow paths whereby the subject catchments would continue to discharge to the quarry and then be pumped to the Willoughby Tributary. Tatham states that the proposed on-site lake has been designed to have sufficient storage to accommodate the system requirements in the absence of this diversion; calculations will be required to confirm this perspective, along with the requisite updates to the AMP
15.	Will the proposed conveyance system along Colling Road only carry minor flows? How are the major flows proposed to be managed?	The proposed Colling Road diversion will be designed to convey both minor and major flows from Catchment S100 and Colling Road.	Acknowledged. Capacity of the right-of-way to accommodate the major flows will have to be provided to the City.	If Nelson elects to proceed with the diversion of flow along Colling Road, the diversion system will be engineered to convey the required minor and major storm peak flows to the satisfaction of the City of Burlington. Also, the conveyance system downstream of the diversion will be reviewed or improved to ensure it has adequate capacity from the existing quarry discharge location to the unnamed tributary of Willoughby Creek.	Nelson (through Tatham) provided a Technical Memorandum (April 13, 2023) to Conservation Halton which outlined that Nelson is now abandoning the proposal to divert flows along Colling Road in favour of maintaining the existing flow paths whereby the subject catchments would continue to discharge to the quarry and then be pumped to the Willoughby Tributary. Tatham states that the proposed on-site lake has been designed to have sufficient storage to accommodate the system requirements in the absence of this diversion; calculations will be required to confirm this perspective, along with the requisite updates to the AMP
16.	In which direction does catchment S102 drain from the Colling Road and Cedar Springs Road intersection. Does it flow north along Cedar Springs Road towards tributary of Willoughby Creek or does it flow east directly towards Willoughby Creek?	We reviewed the existing drainage patterns at the intersection of Colling Road and Cedar Springs Road and believe surface runoff from Catchment S102 drains north along Cedar Springs Road to the Unnamed Tributary of Willoughby Creek.	Confirmation should be provided with survey or a reasonable alternative.	To establish the drainage patterns, a field visit was conducted, and the drainage patterns were reviewed. It is noted there is a culvert under Colling Road that conveys surface runoff north to the unnamed tributary of Willoughby Creek.	Not resolved.
17.	Is the Wetland 13201 a natural feature or has it formed as a result of the obstructed culvert? Does this wetland feature provide any critical hydrologic function?	It is unknown if Wetland 13201 is a natural feature or if it has been formed by the obstruction of the No. 2 Sideroad culvert. Wetland 13201 is not believed to provide a significant hydrologic function.	Confirmation should be provided with a functional analysis or assessment.	Wetland 13201 was included and assessed through the integrated surface and groundwater model, feature based wetland water balance and natural heritage assessment prepared in support of the quarry extensions.	Not resolved.
18.	Thank you for confirming that the existing drainage patterns within Burlington will remain unchanged even if the quarry expands west and south.	No response required.	Acknowledged.	RESOLVED	
19.	Will there be operations and maintenance staff to monitor quarry sumps after the extraction operations cease at Burlington quarry?	Operation and maintenance will be the responsibility of the new owners of the property and they will be required to comply with the instruments under the Ontario Water Resources Act.	Acknowledged. Please add the necessary wording to this effect in Section 7 of the Surface Water Report and include it in the AMP.	The revised AMP speaks to the operation and maintenance of the off-site quarry discharge following rehabilitation of the site and surrender of the ARA license (in perpetuity).	Not resolved.

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20.	Will the discharge from the two expansions follow the existing PTTW or is there a proposal to apply and obtain a separate PTTW and ECA.	Refer to response to Comment 3.	Comment addressed.	RESOLVED	
21.	City requests to be circulated on any proposed changes to the configurations of the existing settling ponds.	Understood.	No further comments.	RESOLVED	
22.	Please provide existing and proposed conditions Visual OTTHYMO 6 hydrologic model schematic.	Existing and proposed VO6 model schematics are enclosed for reference.	Addressed.	RESOLVED	
23.	Extraction in the west extension will reduce the size of sub-catchment draining to wetlands as well as those draining to the municipal drainage systems. This indicates that the drainage will be redistributed during the post development conditions. Please confirm that the extra, redirected flow will be retained in the reconfigured pond and will not result in an increase of flow in a different direction.	The west extension will redistribute the surface runoff draining to the wetlands and municipal drainage systems. The redistributed surface runoff will drain internally to the Quarry's settling ponds where it will be stored and discharged off-site in accordance with the terms and conditions of the PTTW and ECA. As such, the flows draining off-site will not increase under proposed conditions (during operations and post rehabilitation).	Will hydro-period change which could impact environmental features reliant on water volumes at key times of the year?	The proposed monitoring program, wetland hydro period thresholds and mitigation measures specified in the revised AMP have been designed to maintain wetland hydro period.	Not resolved.
24.	It is recommended that the proponent take another look at the proposed rehabilitation plan towards the end of the extraction operation and to make any modifications to the rehabilitation plan to accommodate any hydrologic changes encountered during the extraction period.	The design of the rehabilitated landform needs to be completed now since progressive rehabilitation is required during operations and the work includes significant grading. Mitigation, monitoring and annual reporting of hydrologic conditions will be completed throughout the operations and during rehabilitation to prevent adverse impacts to adjacent key hydrologic features. If the pumping regime requires any future adjustments this can be accommodated based on the proposed rehabilitated landform for the existing quarry and proposed extension.	Applicant should follow principles of adaptive management.	As outlined in the revised AMP, the monitoring and reporting of hydrologic conditions will be completed throughout the duration of the project and the AMP will be revisited every five years to ensure the AMP remains current and any necessary changes to the operation and rehabilitation of the quarry are implemented.	Not resolved.
64.	Section 3.1.1 (Page 28 of 601) "As part of ongoing operations within the existing Burlington Quarry, Nelson is exploring options to divert this external drainage from northwest of Colling Road directly to the discharge location of Quarry Sump 0100; preventing the runoff from entering the existing quarry. This would include the construction of a conveyance system (a culvert, ditch or combination of the two) alongside Colling Road within Nelson's property between Blind Line and the quarries existing discharge location (Quarry sump 0100). With this in place, the external runoff would drain to its existing outlet, the tributary of Willoughby Creek, without entering the active quarry operation. This will reduce the surface water management requirements of the active operation." Please provide more information about the proposed conveyance system along Colling Road between Blind Line and the weir pond (wetland 13202) which will carry external flows bypassing the active quarry operations.	Refer to response to Comments 12, 14, 15, 37 and 65. A preliminary design of the proposed Colling Road diversion is enclosed for reference.	Thank you for providing a preliminary design. A revised design will be needed if the flow rate changes.	Understood.	Nelson (through Tatham) provided a Technical Memorandum (April 13, 2023) to Conservation Halton which outlined that Nelson is now abandoning the proposal to divert flows along Colling Road in favour of maintaining the existing flow paths whereby the subject catchments would continue to discharge to the quarry and then be pumped to the Willoughby Tributary. Tatham states that the proposed on-site lake has been designed to have sufficient storage to accommodate the system requirements in the absence of this diversion; calculations will be required to confirm this perspective, along with the requisite updates to the AMP
70.	Section 3.2.3 West Extension (Page 30) "It is noted, the drainage systems, specifically roadside ditches, downstream of the culvert crossings Cedar Springs Road are poorly defined or nonexistent. It is expected that any surface runoff draining through the culverts will either, evaporate, infiltrate or drain overland following the topographic low through the road allowance or across private property to the Medad Valley and Willoughby Creek." Further investigation is needed to determine the baseline conditions in order to understand the flow regime.	A summary of the drainage conditions established through additional field inspections and streamflow monitoring is as follows: 1) Surface water monitoring location M33 – culvert crossing No. 2 Sideroad is completely obstructed, the downstream end of the culvert could not be located and there is no define channel downstream of No. 2 Sideroad. It is expected surface runoff collects in the wetland upstream and infiltrates or evaporates. Based on monitoring of the wetland completed in 2020 and to date in 2021, little water accumulates in the wetland and the wetland is perched above the groundwater table. The shallow groundwater level increases rapidly during rain events indicating infiltration of surface runoff into the underlying soil. 2) Surface water monitoring location M34 – appears to drain east under Cedar Springs Road onto the Quarry property and into Wetland 13201. During our rounds of surface water monitoring, we have not witnessed flow through this culvert. 3) Surface water monitoring location M35 –surface runoff	#1: No further comments. #2, #3 and #4: Please confirm the drainage direction. Further analysis is needed to estimate flow at each of those locations during the range of storm events. No flow at a specific time should not lead to a no-flow conclusion. #5: Confirmation needed through a survey (please see response to comment # 16).	The drainage patterns described previously were determined through filed investigations. At surface water monitoring location M34, surface runoff drains east under Cedar Springs Road onto the quarry property and into Wetland 13201 through the roadside ditch. At surface water monitoring location M35, surface runoff drains west through a culvert under Cedar Springs Road then under Cedar Springs Court. There are no defined drainage features west of Cedar Springs Court and surface runoff continues to flow west overland. An event based hydrologic analysis was completed in support of the proposed quarry extension and the results of the analysis were presented in the Surface Water Assessment (Tatham Engineering Limited, April 2020) at	Not resolved.

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		drains west through a culvert crossing under Cedar Springs Road and a crossing under Cedar Springs Court. No defined outlet was identified downstream of Cedar Springs 4) Court and surface runoff is expected to flow west overland as sheet flow to Willoughby Creek. During our rounds of surface water monitoring, flow has not been witnessed in this the Cedar Springs Road culvert. 5) Surface water monitoring location M36 – surface runoff drains west through a culvert crossing under Cedar Springs Road and continues west to Willoughby Creek through a poorly defined channel across private property. During our rounds of surface water monitoring, flow has not been witnessed in this culvert. Cedar Springs Road and Colling Road intersection – refer to response to Comment 16.		key locations. Recognizing that the surface catchment areas draining to surface water monitoring locations M34 and M35 will be reduced as part of extraction in the west extension, and consequently peak flows to each culvert will be reduced, we didn't feel it warranted to report the design storm peak flows each culvert crossing and haven't done so with this submission. See response to Comment 16.	
94.	The results of the event based hydrologic model during operation phase and in the post rehabilitation conditions remain the same. These both results are, however, quite different from the existing conditions hydrologic model results for all locations and for all design events. During the operations and under the rehabilitated conditions the West Arm, Weir Pond and Wetland 13201 flows are reduced, and the Burlington Quarry flows significantly increased as compared to the existing conditions. Please refer to Tables 21, 30, and 37. Were the review agencies previously made aware of the fluctuation in flows and is there any correspondence in this regard?	The review agencies were not previously made aware of these changes. The agencies have been made of aware of the changes through the circulation of the Surface Water Assessment.	Under the proposed conditions, both during operation and rehabilitation, peak flow rates at key nodes must match the flows at the same nodes during existing conditions.	As noted, the design storm peak flows directed to the West Arm, Weir Pond and Wetland 13201 will be reduced under the operational and rehabilitation phases of the project. However, discharge to the West Arm and Weir Pond from sumps 0200 and 0100, respectively, will continue to maintain the form and function of these systems. Also, the hydro period of Wetland 13201 will also be maintained through discharge of quarry water as per the recommendations of the revised AMP. The Burlington Quarry node identified represents the peak flow rate into the quarry. The runoff into the quarry will drain to the quarries internal settling ponds where it will be treated, stored and discharged off-site at rates approved through the quarries PTTW.	Not resolved.
110.	It is understood from Section 4.1.2 "South Extension" that a temporary settling pond will be constructed during the initial three years of extraction which will be ultimately replaced with a larger quarry sump that is proposed to maintain a discharge limit of 50.0 liters/second. Design details of both ponds, the temporary settling pond and quarry sump will be required at the design phase.	Understood.	Acknowledged.	RESOLVED	
117.	Section 4.1.3 – "Extraction and quarry dewatering will also lower groundwater levels surrounding the west extension within 350 m of the extraction face. As such, a series of mitigation measures are proposed to address any potential adverse impact that could result from extraction and quarry dewatering." Did the study team identify any of the potential adverse impacts? Mitigation measures must ensure that any identified impacts are satisfactorily addressed when the replica pond is constructed.	The potential adverse impacts were identified in the Level 1 and 2 Hydrogeological and Hydrological Impact Assessment Report, the Surface Water Assessment, and the Level 1 and 2 Natural Environment Technical Report. Additional information regarding the potential impacts and mitigation measures are included in the Watercourse Characterization Tables enclosed.	Please see JART response to Comment # 25.	Additional information regarding the potential impacts and mitigation measures are included in the Watercourse Characterization Tables previously submitted and the revised AMP.	Not resolved.
118.	As suggested in Section 4.1.3, will the proposed replica pond exactly mimic the existing groundwater mounding? Location of the replica pond will essentially be different from the existing irrigation ponds which will result in the mounding being shifted. Will this impact the zone of influence of any wells in the surrounding area? Section 11.3.3.3 of the Burlington Quarry Extension Level 1/2 Assessment Report has further confirmed the impact to the private wells in the vicinity of West Expansion. What would be the strategy for implementing the mitigation measure of deepening the impacted wells?	The purpose of the infiltration pond is to replace the golf course ponds that may have contributed to groundwater recharge in the area. Some of the quarry discharge will be diverted to the infiltration pond, the remaining water will be discharged to the Unnamed Tributary of Willoughby Creek. It was assumed that the pond will be in good hydraulic contact with the bedrock surface and should provide higher leakage than the natural ponds with their accumulated sediments and underlying Halton Till. Some form of long-term maintenance may be required in the final design to ensure that the infiltration pond does not become silted up. The infiltration ponds were represented in the model for the P3456 and RHB1 scenarios. Some of the infiltrated water will likely discharge to the quarry and be recirculated, but the main effect is to recharge the groundwater west of the quarry and maintain higher heads and prevent the private wells from going dry.	Please see JART response to comment #29.	As presented during the meetings held the week of May 16, 2022, additional analysis has been completed to assess the potential impacts the proposed quarry extension will have on the groundwater level west of the west extension, the Medad Valley and Willoughby Creek. The analysis also assessed the proposed infiltration pond's ability to mitigate these potential impacts. The supplemental material prepared in support of the meetings should be reviewed for additional clarification regarding comment 118.	Not resolved.

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142.	Section 6.1.1 Burlington Quarry – “It is recommended that Nelson seek to permanently increase the maximum allowable discharge rate from Quarry Sump 0100. A permanent increase in the maximum allowable discharge rate is not mandatory, only recommended.” Will Nelson Aggregate implement this recommendation long term, under the operations and the rehabilitations scenarios?	The recommendation is being considered by Nelson. However, at this time no increase in off- site discharge is proposed. The discharge rates will be further reviewed as part of the AMP update. It is noted, an amendment to the Quarry’s existing PTTW will be required for any increase to off- site discharge.	The discharge rates will be reviewed as part of AMP update.	RESOLVED	
152.	Please add arrows on drawing DP-1 to show direction of flow in drainage channels.	The drawings have been revised accordingly.	No further comments.	RESOLVED	

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	JART Comments (February 2021)	Applicant Response (July 2021)	Interim JART Response (February 2022)	Applicant Response (June 2022)	JART Response (June 2023)
25.	All studies should be coordinated and integrated. In particular, the findings of the Hydrogeologic and Hydrologic Impact Assessment, Surface Water Assessment and Level 1 and 2 Natural Environment Technical Report should inform each other and should be reviewed for consistency.	The Watercourse and Wetland Characterization Tables enclosed have been prepared by the project team to assemble the results of the various studies in one location for ease of review.	The wetland characterization summaries only provide an annual water budget analysis, and the impact assessment and mitigation sections do not include the requested ecological interpretation for existing (as per TOR with 25 year baseline) interim (for each identified extraction phase) and both post extraction scenarios (rehabilitation scenario 1 and rehabilitation scenario 2). Please revise, present, and summarize daily water balance analyses as average monthly water volumes in tabular format, showing existing, interim and post extraction (as outlined above) with and without mitigation to establish and confirm seasonal variations and include an ecological interpretation for the results. This will set targets/thresholds required to ensure no negative impacts. The watercourse characterization summaries only provide groundwater interactions and proposed reductions, however do not include surface water flow analysis, impact assessment or mitigation sections for existing, interim and post extraction scenarios (as outlined above). Update to integrate surface water analysis, revise to present and summarize with and without mitigation to establish seasonal variations and include ecological interpretation of the results. This will set targets/thresholds required to ensure no negative impacts. Comment remains outstanding.	The results of the integrated surface and ground water model, feature-based wetland water balance and outlet-based water balance analysis along with the conclusions of the Natural Heritage Assessment are included in the Level 1 and Level 2 Hydrogeological and Hydrological Impact Assessment (Earthfx, April 2020), Surface Water Assessment (Tatham Engineering Limited, April 2020), the Level 1 and Level 2 Natural Environment Technical Report (Savanta, April 2020), the Wetland and Watercourse Characterization Tables, the revised AMP and subsequent materials presented/submitted in response to JART and MNDMNRF comments.	On January 1, 2023, Ontario Regulation 596/22 came into effect. As a result, technical review services for planning and development applications previously provided by Conservation Halton (CH) under Memorandums of Understanding with municipalities (e.g., technical reviews related to natural heritage and select aspects of stormwater management) can no longer be provided. As such, we defer this comment to the other JART members to confirm whether it has been addressed Halton Region staff have reviewed Nelson's response and provided the following JART response: The original comment still stands as all studies should be coordinated and integrated and be reviewed for consistency.
26.	Pre-quarry conditions should be described and evaluated, where feasible, to allow for comparison with existing and proposed conditions. The report should address cumulative impacts from quarrying operations and outline where a return to pre- quarry conditions would be preferable to existing conditions from a natural heritage and hazard perspective. Consultation with review agency staff is recommended.	Evaluating the pre-quarry condition is a difficult proposition recognizing the quarry is not the only change in the watershed over the past 60+ years and little to no data (topographic mapping, land use data, etc.) is available pre-quarry. As such, numerous assumptions would need to be made to model the pre-quarry condition and we question the validity of setting criteria based on assumptions. We also understand that this has not been required for other quarry applications within Conservation Halton's watershed. In the assessment base line conditions were current conditions and this includes impacts from the existing quarry. As part of the impact assessment Tatham considered impacts from the existing quarry and recommended revisions to the existing quarry rehabilitation plan to maintain current hydrologic conditions to benefit the surrounding environment.	Requirements / recommendations evolve as science and knowledge advance and are tailored based on the unique characteristics of each project. We acknowledge there are challenges and limitations to evaluating the pre-quarry condition, however, to address cumulative impacts and achieve the best final outcome for the system, we continue to recommend the submission describe and evaluate the pre- quarry condition. Optimizing environmental functional should be the goal informed by system resiliency rather than maintaining existing runoff regime further details and rationale should be provided which demonstrates that “maintaining current hydrologic conditions” is a suitable objective. Comment remains outstanding.	The analysis completed and the proposed surface water mitigation strategy for the quarry aims to maintain the existing form and function of the natural heritage features in and surrounding the quarry property. As such, an analysis of pre-quarry conditions has not been completed. As part of the analysis the existing quarry was considered, and recommendations have been included to enhance the existing approved rehabilitation plan to protect downstream natural heritage features.	Comment previously addressed from a natural hazard perspective. We defer this comment to the other JART members to confirm whether it has been addressed from their perspective.
52.	Description of Monitoring Location SW31 in Section 2.1.1 does not match location shown on Drawing Dwg. SW-1. Update accordingly.	The Existing and Proposed Surface Water Monitoring Locations Plans (Drawings SW-1 and SW-2) have been revised accordingly.	Comment still applies- SW31 is still shown in the same location on SW-1 and SW-2 as provided in the package. Going forward please provide all drawings and charts in colour.	Surface water monitoring station SW31 is correctly illustrated on the Existing Surface Water Monitoring Locations Plan (Drawing SW-1) included in the Surface Water Assessment (Tatham Engineering Limited, April 2020). The proposed surface water monitoring program has been revised as outlined in the revised AMP.	This comment has been addressed from a natural hazard perspective based on a supplementary submission received from the proponent. In the April 13, 2023, Tatham Engineering “Nelson Quarry, Burlington, Response to Comments” supplementary memo, the proponents 1) submitted additional analysis for the erosion hazard for the West Branch of the Mount Nemo Tributary of Grindstone Creek, and 2) have committed to removing the proposed Colling Road diversion and updating the site plan and AMP to reflect that removal. As a result, CH staff is satisfied that our outstanding natural hazard-related comments have been addressed. We defer this comment to the other JART members to confirm whether it has been addressed from their perspective.
53.	Add label for Monitoring Location SW-9 to drawing	Existing and Proposed Surface Water Monitoring Locations Plans (Drawings SW-1 and SW-2) have been revised accordingly.	Addressed.	RESOLVED	RESOLVED
55.	Remove/correct references to Wetland 13036	The references to Wetland 13036 will be corrected.	Addressed.	RESOLVED	RESOLVED

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58.	The study should demonstrate the proposed works will have no negative impacts on sediment transport (erosion and aggradation). The analysis should establish erosion threshold flow rates, and use continuous modeling to assess changes to the duration and frequency of exceedances as well as cumulative effective work and cumulative effective discharge.	The integrated surface and groundwater model (continuous simulation) generally predicts minor reductions in total streamflow through the Unnamed Tributary of Willoughby Creek, Willoughby Creek and the West Arm of the West Branch of the Mount Nemo Tributary of Grindstone Creek as a result of the quarry expansion. Also, the quarry discharge From Sumps 0100 and 0200 are not proposed to be altered. The only changes proposed are: The diversion of flow from external Catchment S101 directly to the Unnamed Tributary of Willoughby Creek; and The temporary discharge of water from the south extension into the West Arm. The proposed Colling Road diversion will direct surface runoff generated north of Colling Road to the Unnamed Tributary of Willoughby Creek, its current and historic outlet, by-passing the quarry settling ponds and quarry sump. The Colling Road diversion is not expected to have a significant impact on the simulation results. As mentioned, the integrated surface and groundwater model generally predicts minor reductions in streamflow in both the Unnamed Tributary of Willoughby Creek and Willoughby Creek. As such, we do not feel an erosion and sediment transport assessment is warranted for these watercourses. The proposal includes discharging water from the south extension to the West Arm at rates of up to 50 L/s. This discharge rate will be refined through the further development of the AMP. However, this discharge rate represents a streamflow that commonly occurs in the West Arm (see streamflow monitoring data) and is conveyed via the low flow channel through the subject property and downstream (as confirmed through the HEC-RAS hydraulic analysis of the West Arm). As such, we do not feel an erosion and sediment transport assessment is warranted for the West Arm	Not addressed. While the modelling shows a general decrease in flows that does not necessarily mean no negative impacts on sediment transport. Looking at individual flow rates at single points also does not account for possible overlap or duration increases. Please establish erosion threshold flow rates and use continuous modeling to assess changes to the duration and frequency of exceedances as well as cumulative effective work and cumulative effective discharge.	The integrated surface and groundwater model is a continuous simulation which generally predicts minor reductions in total streamflow through the unnamed tributary of Willoughby Creek, Willoughby Creek and the West Arm of the West Branch of the Mount Nemo Tributary of Grindstone Creek as a result of the quarry expansion. The quarry discharge from Sumps 0100 and 0200 is not proposed to be altered and, as the model predicts minor reductions in flow, the duration and frequency of the exceedances in the erosion threshold flow rates are not expected to increase. As such, we do not feel an erosion and sediment transport assessment is warranted.	This comment has been addressed from a natural hazard perspective based on a supplementary submission received from the proponent. In the April 13, 2023, Tatham Engineering “Nelson Quarry, Burlington, Response to Comments” supplementary memo, the proponents 1) submitted additional analysis for the erosion hazard for the West Branch of the Mount Nemo Tributary of Grindstone Creek, and 2) have committed to removing the proposed Colling Road diversion and updating the site plan and AMP to reflect that removal. As a result, CH staff is satisfied that our outstanding natural hazard-related comments have been addressed. We defer this comment to the other JART members to confirm whether it has been addressed from their perspective. Ron Scheckenberger has reviewed Nelson's response and provided the following JART response: Comment addressed.
59.	Additional metrics should be used to provide a fulsome assessment of potential impacts to surface water features. At a minimum, the study should include at each key monitoring location (West Arm, East Arm, Willoughby Creek Tributary, Willoughby Creek (SW7 & SW14), Wetland 13201): annual runoff volumes presented for each year (from Water Balance calculations as well as Integrated Surface Water Groundwater Model and/or continuous modeling) monthly runoff volumes presented for each month (average, minimum and maximums; from Integrated Surface Water Groundwater Model and/or continuous modeling) monthly average stream flows presented for each month (average, minimum and maximums; from Integrated Surface Water Groundwater Model and/or continuous modeling) peak flow rates for event-based storm events (from event based hydrologic modeling) : duration and frequency of exceedances of the watercourse’s erosion threshold (from continuous modeling) cumulative effective work on the stream’s beds and banks (from continuous modeling) : the watercourse’s cumulative effective discharge (from continuous modeling) Additional metrics may be required, depending on the initial results and final water management strategy. Alternative metrics will be considered through consultation with the JART.	Daily flow data from the integrated surface and groundwater model were provided for the simulation periods. This data was processed to provide monthly, annual, average monthly, and simulation period averages. Hydrographs of daily values were presented and discussed in the Level 1 and 2 Hydrogeological and Hydrological Impact Assessment Report. Simulation period averages were represented in maps and tables as they are the simplest format for comparative analyses.	Not addressed- Comment stands, please provide the additional metrics as requested. The missing metrics are important for evaluating the impacts of the project for the following reasons. Annual runoff volumes- used to determine any impacts to wetlands Monthly runoff volumes- used to determine any impacts to wetlands on a seasonal level Monthly average stream flows- used to evaluate any impacts on fish and fish habitat due to proposed flow regime on a seasonal level Peak flow rates- used to evaluate erosion, flooding, and other negative impacts on watercourses Duration and frequency exceedances- used to evaluate ecological functions, erosion, and deposition, Cumulative effective work- measure of stream power used to evaluate bank erosion and the effect on stream morphology, as well as erosion and deposition. Cumulative effective discharge- watercourse effects.	The results of the integrated surface and ground water model, feature-based wetland water balance and outlet-based water balance analysis along with the conclusions of the Natural Heritage Assessment are included in the Level 1 and Level 2 Hydrogeological and Hydrological Impact Assessment (Earthfx, April 2020), Surface Water Assessment (Tatham Engineering Limited, April 2020), the Level 1 and Level 2 Natural Environment Technical Report (Savanta, April 2020), the Wetland and Watercourse Characterization Tables, the revised AMP and subsequent materials presented/submitted in response to JART and MNDMNRF comments. Additional metrics have not been provided.	This comment has been addressed from a natural hazard perspective based on a supplementary submission received from the proponent. In the April 13, 2023, Tatham Engineering “Nelson Quarry, Burlington, Response to Comments” supplementary memo, the proponents 1) submitted additional analysis for the erosion hazard for the West Branch of the Mount Nemo Tributary of Grindstone Creek, and 2) have committed to removing the proposed Colling Road diversion and updating the site plan and AMP to reflect that removal. As a result, CH staff is satisfied that our outstanding natural hazard-related comments have been addressed. We defer this comment to the other JART members to confirm whether it has been addressed from their perspective.

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60.	The climate data for the impact assessments should be extended to a minimum of 20 years in keeping with the previously proposed duration and standard industry practices (2000 to 2019+, in conjunction with ongoing monitoring).	The wetland water balance analysis covered a 22-year period from 1998 to 2019.	Not Addressed. The presented results do not show full period of analysis. The analysis is based on 10 years of model results. Please present all results.	The feature-based wetland water balance results for the operations and rehabilitation phases of the project are illustrated for a 22-year period in Appendices N and R of the Surface Water Assessment (Tatham Engineering Limited, April 2020). Similarly, the outlet-based water balance results for the operations and rehabilitation phases of the project are illustrated for a 22- year period in Appendices O and S of the Surface Water Assessment (Tatham Engineering Limited, April 2020).	On January 1, 2023, Ontario Regulation 596/22 came into effect. As a result, technical review services for planning and development applications previously provided by Conservation Halton (CH) under Memorandums of Understanding with municipalities (e.g., technical reviews related to natural heritage and select aspects of stormwater management) can no longer be provided. As such, we defer this comment to the other JART members to confirm whether it has been addressed. Ron Scheckenberger has reviewed Nelson's response and provided the following JART response: RESOLVED
63	The accuracy of the survey data used should be included within the document. LiDAR data with a +/- 0.1 metre accuracy is available for purchase from Conservation Halton to improve the accuracy of the results, if necessary.	The topographic mapping was generated from a drone survey completed November 22, 2018 having an accuracy of +/- 3 cm.	Addressed.	RESOLVED	RESOLVED
67.	Grading details and invert elevations should be provided for the existing golf course weir pond, diversion channel and irrigation pond system to fully illustrate how the existing water management system functions	The existing weir pond, diversion channel and golf course irrigation ponds have been surveyed. Drawings illustrating the function of these features are enclosed for reference.	Addressed.	RESOLVED	RESOLVED
68.	In addition to the information provided in the Existing Condition Water Balance, the depth of water and bathymetry of the wetlands should be provided, in order to assess potential impacts to the wetlands. Changes in water depth should be provided in the interim and ultimate conditions as well.	The existing wetlands have been surveyed and drawings of the bathymetric survey are included in the Wetland Characterization Tables enclosed. The changes in water depth are illustrated on the graphs provided in Appendix N and Appendix R of the Surface Water Assessment.	Partially addressed. Bathymetry provided in watercourse and wetland characterization report. Please provide the hydro period depths for all wetlands in tabular form as well as graph to allow for easier comparison.	As discussed, the wetland hydro period depths are illustrated on the graphs provided in Appendix N and Appendix R of the Surface Water Assessment (Tatham Engineering Limited, April 2020).	On January 1, 2023, Ontario Regulation 596/22 came into effect. As a result, technical review services for planning and development applications previously provided by Conservation Halton (CH) under Memorandums of Understanding with municipalities (e.g., technical reviews related to natural heritage and select aspects of stormwater management) can no longer be provided. As such, we defer this comment to the other JART members to confirm whether it has been addressed. Ron Scheckenberger has reviewed Nelson's response and provided the following JART response: Request to provide wetland hydroperiods in tabular form not addressed
69.	Please provide digital, daily water levels, presented graphically (to depict the wetland hydro period) and summarize daily water balance analyses as average monthly water volumes presented in tabular format integrated in the report. Compare driest year, average and wettest year monthly water volumes to assess potential impact.	The wetland hydro period monitoring data is illustrated graphically in Appendix F of the Surface Water Assessment. Updated graphs including the remainder of the monitoring data for 2019 and the data for 2020 are enclosed. The results of the water balance analysis are illustrated on the graphs included in Appendix I, N and R of the Surface Water Assessment.	Partially Addressed. Present and summarize daily water balance analyses as average monthly water volumes in tabular format integrated in the report.	The results of the integrated surface and ground water model, feature-based wetland water balance and outlet-based water balance analysis along with the conclusions of the Natural Heritage Assessment are included in the Level 1 and Level 2 Hydrogeological and Hydrological Impact Assessment (Earthfx, April 2020), Surface Water Assessment (Tatham Engineering Limited, April 2020), the Level 1 and Level 2 Natural Environment Technical Report (Savanta, April 2020), the Wetland and Watercourse Characterization Tables, the revised AMP and subsequent materials presented/submitted in response to JART and MNDMNRF comments. Additional metrics have not been provided.	On January 1, 2023, Ontario Regulation 596/22 came into effect. As a result, technical review services for planning and development applications previously provided by Conservation Halton (CH) under Memorandums of Understanding with municipalities (e.g., technical reviews related to natural heritage and select aspects of stormwater management) can no longer be provided. As such, we defer this comment to the other JART members to confirm whether it has been addressed. Ron Scheckenberger has reviewed Nelson's response and provided the following JART response: Request to provide a summary of daily water balance as average monthly water volumes in tabular format in the report not addressed
71.	Parameter assumptions (e.g. soil water holding capacity, SCS curve numbers, etc.) and detailed calculations should be provided in a supporting appendix.	The wetland water balance and event based hydrologic model input parameters have been summarized in a table enclosed for reference.	Addressed.	RESOLVED	RESOLVED
72.	The initial wetland volume, stage-discharge curve, storage correction factor and overflow correction factor for each wetland should be provided to illustrate the scale of adjustment used and support the validity of the water balance calibration.	Refer to response to Comment 39. The initial wetland volumes, stage-storage- discharge curves, storage correction factors and overflow correction factors for each wetland are summarized in a table enclosed.	Not Addressed. We are of the opinion that this cannot be deferred to the AMP as it is an important piece of the impact analysis. The correction factors provided seem to indicate that 3 of the 4 calibrated wetlands are providing double the storage for a given depth than what they would have anticipated based on the stage-storage-discharge curve that was based on Topo. This seems counterintuitive since the correction factors were to address vegetation /topo variations which would likely be losses of flood storage. Please provide more details and	The wetland bathymetric survey included collecting cross-sections of the wetland bottom at intervals across the wetland, leading to some uncertainty in the wetland elevations between the cross-sections. Based on our field investigations of the wetlands, the wetland bottoms are highly irregular and there are large areas of the wetlands that contain isolated pockets of wetland storage that is not reflected in the bathymetric survey. To account for the additional storage provided in these pockets, a correction factor was applied to the wetland storage volumes.	On January 1, 2023, Ontario Regulation 596/22 came into effect. As a result, technical review services for planning and development applications previously provided by Conservation Halton (CH) under Memorandums of Understanding with municipalities (e.g., technical reviews related to natural heritage and select aspects of stormwater management) can no longer be provided. As such, we defer this comment to the other JART members to confirm whether it has been addressed. Ron Scheckenberger has reviewed Nelson's response

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			example calculations to better explain these factors. Please also provide an explanation as to why some of the units of measurements vary by location.		and provided the following JART response: This continues to be of concern in that the data uncertainty can have an impact on the level of interpretation of the results – as noted earlier a sensitivity analysis would provide added insights into this potential and perhaps guide the refinement of key parameters.
77.	While the daily water balance is a reasonable predictor of the wetland hydro periods in 2016 through 2018, the report should discuss the weaker agreement for 2015 and 2019.	Refer to response to Comment 39.	Not addressed. CH does not agree that performing calibration during the AMP instead as part of this analysis is appropriate. Comment stands.	There are several factors that impact the calibration of the feature-based wetland water balance which may be causing the differences noted as follows: Accuracy of the precipitation and climate data; The location of the climate station relative to the site; Missing climate records; Hydrologic parameters (hydraulic conductivity, void ratio, etc.); and Wetland storage volumes. There is an inherent degree of accuracy associated with rain gauges and climate gauges which needs to be recognized. There is also a degree of error when using data for an off-site climate station which increases with distance from the site. Rain gauges and climate gauges also suffer from technical issues leading to losses of data which can impact results. Inconsistencies in soil parameters across as site and well as the hydrologic/hydraulic parameters assigned to the wetland can lead to reduced accuracy. However, given the complexity of the system, we believe the integrated surface and groundwater model and feature-based wetland water balance generally provide a good predictor of wetland hydro period. It is also noted that the feature-based water balance can be updated and refined in the future as additional monitoring data is collected to ensure proper wetland hydro period thresholds are assigned to each wetland.	On January 1, 2023, Ontario Regulation 596/22 came into effect. As a result, technical review services for planning and development applications previously provided by Conservation Halton (CH) under Memorandums of Understanding with municipalities (e.g., technical reviews related to natural heritage and select aspects of stormwater management) can no longer be provided. As such, we defer this comment to the other JART members to confirm whether it has been addressed. Ron Scheckenberger has reviewed Nelson's response and provided the following JART response: This continues to be of concern in that the data uncertainty can have an impact on the level of interpretation of the results – as noted earlier a sensitivity analysis would provide added insights into this potential and perhaps guide the refinement of key parameters
78.	Staff have assumed the Key Points of Interest on this drawing coincide with the five outlet points outlined in Table 19. Please confirm within the report.	The Key Points of Interest illustrated on the Drainage Plans (Drawings DP-1, DP-2 and DP-3) coincide with the five locations presented in Table 19.	Addressed.	RESOLVED	RESOLVED
85.	The report should include the following: A schematic supporting the hydrologic model. A summary of the sources/rationale for the selected hydrologic parameter values. A table of all input parameters for each subcatchment. d. Hard copy of input and output files.	Refer to response to Comments 71 and 83. A summary of the sources/rationale for the selected hydrologic parameters is enclosed for reference. The digital VO6 model files have been provided in lieu of hard copy input and output files. Please advise if you still require hard copy input and output files.	While Catchment input parameter tables were provided, several sub catchments appear to be missing: 101, 131, west, south. These missing subcatchments are included in the summary CN tables, but do not have detailed parameter tables.	The additional catchment input parameter tables are enclosed for reference. See **Tab 1**.	This comment has been addressed from a natural hazard perspective based on a supplementary submission received from the proponent. In the April 13, 2023, Tatham Engineering “Nelson Quarry, Burlington, Response to Comments” supplementary memo, the proponents 1) submitted additional analysis for the erosion hazard for the West Branch of the Mount Nemo Tributary of Grindstone Creek, and 2) have committed to removing the proposed Colling Road diversion and updating the site plan and AMP to reflect that removal. As a result, CH staff is satisfied that our outstanding natural hazard-related comments have been addressed. We defer this comment to the other JART members to confirm whether it has been addressed from their perspective.
86.	MTO IDF data was not provided in Appendix L. Conservation Halton staff recommend City of Burlington IDF curves be compared to the MTO data, and the more appropriate values used and provided in the report.	A comparison of the MTO and City of Burlington IDF data is enclosed for reference along with a comparison of the hydrologic model results for each.	Addressed.	RESOLVED	RESOLVED
87.	Revisit drainage areas to ensure model and Existing Conditions Drainage Plan, DP-1 match.	The hydrologic model and Existing Conditions Drainage Plan (Drawing DP-1) have been reviewed and revised to ensure consistency.	Addressed.	RESOLVED	RESOLVED
88.	CN values used in the hydrologic model are low for the soil types in the subject area. Values used should be justified or revised accordingly. AMC III conditions should be used for the Regional Storm.	Refer to response to Comment 85. Regional Storm model runs have been completed using AMCIII antecedent moisture conditions. The Regional Storm model runs are included with the digital VO files enclosed.	Please explain the rationale for selecting CN numbers for “small grain, contoured, poor” as the cultivated category CN. AMCIII has been addressed.	The CN values assigned to the cultivated land use type are typical of published values throughout Ontario.	RESOLVED

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89.	As only the last 12 hours of the Regional Storm were modeled, the Initial Abstraction (Ia) rate used does not adequately account for saturated soil conditions and should be reduced.	The initial abstraction values included in the Regional Storm model runs have been revised accordingly.	Ia values still seem high for the Regional Storm event. The Ia rates assume Ia=0.2*S, or that 20% of the storage is assumed to be the initial abstraction. It would be more appropriate to set the Ia to 0 mm as the proceeding rain fills the available storage prior to the Regional Storm.	The IA values were previously revised as requested. The revised IA = 0.2S as recommended for the SCS Curve Number Method.	This comment has been addressed from a natural hazard perspective based on a supplementary submission received from the proponent. In the April 13, 2023, Tatham Engineering "Nelson Quarry, Burlington, Response to Comments" supplementary memo, the proponents 1) submitted additional analysis for the erosion hazard for the West Branch of the Mount Nemo Tributary of Grindstone Creek, and 2) have committed to removing the proposed Colling Road diversion and updating the site plan and AMP to reflect that removal. As a result, CH staff is satisfied that our outstanding natural hazard-related comments have been addressed. We defer this comment to the other JART members to confirm whether it has been addressed from their perspective.
95.	Explanation for the difference in the Regional Storm flow for the West Arm of the West Branch identified in Table 22 (as used in the hydraulic model) and from that provided in Table 21 (Section 3.4.3) should be provided, or the analysis updated accordingly.	The Regional Storm peak flows have been updated accordingly.	Addressed, but please confirm that Table 22 has been updated.	The revised table is enclosed for reference. See **Tab 2**.	RESOLVED
96.	The accuracy and extent of the drone survey data in the vicinity of the Quarry and expansion lands should be included within the document, confirming it is sufficient to support hazard delineations in keeping with Provincial Guidelines. To improve the accuracy of the results, LiDAR data with a +/- 0.1 metre accuracy is available from the Land Information Ontario Data Hub (https://geohub.lio.gov.on.ca/), if necessary.	The topographic mapping was generated from a drone survey completed November 22, 2018 having an accuracy of +/- 3 cm. A geodetic topographic survey of the West Arm of the West Branch of the Mount Nemo Tributary of Grindstone Creek was completed across the south extension lands in support of the Natural Hazards Assessment. The topographic survey was completed by Tatham Engineering Limited January 2020. The topographic survey data has been supplemented with the Drone survey data for the channel overbanks.	Addressed.	RESOLVED	RESOLVED
97.	The Natural Hazards Plan, Dwg NH-1 should include: • Source of topographical information including vertical datum. • Stamps and signatures of the qualified professional(s) responsible for the hazard delineation.	The Natural Hazards Plan (Drawing NH-1) has been revised accordingly (see enclosed).	Addressed.	RESOLVED	RESOLVED
98.	Saturated soils (i.e. AMCIII conditions) should be assumed when modeling the Regional Storm using the last 12 hours of the Hurricane Hazel rainfall distribution. Modeling and the report should be updated accordingly.	Refer to response to Comments 88 and 89.	Not Addressed. Please see Comment No. 89 response.	The Regional Storm has been assessed under AMCIII conditions as acknowledged in Interim JART Response (February 2022) Comment 88. The updated hydrologic model results were submitted as part of First Response submission package.	This comment has been addressed from a natural hazard perspective based on a supplementary submission received from the proponent. In the April 13, 2023, Tatham Engineering "Nelson Quarry, Burlington, Response to Comments" supplementary memo, the proponents 1) submitted additional analysis for the erosion hazard for the West Branch of the Mount Nemo Tributary of Grindstone Creek, and 2) have committed to removing the proposed Colling Road diversion and updating the site plan and AMP to reflect that removal. As a result, CH staff is satisfied that our outstanding natural hazard-related comments have been addressed. We defer this comment to the other JART members to confirm whether it has been addressed from their perspective.
102.	Parameterization concerns identified for Existing Conditions should also be addressed within Proposed Conditions models	Understood. Refer to response to Comment 101.	Addressed. Please see Comment Nos. 88 and 89 for additional questions on parameters.	RESOLVED	RESOLVED
103.	Results are presented in different locations throughout the report. Recommend for each monitoring location a table for each metric that summarizes results for pre- quarry (where applicable), existing, operational phases, and rehabilitation conditions.	Refer to response to Comment 59.	Not addressed. See additional response for Comment No. 59.	The results of the assessment are presented in the Surface Water Assessment (Tatham Engineering Limited, April 2020) and the Wetland and Watercourse Characterization Tables.	On January 1, 2023, Ontario Regulation 596/22 came into effect. As a result, technical review services for planning and development applications previously provided by Conservation Halton (CH) under Memorandums of Understanding with municipalities (e.g., technical reviews related to natural heritage and select aspects of stormwater management) can no longer be provided. As such, we defer this comment to the other JART members to confirm whether it has been addressed. Ron Scheckenberger has reviewed Nelson's response and provided the following JART response: Request to reorganize data/information for monitoring locations in a tabular format not addressed

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104.	Proposed Conditions should also document and consider impacts during north and south lake filling.	Refer to response to Comment 43. In addition, the integrated surface and groundwater model evaluated the impacts of both rehabilitation scenarios for the existing quarry which are included in the Level 1 and 2 Hydrogeological and Hydrological Impact Assessment Report. As noted in the Surface Water Assessment, allowing the existing quarry to fill and form a lake in accordance with the approved rehabilitation plan will cease all discharge from the quarry to the Unnamed Tributary of Willoughby Creek and an alternative rehabilitation scenario is recommended.	Not addressed. Comment stands.	The assessment completed, through both the integrated surface and groundwater model and feature-based wetland water balance, considered worst case scenarios for Phases 1 and 2, Phases 3 through 6 and the two rehabilitation scenarios. Additional analysis is not warranted.	On January 1, 2023, Ontario Regulation 596/22 came into effect. As a result, technical review services for planning and development applications previously provided by Conservation Halton (CH) under Memorandums of Understanding with municipalities (e.g., technical reviews related to natural heritage and select aspects of stormwater management) can no longer be provided. As such, we defer this comment to the other JART members to confirm whether it has been addressed. Ron Scheckenberger has reviewed Nelson's response and provided the following JART response: Request to document impacts under the scenario of north and south lake filling not addressed
105.	Quarry discharges and the Colling Road diversion are not applied consistently in the different analyses. Results should incorporate the proposed pumping regime with and without the proposed diversion at Colling Road.	The event based hydrologic model has been updated to include proposed conditions with and without the Colling Road diversion. The digital VO files are enclosed for reference.	Updated model includes requested scenarios. Please ensure reporting is updated to provide the results of all the scenarios.	The updated hydrologic model results were submitted as part of the First Response submission package.	This comment has been addressed from a natural hazard perspective based on a supplementary submission received from the proponent. In the April 13, 2023, Tatham Engineering “Nelson Quarry, Burlington, Response to Comments” supplementary memo, the proponents 1) submitted additional analysis for the erosion hazard for the West Branch of the Mount Nemo Tributary of Grindstone Creek, and 2) have committed to removing the proposed Colling Road diversion and updating the site plan and AMP to reflect that removal. As a result, CH staff is satisfied that our outstanding natural hazard-related comments have been addressed. We defer this comment to the other JART members to confirm whether it has been addressed from their perspective.
106.	Results should be evaluated by the appropriate qualified professional (e.g. water resources engineer, ecologist, or fluvial geomorphologist).	It is unclear as to what results have not been evaluated by a qualified professional. The Surface Water Assessment has been prepared by a water resource engineer, the Level 1 and 2 Natural Environment Technical Report was prepared by ecologists, and the Level 1 and 2 Hydrogeological and Hydrological Impact Assessment Report was prepared by professional engineers.	As CH requested the analysis be updated, we wanted to ensure the updated results continue to be evaluated and discussed by the appropriate qualified professional within this document (and through integration of the various reports).	We confirm, the analysis and all results have been prepared and evaluated by appropriate qualified professionals.	RESOLVED
107.	The depth of water and bathymetry of the wetlands should be provided for any interim phases and in the ultimate condition, in order to assess potential impacts to the wetlands.	Refer to response to Comment 68.	See response to Comment No. 68.	As discussed, the wetland hydro period depths are illustrated on the graphs provided in Appendix N and Appendix R of the Surface Water Assessment (Tatham Engineering Limited, April 2020).	On January 1, 2023, Ontario Regulation 596/22 came into effect. As a result, technical review services for planning and development applications previously provided by Conservation Halton (CH) under Memorandums of Understanding with municipalities (e.g., technical reviews related to natural heritage and select aspects of stormwater management) can no longer be provided. As such, we defer this comment to the other JART members to confirm whether it has been addressed. Ron Scheckenberger has reviewed Nelson's response and provided the following JART response: See response to comment 68
122.	Further to above comments, it is noted specifically for Table 28, Proposed Condition (Operations) Outlet Water Balance Results Summary & Table 36, Proposed Condition (Rehabilitation) Outlet Water Balance Results Summary: Existing conditions should be presented in the same tables as Proposed conditions to facilitate reviews. Runoff volumes with mitigation measures (Quarry Sump Q100 & Q200 discharges) should be presented. Currently significant reductions in West Arm Runoff Volumes are indicated in the tables but proposed mitigation measures have not been included in the analysis. Significant increases in Weir Pond Runoff Volumes are predicted because of the proposed diversion of external runoff along Colling Road. An assessment of pre- Quarry conditions should be included in the report to support the claim this increase is reflective of a more natural streamflow hydrograph.	Refer to response to Comment 59. Tables 28 and 36 have been revised accordingly.	Partially addressed. See response to Comment No. 59 outlining the requested additional metrics.	The results of the integrated surface and ground water model, feature-based wetland water balance and outlet-based water balance analysis along with the conclusions of the Natural Heritage Assessment are included in the Level 1 and Level 2 Hydrogeological and Hydrological Impact Assessment (Earthfx, April 2020), Surface Water Assessment (Tatham Engineering Limited, April 2020), the Level 1 and Level 2 Natural Environment Technical Report (Savanta, April 2020), the Wetland and Watercourse Characterization Tables, the revised AMP and subsequent materials presented/submitted in response to JART and MNDMNRF comments. Additional metrics have not been provided.	On January 1, 2023, Ontario Regulation 596/22 came into effect. As a result, technical review services for planning and development applications previously provided by Conservation Halton (CH) under Memorandums of Understanding with municipalities (e.g., technical reviews related to natural heritage and select aspects of stormwater management) can no longer be provided. As such, we defer this comment to the other JART members to confirm whether it has been addressed. Ron Scheckenberger has reviewed Nelson's response and provided the following JART response: Refer to discussion on additional metrics requested under comment 59

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126.	Further to above comments, it is noted the ISWGA does not discuss the proposed diversion along Colling Road. Table 29, Proposed Condition Integrated Surface Water Groundwater Model Results may require revision.	Understood. The surface water management strategy/report will be revised as necessary through the development/refinement of the AMP in consultation with the agencies.	Agreed.	RESOLVED	RESOLVED
128.	Further to above comments, it is noted specifically for Table 30, Proposed Condition (Operations) Hydrologic Model Results Summary & Table 37, Proposed Condition (Rehabilitation) Hydrologic Model Results Summary – Willoughby Creek Tributary on the downstream side of Colling Road should be included in as a point of interest in addition to or instead of the Weir Pond. Results both with and without the diversion of runoff along at Colling Road should be provided. For consistency, peak quarry sump discharge peak flow rates should be added to the peak flows provided in the tables	Refer to response to Comments 51, 59 and 105. The peak quarry discharge flow rate has been added to Tables 30 and 37 as requested.	Partially addressed. See response to Comment No. 59 outlining the requested additional metrics.	The results of the integrated surface and ground water model, feature-based wetland water balance and outlet-based water balance analysis along with the conclusions of the Natural Heritage Assessment are included in the Level 1 and Level 2 Hydrogeological and Hydrological Impact Assessment (Earthfx, April 2020), Surface Water Assessment (Tatham Engineering Limited, April 2020), the Level 1 and Level 2 Natural Environment Technical Report (Savanta, April 2020), the Wetland and Watercourse Characterization Tables, the revised AMP and subsequent materials presented/submitted in response to JART and MNDMNRF comments. Additional metrics have not been provided.	This comment has been addressed from a natural hazard perspective based on a supplementary submission received from the proponent. In the April 13, 2023, Tatham Engineering “Nelson Quarry, Burlington, Response to Comments” supplementary memo, the proponents 1) submitted additional analysis for the erosion hazard for the West Branch of the Mount Nemo Tributary of Grindstone Creek, and 2) have committed to removing the proposed Colling Road diversion and updating the site plan and AMP to reflect that removal. As a result, CH staff is satisfied that our outstanding natural hazard-related comments have been addressed. We defer this comment to the other JART members to confirm whether it has been addressed from their perspective.
151.	Update recommendations and the summary as necessary to reflect any changes resulting from the above feedback.	The surface water management strategy will be revised as necessary through the development/refinement of the AMP in consultation with the agencies.	Comment partially addressed. This section should be updated both separately for the assessment and in conjunction with the AMP work.	The Surface Water Assessment has not been updated as we don’t believe it is warranted at this time.	This comment has been addressed from a natural hazard perspective based on a supplementary submission received from the proponent. In the April 13, 2023, Tatham Engineering “Nelson Quarry, Burlington, Response to Comments” supplementary memo, the proponents 1) submitted additional analysis for the erosion hazard for the West Branch of the Mount Nemo Tributary of Grindstone Creek, and 2) have committed to removing the proposed Colling Road diversion and updating the site plan and AMP to reflect that removal. As a result, CH staff is satisfied that our outstanding natural hazard-related comments have been addressed. We defer this comment to the other JART members to confirm whether it has been addressed from their perspective.

NEC COMMENTS

	JART Comments (February 2021)	Applicant Response (July 2021)	Interim JART Response (February 2022)	Applicant Response (June 2022)	JART Response (June 2023)
27.	The report should include analysis of pre-golf course/quarry conditions and speak to how the drainage patterns of the area may have been impacted as a result of the existing extraction operation. Part 2.2.1 of the NEP requires the consideration of single, multiple, or successive development that has occurred or is likely to occur. The report should also clarify language used in reference to the existing water features on the golf course lands. If they are features that contribute to the water balance and hydrological system of the area, a broader analysis of the impact of removing them on key natural and key hydrologic features should be incorporated. Any link to the proposed rehabilitation plan should be focused on protecting or enhancing the function of key hydrologic features including any identified wetlands (Part 2.6.3, 2.7.3, 2.7.6 (d), 2.9.3 (d & e), 2.9.11 (a & b). If the ponds are considered man-made and their function and impact on the surface/groundwater artificial, a broader analysis of cumulative impacts should be incorporated as this will be the second identifiable time that key hydrologic functions of the golf course lands will have been altered. Coupled with better details on pre-golf course/quarry conditions, this analysis should drive proposed rehabilitation efforts.	Refer to response to Comment 26. Similar to the Quarry, the Burlington Springs Golf and Country Club was constructed in 1962 and little information exists regarding the topography and land use prior to golf course construction. It's noted, the integrated surface and groundwater model provides a detailed analysis of the impact of removing these features on the surrounding key hydrologic features. The Level 1 and 2 Hydrogeological and Hydrological Impact Assessment Report (Earthfx, April 2020) provides a detailed description of the integrated surface and groundwater model and the impact assessment completed.	Not addressed. As per the response to Comment 26, mapping data for ground conditions, albeit at a less granular level, are available from the National Topographic Series from 1909 to present day. These provide accurate approximations of watercourses on and around the subject properties prior to initiation of aggregate extraction activities and golf course construction, and subsequent evolution of the landscape and watersheds. Similar aerial photo data are available starting from 1934. Given the availability of these data, it is prudent to include this information in the surface water analysis and rehabilitation efforts. While restoration and enhancement following development that has occurred or may occur is not predicated on recreation of pre-1950s conditions, rehabilitation can be framed in reference to historical data available for prior surface conditions and informed by system resiliency and not a strategy of "maintaining current hydrologic conditions" that reflect a modern intervention.	The analysis completed and the proposed surface water mitigation strategy for the quarry aims to maintain the existing form and function of the natural heritage features in and surrounding the quarry property. As such, an analysis of pre-quarry conditions has not been completed. As part of the analysis the existing quarry was considered, and recommendations have been included to enhance the existing approved rehabilitation plan to protect downstream natural heritage features.	Not addressed as modeling without perpetual pumping is not provided and pre-quarry conditions are not considered.
28.	It is noted that extraction will reduce the drainage area to wetlands 13200 & 13201 but that the area will be supplemented with water pumped from the quarry in order to maintain hydro periods. Is this proposed in perpetuity? Will flows to this wetland be protected through the proposed rehabilitation strategy? NEC Staff would not agree that pumping water into a wetland to maintain its hydro period fundamentally protects or enhances the feature. This proposed approach should be sufficiently evaluated by a qualified ecology professional to ascertain any additional mitigation strategies required to maintain the wetlands beyond balancing hydro periods.	The drainage area to Wetland 13200 will be reinstated as part of rehabilitation of the site and the discharge into this feature will cease post rehabilitation. The proposed discharge to Wetland 13201 will continue in perpetuity as part of the rehabilitation plan for the site.	Partially addressed. The quarry discharge rate of flow to the Mount Nemo Creek tributary is relatively brief given the life of the quarry vs. the extant landscape. Estimates of quarry discharge contributions in proportion to overall flow where fish habitat occurs in this watershed would be informative as the hydro-geological report indicates that absent perpetual pumping the resulting lake will be at a level conforming to the water table. Potential impacts to downstream water volumes are relative, given the life of the existing quarry and pumping regime vs. the age of the overall landscape.	Wetland 13201 has no outlet and does not drain to the unnamed tributary of Lake Medad. The culvert crossing No. 2 Sideroad at Wetland 13201 is completely obstructed and there is no direct hydraulic connection between the wetland and the unnamed tributary. As such, the drainage area contributing surface runoff to the unnamed tributary will not be altered through extraction in the west extension. The integrated surface and groundwater model does predict a minor reduction in groundwater contributions to the unnamed tributary. To mitigate the reduction in groundwater contributions, the hydro period of Wetland 13201 will be maintained, maintaining the existing infiltration into the overburden aquifer, and the proposed infiltration pond will supplement the groundwater system in this area.	Remains only partially addressed as modeling without perpetual pumping is not provided.
29.	Additional details for the 'replica pond' along Collings Road are being sought. How does shifting the current irrigation ponds and implementing a longer diversion channel maintain or enhance the key hydrologic functions of the site? Mitigation methods suggest that "a portion" of wetland 13200's drainage area will be reinstated as part of the rehabilitation plan. As part of this it is identified that fill will be imported to raise grade in the area to original ground level. How much fill is required? Why is only 'a portion' being reinstated? Is some pumping still going to be required if the drainage area cannot be replicated? New 'replica' ponds should be justified per Part 2.6.7 of the NEP (2017) that requires ponds be designed to avoid key natural and hydrologic features and shall be designed to be offline.	The golf course ponds and diversion channel are not key hydrologic features. They are man-made features constructed to irrigate the golf course. The primary source of water for the diversion channel and golf course ponds is the quarry discharge which is diverted from the weir pond (Wetland 13202) onto the golf course property. The infiltration pond is proposed to mimic existing conditions, specifically the diversion channel and golf course irrigation ponds. The portion of Wetland 13200 drainage area that is removed during extraction will be reinstated as part of the rehabilitation of the site; reinstating the entire drainage area to Wetland 13200. The quantity of fill required to reinstate the drainage area is 305,000 m^3. Once the drainage area is reinstated, pumping from the quarry into the wetland will cease as it is no longer required. The infiltration pond is proposed to mimic existing conditions and will be constructed offline with a passive inlet structure (diversion pipe).	Partially addressed. The role of the proposed infiltration pond, to mimic existing conditions, including the diversion channel and golf course irrigation ponds, does not address Part 2.9.11 (a & b). Comment 27 has a bearing on whether the existing golf- course ponds and watercourses may overlap historic surface water drainage patterns in this portion of the project area, allowing an evaluation of any authentication for their description and/or categorization as key hydrologic features. In short, rehabilitation as part of the West Extension should take these pre-golf course and quarry conditions into account. The sustainability of the pumping in perpetuity to maintain water flow to Collings Road / 13202 should be evaluated in the comparison to no-pumping ground and surface water conditions. In this context, the need for an infiltration pond along Collings Road may be obviated, lacking a drawdown from pumping, and negating NEP 2.6.7 concerns. No details are provided for the source and duration of the proposed fill material and activity, which are required to evaluate this method of rehabilitation.	From a review of the available historic aerial photos, it does not appear that a historic watercourse or ponds existed on the Burlington Springs Golf and Country Club prior to the construction of the diversion channel and irrigation ponds. A watercourse is visible in the aerial photos on the quarry property which drained into the Colling Road roadside ditch and unnamed tributary of Willoughby Creek, like the existing quarry discharge from sump 0100. The golf course ponds, and diversion channel are not key hydrologic features. They are man-made features constructed to irrigate the golf course. The proposed surface water mitigation strategy for the quarry aims to maintain the existing form and function of the natural heritage features, specifically the unnamed tributary of Willoughby Creek and Willoughby Creek, which have received quarry discharge for over 60 years. An assessment of the pre-quarry condition has not been completed.	Not addressed as modeling without perpetual pumping is not provided.

MATRIX SOLUTIONS COMMENTS

	JART Comments (February 2021)	Applicant Response (July 2021)	Interim JART Response (February 2022)	Applicant Response (June 2022)	JART Response (June 2023)
30.	The surface water assessment establishes surface water drainage conditions across the Burlington Quarry, South Extension, and West Extension lands to assess impacts from the proposed quarry extension and provides context to surface water hydrology and hydrogeology, which is directly linked to fish habitat impacts. This assessment was completed primarily through identification of existing drainage patterns, water balance, and event based hydrologic modelling. There is an overall lack of integration with the surface water report with regards to the 2020 NETR- this is primarily on the basis that the surface water discussion extends beyond the 120.0 meter limit of the extraction footprint.	As noted by the reviewer, it was important to assess the likely changes to the local hydrology and to the groundwater system as a result of the proposed quarry extension because they are directly linked to fish habitat impacts. The purpose of building an integrated surface and groundwater model was to provide a quantitative framework for assessing these impacts in the vicinity of the quarry (which extended well beyond the 120 m limit). The data collection effort was a key part of the study as it provides targets for calibrating the model to ensure it represents current conditions regionally and in the quarry vicinity. Please refer to the Watercourse and Wetland Characterization Tables enclosed as Schedule B and Schedule C with this submission for additional information regarding the surface water impacts on fish and fish habitat.	A general lack of integration remains. Please see JART response to Comment #25. Comment Noted- The review comment was referring to the integration between the NETR and the surface water studies. The inclusion of watercourse and wetland characterization does provide additional resolution of fish related impacts that may be due to hydrology. Although the surface water quality impacts do extend beyond 120m, the fisheries data relies on data that is from 2003/ 2006 and more recent fish data is limited. Given the gap in time, the reviewer is to assume that the data from 2003/2006 is still the baseline condition to which fisheries impacts would be based on. Given increasing drought conditions and warmer climates experienced during that time interval and present-day conditions, the concern is if this fisheries data is still relevant or if has changed. Fish community response should be described according to more recent model predictions. This will determine if fish community response changes over time during future quarry operation.	The results of the integrated surface and ground water model, feature-based wetland water balance and outlet-based water balance analysis along with the conclusions of the Natural Heritage Assessment are included in the Level 1 and Level 2 Hydrogeological and Hydrological Impact Assessment (Earthfx, April 2020), Surface Water Assessment (Tatham Engineering Limited, April 2020), the Level 1 and Level 2 Natural Environment Technical Report (Savanta, April 2020), the Wetland and Watercourse Characterization Tables, the revised AMP and subsequent materials presented/submitted in response to JART and MNDMNRF comments.	The applicant's updated AMP addresses items related to surface flows and groundwater contributions but relies on historical information and data collected by other agencies to describe the fish community outside of the proposed quarry extension footprints. The applicant maintains the position that flows will be maintained as in the existing quarry, such that no changes to the fish community composition in the downstream receiving waters is anticipated.
31.	The surface water assessment acknowledges Willoughby Creek and West Arm as fish habitat, and that base flows and water temperature are critical to the form and function of the watercourses from a natural heritage and fish spawning perspective. The proposed condition integrated surface water/groundwater analysis predicts a minor reduction in monthly streamflow due to the lowering of groundwater and suggests maintaining the discharge from the Quarry Sump 0100 to ensure that some reaches of Willoughby Creek does not run dry. Furthermore, it mentions that the predictive water/groundwater model predicts a measurable reduction in flow of the unnamed tributary of Lake Medad during operations and quarrying. For this reason, the surface water assessment report recommends that streamflow and water temperature thresholds be established from historic surface water monitoring completed in support of the proposed quarry extension. The rationale for future management of quarry water as is lacking in critical details such as "how does the hydro periods function in terms of downstream fisheries". There is also no table or rationale illustrating how the reductions streamflow and lowering of groundwater as predicted by the groundwater models will be offset by pumping operations.	Additional information is provided in the JART NETR response to comments and the Watercourse Characterization Tables enclosed (Schedule C). Pumping is done under current (baseline) conditions to dewater the existing quarry. The water is discharged from the quarry sumps into the Unnamed Tributary of Willoughby Creek and to the West Arm of the West Branch of the Mount Nemo Tributary of Grindstone Creek. Some of the discharge in these streams seep into the underlying aquifer. This practice is proposed to continue as part of the proposed quarry extensions. Streams close to the new excavations will likely experience a decrease in flows while the Unnamed Tributary to Willoughby Creek and the West Arm of the West Branch of the Mount Nemo Tributary of Grindstone Creek will have higher flows and higher losses to groundwater. Determining the like changes in these volumes under the different scenarios was a key objective of the integrated model. The primary source of flow into the Unnamed Tributary of Willoughby Creek and to the West Arm of the West Branch of the Mount Nemo Tributary of Grindstone Creek is quarry discharge. As mentioned, the reductions in streamflow are predicted to be minor and quarry discharge is proposed to occur long-term to maintain streamflow in these features. Additional rationale and details regarding off-site discharge will be provided as the AMP is refined in consultation with the agencies moving forward.	Noted- the response provided is to continue with pumping in perpetuity to maintain adequate stream discharge conditions which will benefit the fisheries community downstream of the quarry extension. The question relates how the pumping scenario will be maintained to balance the predicted losses due to quarrying. Based on this response, details will be provided in the AMP, which has not been provided.	The revised AMP outlines the proposed surface water management strategy for the quarry extension including pumping rates and volumes. The quarry discharge will be further refined through the necessary amendment to the quarries MECP Environmental Compliance Approval to protect the downstream natural heritage features and groundwater resources.	These items are addressed in the updated AMP provided by the applicant.

MATRIX SOLUTIONS COMMENTS

32.	Drainage to the South Extension is anticipated to be reduced in size as open extraction will intercept rainfall, groundwater, and surface runoff. To alleviate the reduced drainage, discharge to the West Arm from the Quarry Sump 0200 is proposed to continue throughout its operations in accordance with Nelson's Permit to Take Water (PTTW) and Environmental Compliance Approval (ECA) that will require an amendment to include the discharge from the south extension. For the West Extension, extraction activities will reduce the size of the sub catchments draining to several of its existing outlets. Extraction and quarry dewatering are predicted to lower groundwater levels surrounding the west extension within 350.0 meters of the extraction face. Similar to the West Arm discharges, discharge to the Colling Road roadside ditch and Willoughby Creek will be maintained from the Quarry Sump 0100 and is proposed to continue throughout the duration of quarry operations in accordance with Nelson's PTTW and ECA that will require an amendment to include the discharge from the west extension. The runoff regime to the discharge outlets requires further detail. For example, how is the reduced drainage from quarrying balanced by the pumping? As it is understood that the Assessment of impact to Willoughby Creek is based on computer simulations and not real field measurements to verify existing conditions, how is the flow to the downstream reaches validated? If the discharge regime is set to mimic existing conditions, how will this be operationalized in terms of pumping rate?	Continuous streamflow monitoring data has been collected at three locations (SW14, SW7 and SW2) along Willoughby Creek and at SW1 at the upstream end of the Unnamed Tributary of Willoughby Creek since 2014. The integrated surface and groundwater model has been calibrated to the streamflow monitoring data from these monitoring stations. The streamflow data collection effort was a key part of the study as it provides targets for calibrating the model to ensure it represents current conditions regionally and in the quarry vicinity. The calibrated integrated surface and groundwater model has been used to predict the impacts the proposed quarry expansion will have on surface and groundwater features. As mentioned, the primary source of flow into the Unnamed Tributary of Willoughby Creek and Willoughby Creek is quarry discharge. As mentioned, the reductions in streamflow are predicted to be minor and quarry discharge is proposed to occur long-term to maintain streamflow in these features. Additional rationale and details regarding off-site discharge will be provided as the AMP is refined in consultation with the agencies moving forward.	The response on validation of the model appears to be on the basis of calibration with monitoring data. The response provided seems to be similar to that noted in comment 31, which is that details will be provided in the AMP, which has not been currently provided yet.	The integrated surface water groundwater model was calibrated and validated against streamflow monitoring data for use as a predictive tool. As discussed, the calibrated integrated surface and groundwater model has been used to predict the impacts the proposed quarry expansion will have on surface and groundwater features. The revised AMP outlines the proposed surface water management strategy for the quarry extension including pumping rates and volumes. The quarry discharge will be further refined through the necessary amendment to the quarries MECP Environmental Compliance Approval to protect the downstream natural heritage features and groundwater resources.	These items are addressed in the updated AMP provided by the applicant. The applicant will refine discharge flows through the MECP Environmental Compliance Approval process.
33.	The other aspect of the surface water assessment that should be discussed is the water quality of the discharge waters. If the extraction were to continue to occur in phases, is the water quality of the discharge assumed to be the same? There is a possibility that excavation procedures including blasting may result in the release of contaminants. There is also a possibility that the Enbridge Pipeline which runs along Colling Road could be ruptured through blasting and could impact downstream fish habitat. The cumulative effects of the extraction with respect to water quality and quantity should be explained further in this section.	The discharge from the existing quarry operates under an ECA which specifies a sampling program to confirm the discharge water is of appropriate quality to discharge off-site. Moving forward, the quarry will continue to operate under the terms and conditions of the ECA. Also, the quarry operates a series of settling ponds on the quarry floor to settle sediment and contaminants out of the water before being discharged off-site. The settling ponds will remain throughout operations and post rehabilitation to ensure the water is adequately treated before being discharged off-site. It's noted, the quarry has operated in this manner for years and has remained in compliance with the terms and conditions of the ECA since issued.	Please confirm that it is intended to amend/ update the ECA. Are not the existing settling ponds proposed to be removed long term (I.e. post- rehabilitation)? Noted- it is assumed that the ECA will ensure that water quality parameters for discharge water will be adhered to during the quarry extension. The concern relates to water quality discharging into fish habitat- as this is also a DFO requirement, it is assumed that this will also be reflected in the revised AMP which has not been received by the JART Team.	The quarries existing ECA will have to be amended to include the proposed surface water management strategy if the ARA license is issued. The existing settling ponds will be expanded during operations to store and treat the quarry water prior to off-site discharge. As part of rehabilitation, the settling ponds will remain as a lake on the quarry floor to store and treat quarry water prior to off-site discharge. The revised AMP outlines the proposed water quality sampling and water quality thresholds for the quarry extension. The water quality sampling, including testing parameters and objective limits, will be further refined through the necessary amendment to the quarries MECP Environmental Compliance Approval to protect the downstream natural heritage features and groundwater resources.	These items are addressed in the updated AMP provided by the applicant. The applicant will ensure that discharge water quality will be maintained through the amended MECP Environmental Compliance Approval process, if the ARA license is issued**.**
34.	The approved rehabilitation plan envisions that the existing Burlington Quarry will be rehabilitated into a lake upon completion of extraction activities, which will result in no further discharges to both Willoughby Creek and West Arm unless water levels in the lake rise in response to wet conditions. This scenario is anticipated to reduce or eliminate base flows to these systems. As this scenario is considered a negative effect, a new proposed rehabilitation plan proposes rehabilitation of the west extension into a lake (mentioned originally as part of the adaptive management plan) but in the surface water management plan, this has been changed to a conversion of the lands to a landform suitable for recreational, natural heritage and water management purposes. This scenario also includes maintaining the long-term offsite discharge from Quarry Sump 0100 and Quarry Sump 0200 to the tributary of Willoughby Creek and West Arm as part of the new rehabilitation plan for the Burlington Quarry and West Extension. The discussion of continual pumping and controlled release of water coming from the lake should be explored further as there may be some benefit to having the lake discharge provide a more stable flow regime that is less susceptible to mechanical failure or disruptions. There is also a diversion from Colling Road that has been proposed and the resultant effects on downstream fisheries habitat along Willoughby Creek should also be discussed.	If the existing quarry is rehabilitated as currently approved (into a lake), the predicted lake water level is expected to fluctuate from approximately 268.75 m to 269.30 m, with an average water level of 269.05 m. The existing weir discharging water to the Unnamed Tributary of Willoughby Creek at Collings Road has a sill elevation of 269.08 m and upstream wetland average water level is 269.27 m. As such, a rehabilitated quarry lake will not drain into the wetland via gravity flow. To achieve gravity flow into the Unnamed Tributary of Willoughby Creek, the existing weir will have to be lowered, adversely impacting the wetland upstream. The existing culvert crossing Collings Road downstream of the weir has an invert elevation of 268.85 m and a weir or outlet elevation below 268.85 m cannot be achieved. It's noted, even if the weir and wetland are removed and the rehabilitated lake outlet set to 268.85 m, there will be periods when discharge to the Unnamed Tributary of Willoughby Creek ceases. The proposed Colling Road diversion will direct surface runoff generated north of Colling Road to the Unnamed Tributary of Willoughby Creek, its current and historic outlet, by-passing the quarry settling ponds and quarry sump.	Agreed- explanation regarding the sill elevations does not facilitate the use of the lake to provide the necessary flows through gravity discharge. Clarification if there will be a change in the current hydro period during interim and post extraction scenarios and this information should be provided in the AMP in regards to mitigation measures.	Any reduction in wetland hydro period is to be mitigated. The revised AMP outlines the proposed monitoring program, wetland hydro period thresholds and mitigation measures.	These items are addressed in the updated AMP provided by the applicant.

NORTH-SOUTH ENVIRONMENTAL INC COMMENTS

	JART Comments (February 2021)	Applicant Response (July 2021)	Interim JART Response (February 2022)	Applicant Response (June 2022)	JART Response (June 2023)
146.	Surface water thresholds for wetland hydro period are proposed in this report (Section 6.4). It is noted on Page 86 that "If the wetland water level drops to zero at a monitoring location (0.0 water level staff gauge reading) before the hydro period threshold stipulated in the previous table, the applicable mitigation measures described in Section 6.5 are to be implemented while the cause of the potential impact is evaluated to determine if it has been caused by extraction and/or quarry dewatering." These thresholds are therefore critical for maintaining wetland functions related to hydro period. The thresholds are not sufficiently conservative to protect the function of these ponds should the quarry affect their hydro period. Pond functions such as amphibian breeding rely on "good" years (years where water remains late into spring and summer) to make up for years where ponds dry up unusually early. The individual monitoring results for each wetland shown in Tables 32 to 35 show that these wetlands generally dry up in late spring or early summer, while the monitoring thresholds in Table 42 show thresholds in the early spring, generally the end of April or beginning of May. Wetlands that consistently dry up in early spring have low capacity to support amphibian breeding and other functions. Later thresholds should be established to ensure standing water is maintained for long enough to promote amphibian breeding and other functions. Wetland 13023 (the wetland immediately to the west of the south extension, which supports SWH for breeding amphibians as well as Painted Turtle), is not included in these analyses. The report should discuss monitoring and thresholds for this wetland, even though it is supported by quarry discharge.	The wetland hydro period thresholds have been established to identify potential impacts related to the quarry expansion based on wetland hydro period monitoring data. Establishing sufficiently conservative thresholds will lead to false triggers caused by climatic conditions during dry years. The intention is to set thresholds, so the existing function of the wetlands is maintained. It is not the intention to set conservative thresholds to increase the length of time the wetlands hold water to improve amphibian breeding. The AMP will be refined moving forward in collaboration with the review agencies establishing appropriate thresholds for the wetlands. Wetland 13023 is included in the integrated surface and groundwater model and wetland water balance analysis.	Concerns remain about the thresholds that have been set but we will review this in the AMP.	The revised AMP outlines the proposed monitoring program, wetland hydro period thresholds and mitigation measures.	This comment stands. As noted, thresholds based on the earliest period the wetland dries up would not ensure that the wetland's function was maintained if the threshold was not exceeded, but the pond dried up close to the earliest date recorded, every year.

SURFACE WATER EXPERT COMMENTS

	JART Comments (February 2021)	Applicant Response (July 2021)	Interim JART Response (February 2022)	Applicant Response (June 2022)	JART Response (June 2023)
35.	Evolution and background details on the purpose and development of the Terms of Reference would be helpful to understand the context of the scope of the surface water assessment.	The Terms of Reference were developed in accordance with the Halton Region Aggregate Resources Reference Manual.	Can Tatham provide a summary as to how the TOR are in compliance with the HR ARRM?	The Terms of Reference are enclosed for reference. See **Tab 3**.	The information provided in the TOR does not outline how the TOR are in compliance with the Halton Region Aggregate Resources Reference Manual. Nor does it provide any indication how comments from JART were addressed in the work plan.
36.	Rating Curve development is unclear; given the importance to corroborating modelling results this should be discussed in further detail including an indication of potential error bands.	The rating curves at each surface water monitoring station have been developed from in-situ streamflow and depth measurements collected since the stations were established. A staff gauge has been installed at each monitoring location to provide a consistent water depth measurement for each streamflow measurement collected. The rating curves development for each streamflow monitoring station are enclosed for reference.	For each rating curve Tatham should consider a level of confidence assessment given the weight placed on this numerical transformation. Also there are some rating curves developed from very few points (i.e. 2 and 3 respectively for SW 25 and 26). In addition, it would appear that a rating point was secured for SW2 at 6 m3/s – is this correct? This seems very high …	The in-situ streamflow measurements collected are compared and scrutinized and outliers have been removed from the streamflow rating curves. The rating curves with few data points will continue to be developed as additional in-situ streamflow measurements are collected. It is noted, the rating curves for the streamflow monitoring locations used to calibrate the integrated surface and groundwater model have been developed from a series of in-situ streamflow measurements (12 or more). For SW2, hydraulic calculations were completed to estimate a theoretical peak flow to extrapolate the rating curve. This 6 m^3/s peak flow included in the rating curve is the theoretical peak flow.	Given that data will continue to be collected and rating curves refined there needs to be a means to consider this data through the AMP and modify / adjust recommendations accordingly based on updated model calibration. It is not clear from the review of the AMP how this is to be realized.
37.	The Colling Rd. diversion seems central to future management of quarry water; additional background and status on this proposal is required including the potential for a back-up strategy in the event this is not ultimately feasible.	The Colling Road diversion is not central to the management of quarry water. If the diversion is not approved, the surface runoff from north of Colling Road will continue to drain through the quarry as it currently does. To accommodate the surface runoff from north of Colling road, the on- site settling ponds will be reconfigured to provide sufficient on-site volume to store the additional water until it can be discharged off-site in accordance with the terms and conditions of the PTTW.	Spatial and functional implications of this option should be included in the reporting	The proposed Colling Road diversion was included in the integrated surface and groundwater model. The implications of the diversion have been considered along the unnamed tributary of Willoughby Creek and Willoughby Creek. The results of the integrated surface and groundwater model are included in the Level 1 and Level 2 Hydrogeological and Hydrological Impact Assessment (Earthfx, April 2020), the Watercourse Characterization Tables, and subsequent materials presented/submitted in response to JART and MNDMNRF comments.	Nelson (through Tatham) provided a Technical Memorandum (April 13, 2023) to Conservation Halton which outlined that Nelson is now abandoning the proposal to divert flows along Colling Road in favour of maintaining the existing flow paths whereby the subject catchments would continue to discharge to the quarry and then be pumped to the Willoughby Tributary. Tatham states that the proposed on-site lake has been designed to have sufficient storage to accommodate the system requirements in the absence of this diversion; calculations will be required to confirm this perspective, along with the requisite updates to the AMP.
38.	Cross-references to the Hydrogeological Assessment reporting should be minimized and relevant text supporting the findings/recommendations in the Surface Water reporting should be extracted and repeated in the Surface Water reporting for completeness.	The Watercourse and Wetland Characterization Tables enclosed (Schedule B and Schedule C) have been prepared by the project team to assemble the results of the various studies in one location for ease of review.	Additional text and graphical data should be integrated as requested beyond the 2 Schedules cited	The results of the integrated surface and ground water model, feature-based wetland water balance and outlet-based water balance analysis along with the conclusions of the Natural Heritage Assessment are included in the Level 1 and Level 2 Hydrogeological and Hydrological Impact Assessment (Earthfx, April 2020), Surface Water Assessment (Tatham Engineering Limited, April 2020), the Level 1 and Level 2 Natural Environment Technical Report (Savanta, April 2020), the Wetland and Watercourse Characterization Tables, the revised AMP and subsequent materials presented/submitted in response to JART and MNDMNRF comments.	As noted it would be helpful to include information from related reports in the Surface Water Report.
39.	Rationale as to why runoff parameters to wetlands were not adjusted for the wetland results calibration (validation) should be provided. Further, the methodology to establishing wetland “storage correction factors” should be expanded upon as this is a key aspect of validating the model’s performance.	The wetland water balance calibration will be refined as additional surface water monitoring data is collected. The wetland water balance calibration methodology will be fully described as the AMP is further developed/refined.	The risks and sensitivity of applying the current runoff parameters vs future updated parameters should be reviewed and discussed in the current reporting; consider a sensitivity analysis	Wetland storage correction factors - The wetland bathymetric survey included collecting cross-sections of the wetland bottom at intervals across the wetland, leading to some uncertainty in the wetland elevations between cross-sections. Based on our field investigations of the wetlands, the wetland bottoms are highly irregular and there are large areas of the wetlands that contain isolated pockets of wetland storage that is not reflected in the bathymetric survey. To account for the additional storage provided in these pockets, a correction factor was applied to the wetland storage volumes. As a first step in calibration, a sensitivity analysis was completed to evaluate the impact each hydrologic model parameter has on wetland hydro period and water levels. The hydrologic parameters were altered within acceptable ranges to evaluate their impact on the water balance results. Given the feature-based wetland water balances generally provide a good fit to the available monitoring data, it is not expected that any future calibration will result in significant changes to the hydrologic parameters. The hydrologic parameters are expected to be tweaked, if necessary, to provide an improved fit as additional monitoring data is collected.	Given that the field data do not capture the “large areas of the wetlands that contain isolated pockets of wetland storage …” how confident are you that the storage is in fact there and causing attenuation? The calibration results could be a false signal based on runoff parameters rather than storage parameters which may skew the results. It is good that the “The hydrologic parameters are expected to be tweaked, if necessary, to provide an improved fit as additional monitoring data is collected” – the implications to recommendations as set out in the AMP need to be documented and considered.

SURFACE WATER EXPERT COMMENTS

40.	Why was the hydrologic modelling conducted with a simplistic SCS event-based technique rather than a more detailed continuous modelling approach?	The integrated surface and groundwater model is a continuous hydrologic simulation which has been used for the impact assessment in support of the quarry expansion. The simplistic SCS event based hydrologic model was used to estimate the volume of storage required to manage surface runoff on-site during operations and post rehabilitation for the various design storms and Regional Storm. The volume of storage provided on-site is the greater of the storage estimated through the event based and continuous simulations.	Tatham should provide comparisons between the event and continuous simulation results and also examine the use of similar time steps in the assessment	The integrated surface and groundwater model is a continuous simulation using actual precipitation data and completed on a daily time step. The event- based simulation assessed theoretical design storms and the Regional Storm. The two analyses were completed for different purposes and provide different results. As such, we don't believe the comparison is warranted.	It is unclear why a peak flow and runoff volume comparison would not add value to at a minimum provide a numerical check on the two modelling exercises despite their differences in application.
41.	The integration of the natural systems feature characteristics and their water needs is not well established. The form and function of these features should be elaborated on and better connected to the results interpretation.	Watercourse and Wetland Characterization Tables (enclosed – Schedule B and Schedule C) have been prepared to better integrate the potential impacts changes in surface and groundwater quantity will have on the natural heritage features.	Please see JART Comment #25.	The results of the integrated surface and ground water model, feature-based wetland water balance and outlet-based water balance analysis along with the conclusions of the Natural Heritage Assessment are included in the Level 1 and Level 2 Hydrogeological and Hydrological Impact Assessment (Earthfx, April 2020), Surface Water Assessment (Tatham Engineering Limited, April 2020), the Level 1 and Level 2 Natural Environment Technical Report (Savanta, April 2020), the Wetland and Watercourse Characterization Tables, the revised AMP and subsequent materials presented/submitted in response to JART and MNDMNRF comments.	As noted it would be helpful to include information from related reports in the Surface Water Report.
42.	The reporting states that there was an iterative process used to refine the Site Plan however no details are provided; documentation of this process should be included in the reporting.	The Site Plans have been revised as the project progressed from initiation through to first submission based on the results of the Level 1 and 2 Hydrogeological and Hydrological Impact Assessment Report, the Surface Water Assessment, and the Level 1 and 2 Natural Environment Technical Report. The Site Plans were revised to protect the existing Natural Heritage Features and key hydrologic features on and off-site. For example, the extraction limit was revised to maintain the drainage areas to the wetlands adjacent to the south extension, to provide adequate buffers around natural heritage features and eliminate disturbances to significant woodlands. We don't feel it is warranted to include a description of each Site Plan change in the reports. It is just important to know the Site Plans have been developed considering the recommendations and conclusions of the various technical studies.	We respectfully disagree – the documentation of the iterative process is considered important to gain an understanding of the applicants work leading to the current proposal – pls reconsider	The work completed in support of the Site Plans is outlined in the Level 1 and Level 2 Hydrogeological and Hydrological Impact Assessment (Earthfx, April 2020), Surface Water Assessment (Tatham Engineering Limited, April 2020), the Level 1 and Level 2 Natural Environment Technical Report (Savanta, April 2020), the Wetland and Watercourse Characterization Tables, the revised AMP and subsequent materials presented/submitted in response to JART and MNDMNRF comments. Again, we don't feel it is warranted to include a description of each Site Plan change in the reports. It is just important to know the Site Plans have been developed considering the recommendations and conclusions of the various technical studies.	As noted it would be helpful to include information from related reports in the Surface Water Report. We remain unclear why documenting the adjustments in the Site Plan to presumably improve the operations and reduce impacts is not a warranted action?
43.	Details of impacts during remediation when the lake is filling are not provided; these need to be documented and considered in the assessment of impacts to surrounding systems.	Upon completion of extraction in the south extension, the discharge from the south extension will cease and the quarry will be allowed to fill with water forming a lake. However, the discharge to the West Arm of the West Branch of the Mount Nemo Tributary of Grindstone Creek will continue. The potential impacts during rehabilitation of the south extension are the same as those for extraction in the west extension (under Scenario PH3456).	Consider including provided explanation in the updated reporting	The explanation was provided in our response to the JART first submission comments which we feel is sufficient to address this comment.	As noted it would be helpful to include information from related reports in the Surface Water Report.
44.	The study is understood to have been guided by the TOR developed for the Level 1 and 2 Hydrogeologic and Hydrologic Assessment; these are dated Feb 2020 and the submitted report is April 2020. While it is acknowledged that considerable work occurred for several years prior to the submission of the subject reporting, the authors should consider adding a section which outlines how the TOR evolved, what was their purpose and how the reporting has met the requirements of the TOR, including any deviations.	Refer to response to Comment 35. The primary deviation from the TOR was the use of a 10-year rather than 25-year simulation period to determine long-term average components of the water budget. Long run times and model stability issues created practical limitations for the model run times. The stability issues were not related to the quarry but rather to conditions at Mt. Nemo, where the Escarpment is very steep. The model simulation started in 2009 (WY2010) and extends to 2019. There are dry periods and wet periods within that span. It also represents a period for which the best (continuous) observational data were available. There were limited data prior to 2006.	Please see JART response to Comment #35.	The Terms of Reference are enclosed for reference. See **Tab 3.**	Please refer to response comment 35.
45.	The text indicates that the "objective" of the study is to "establish the existing form and function of the surface water features on-site and in the surrounding area and determine if the proposed quarry extension will have an adverse impact …" As noted in several of the comments that follow, the study tends to focus on water balance and hydro period as the only markers for impacts to wetlands and outlet receivers. Form and function are not explicitly integrated into the assessment as this requires input and support from the natural ecology study. As such, there is a need to further and more directly integrate the understanding of impacts from an ecological perspective to further inform and guide the overall water management strategy.	Refer to response to Comment 41.	Please refer to JART response to Comment #25.	The results of the integrated surface and ground water model, feature-based wetland water balance and outlet-based water balance analysis along with the conclusions of the Natural Heritage Assessment are included in the Level 1 and Level 2 Hydrogeological and Hydrological Impact Assessment (Earthfx, April 2020), Surface Water Assessment (Tatham Engineering Limited, April 2020), the Level 1 and Level 2 Natural Environment Technical Report (Savanta, April 2020), the Wetland and Watercourse Characterization Tables, the revised AMP and subsequent materials presented/submitted in response to JART and MNDMNRF comments.	As noted it would be helpful to include information from related reports in the Surface Water Report.

SURFACE WATER EXPERT COMMENTS

46.	Were the monitoring locations advanced by Nelson reviewed and approved by the regulators/agencies either before or after installation? Also, what was the basis for establishing the locations of the gauges in the surrounding area?	Refer to Response to Comment 7.	Please refer to JART response to Comment #7.	The surface and groundwater monitoring locations included in the revised AMP have been developed in cooperation with the MNDMNRF.	So to confirm the JART membership was not consulted? Consider including the rationale for locating the gauges as well as the feedback provide by MNDMNRF on their siting.
47.	The report states that there are two (2) additional wetlands (within the west extension area) which were to be monitored this spring (2020); have these data been collected and if so do they have any impact on recommendations for water management?	Continuous wetland and shallow groundwater monitoring stations were established in each wetland in the west extension lands in the spring of 2020. The wetland hydro period and shallow groundwater monitoring data collected to date is illustrated on graphs enclosed. Based on the results from 2020, both wetlands are perched and have short hydro periods. The collected data does not change our conclusions or recommendations. Monitoring in both wetlands will continue throughout the ARA licensing process and they are both suggested as part of the long-term monitoring program for the quarry.	Acknowledged. Data will need to be reviewed by JART.	RESOLVED	As noted it would be helpful to include new monitoring information from recent field work in the Surface Water Report.
48.	The report indicates that the monitoring period was established as six (6) years; as Tatham is aware not all gauges have 6 years of data with some only having 2 years and others no data (i.e. those proposed for this past spring). Can Tatham comment as to how the lack of a full (6-year) and consistent monitoring period for all gauges affects the findings? Further, has each monitoring year been reviewed in terms of its relationship to climatic norms? This is important when reviewing the results at gauges with different monitoring periods	The monitoring program implemented for this license application has evolved over the past six plus years with the findings and conclusions of the various technical studies. Monitoring data will continue to be collected throughout the licensing process and our conclusions and recommendations will be re-evaluated as additional data is collected. Our findings are based on a combination of monitoring data and simulation results. The lack of a full 6-year monitoring period does not impact our findings. The use of on-going monitoring data to establish targets where required will be considered in development of the AMP in consultation with the appropriate agencies. Each monitoring year has been reviewed in terms of its relationship to climate normals, particularly in terms of wet and dry years. It is important to understand how climate impacts surface water features and this is considered in our analysis as our wetland water balance has been simulated over a year period and the integrated surface and groundwater model simulation covers a 10 year period. A climate summary is enclosed for reference.	OK The data provided for climatic comparison is unclear – substantial differences are evident between RBG and EarthFx records – these need to be rationalized against long term means on a year by year basis to establish the adequacy of the selected time period	As specified in the revised AMP, a minimum of three years of data will be collected and used to establish threshold values moving forward. The best available climate data was used for the simulation period, specifically the period of available monitoring data, of the integrated surface and groundwater model and feature-based wetland water balance. Moving forward, Nelson has invested in an on-site climate station that will be used to collect site specific climate and precipitation data.	It is understood that a minimum of three years of data will be collected to establish the thresholds. It would also be advisable if this can include an assessment of the appropriateness of the subject three years in establishing those thresholds given the data skew which could result from years well beyond climatic norms.
49.	Rating curves at each gauge site were noted to be developed by Tatham however no details have been provided. How many data points have been collected at each site and how many reflect storm conditions vs. non-storm conditions? Further has there been any effort to corroborate the water levels to flows using theoretical hydraulics of the local reaches?	Refer to response to Comment 36. The number of in-situ streamflow measurements used to develop the rating curves are illustrated on the enclosed graphs. In-situ streamflow measurements have been collected during a variety of climate conditions including spring freshet and during rain events. The rating curves will continue to be refined moving forward as additional in-situ streamflow measurements are collected.	As noted under the response to the reply to comment 36, there are some concerns with the rating curves. Can Tatham comment on the upper levels (rates) determined in the rating curves vs the upper flow rates from the modelling and associated reliability in transformation of levels to flow rates?	The rating curves for the streamflow monitoring locations used to calibrate the integrated surface and groundwater model have been developed from a series of in-situ streamflow measurements (12 or more) of varying flows. For SW2, hydraulic calculations were completed to estimate a theoretical peak flow to extrapolate the rating curve. The 6 m^3/s peak flow included in the rating curve is the theoretical peak flow. Also, additional hydraulic calculations have been undertaken to validate the results of the streamflow monitoring at the surface water monitoring locations. However, we prefer to use, and have used, the in-situ streamflow measurements to develop the rating curves whenever possible.	As noted in the reply to comment 36, there needs to be a means in the AMP to consider updated rating curves in setting thresholds. Please elaborate and include in the updated surface water report.
50.	The reports states that monitoring at all sites was to continue beyond the September 15, 2019 period selected as the end of reporting. Can Tatham verify that all gauges have continued and that the data from these gauges will be used to support decision-making in the future?	All surface water monitoring stations remain in operation except SW7. SW7 was located on private property and the owner of the property asked for the device to be removed in 2020. All of the surface water monitoring locations currently in operation will remain operational throughout the ARA licensing process and it is expected a majority will be maintained throughout extraction in the expansion areas as a condition the Quarry's AMP.	As data are collected the influence of new information on study recommendations needs to be considered; what is the process? Will this be detailed in the AMP?	The additional data collected will be used to assess impacts, establish thresholds and direct mitigation as described in the revised AMP.	Resolved.
54.	What was the protocol for the manual in-situ measurements taken at the 38 locations surrounding the existing quarry? Was there an inter-event time? Were they always dry periods or also wet periods? Were results adjusted for actual antecedent conditions?	In-situ streamflow measurements were collected every other month from the 38 locations surrounding the existing quarry to confirm the presence of flow. The measurements were generally collected in the spring, summer and fall to understand the seasonality of flow in these watercourses.	Stated protocol needs to be incorporated into updated reporting	The protocol was provided in our response to the JART first submission comments which we feel is sufficient to address this comment.	As noted it would be helpful to include this information in the updated Surface Water Report.

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56.	The report states that a single drive point piezometer was installed adjacent to each wetland to monitor shallow groundwater to assist in baseline monitoring. Can Tatham advise as to the rationale for only having a single gauge and what the potential for up and down gradient variation may be and how this may affect the baseline conditions? Based on more common industry practices, wetlands are typically instrumented with multiple gauges to improve the understanding of groundwater/surface water interactions in complex settings.	A single shallow groundwater monitoring mini- piezometer was installed in each monitored wetland based on the results of previous monitoring and our understanding that the wetlands in the area are generally perched. As illustrated through the results of the groundwater monitoring and integrated surface and groundwater model, the wetlands are generally perched, receiving no to minor groundwater contributions (less than 3% of total annual inflow) during spring freshet.	Based on the hydrograph there is seasonal groundwater and based on this one piezometer may not be sufficient to characterize the wetland function. A rationalization for the approach should be documented. The data will need to be reviewed by JART.	As outlined in the revised AMP, additional drive point wells have been installed in the wetlands east of the south extension and in the west extension to collect additional data and confirm our understanding of the overburden aquifer.	This is a positive action. As noted it would be helpful to include this information in the updated Surface Water Report
57.	Water quality samples were collected from selected surface water monitoring sites for 2018 and 2019 and tested for a limited suite of parameters (TSS, pH and Conductivity); can Tatham advise how these sites were selected and the sampling period determined and why only 3 parameters were tested? Further there seems to be limited interpretation of these data in terms of physical characterization - how is this information being used?	The sampling sites were selected to characterize the water quality as follows: • SW15 – external water quality entering the quarry; • SW1 – water quality entering Unnamed Tributary of Willoughby Creek; • SW2 – water quality of Willoughby Creek at downstream limit of study; • SW14 – water quality of Willoughby Creek upstream of quarry discharge; • SW29 – water quality in Unnamed Tributary of Lake Medad; • SW6 – water quality of West Arm of the West Branch of the Mount Nemo Tributary of Grindstone Creek leaving the south extension lands; • SW10 – water quality of the West Branch downstream of confluence of West and East Arms; • SW28 – water quality of the East Branch; and • SW30/SW31/SW32/SW35/SW24 – water quality of watercourses in the surrounding area. It's noted, water quality samples are collected from the quarry discharge in accordance with the ECA. The water quality sampling was not restricted to three parameters. A full spectrum of parameters was tested including general chemistry, metals and nutrients as illustrated in the water quality sample results summaries included in Appendix H of the Surface Water Assessment.	Further clarity on the rationale, objective and use of these data should be incorporated into the updated reporting.	How the sampling sites were selected is provided in our response to the JART first submission comments which we feel is sufficient to address this comment.	As noted it would be helpful to include this information in the updated Surface Water Report.
61.	Can the source and vintage of the topographic and aerial mapping be provided? Further there is reference to field survey - can this report provide documentation on the extent and purpose of the field survey?	The topographic mapping was generated from a drone survey completed November 22, 2018 having an accuracy of +/- 3 cm. A topographic survey was completed of various on-site features including: • Groundwater monitoring wells; • Surface water monitoring stations; • Wetland bathymetry; • Golf course diversion channel and irrigation ponds; • Weir pond outlet structure; • Various culvert crossings; and • West Arm through the south extension lands.	Please include this information in updated report – also please document differences with publicly available data/mapping	The sources of the topographic data are provided in our response to the JART first submission comments which we feel is sufficient to address this comment.	As noted it would be helpful to include this information in the updated Surface Water Report.
62.	Has Tatham compared drainage area mapping with that available through other sources? I.e. CH, MNRF, etc. This would be beneficial to assist in a comparative verification of the mapping.	Our watershed/catchment delineation has been compared against catchment delineations from the MNRF OFAT tool and Conservation Halton's watershed boundaries. Only minor discrepancies exist between the various catchment delineations compared.	Please include details of minor differences in updated report – also pls document differences with publicly available data/mapping.	A description of the comparison completed is provided in our response to the JART first submission comments which we feel is sufficient to address this comment.	As noted it would be helpful to include this information in the updated Surface Water Report.
65.	Report states that Nelson is exploring options to divert drainage external to the quarry along Colling Rd. This alternative/option is cited in subsequent sections of the reporting as a core requirement of the mitigation strategy. Can Tatham provide additional details on what Nelson has done to "explore" this alternative? Has the City of Burlington been contacted in terms of potential influence on roadway drainage? Has CH been contacted in terms of transferred impacts? Have neighbors been contacted? Have there been any earlier analyses and or design proposals?	The feasibility of diverting the flow has been explored and it has been confirmed that the flow can be diverted through a combination culvert and ditch system. The City of Burlington and Conservation Halton have been made of aware of the proposal through the circulation of the Surface Water Assessment. Local residents have not been contacted regarding the proposal. Refer to response to Comment 37 and 64 for additional details.	Functional implications need to be reviewed with all potential affected parties.	The Colling Road diversion is not central to the management of quarry water. If the diversion is not approved, the surface runoff from north of Colling Road will continue to drain through the quarry as it currently does. If Nelson elects to proceed with the diversion of flow along Colling Road, the diversion system will be engineered to convey the required minor and major storm peak flows to the satisfaction of the City of Burlington. Also, the conveyance system downstream of the diversion will be reviewed or improved to ensure it has adequate capacity from the existing quarry discharge location to the unnamed tributary of Willoughby Creek.	Nelson (through Tatham) provided a Technical Memorandum (April 13, 2023) to Conservation Halton which outlined that Nelson is now abandoning the proposal to divert flows along Colling Road in favour of maintaining the existing flow paths whereby the subject catchments would continue to discharge to the quarry and then be pumped to the Willoughby Tributary. Tatham states that the proposed on-site lake has been designed to have sufficient storage to accommodate the system requirements in the absence of this diversion; calculations will be required to confirm this perspective, along with the requisite updates to the AMP.

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66.	The south extension is discussed in terms of drainage area which discharges to the West Arm (36.0 hectares). There is also reference to a further drainage area draining overland into wetlands which are part of the East Arm however no drainage area is provided? Can Tatham advise?	The drainage area to the East Arm is not being altered through the south extension. As such, changes were not discussed. The drainage areas to the East Arm are illustrated on the various Drainage Plans (Drawings DP-1, DP-2 and DP-3) enclosed.	For completeness consider adding clarification as noted in response.	Clarification is provided in our response to the JART first submission comments which we feel is sufficient to address this comment.	As noted it would be helpful to include this information in the updated Surface Water Report.
73.	The Water Balance Calibration section provides details on the approach and suggests that there was a topographic survey - can details of this survey be provided? Also the calculations have been reported daily and monthly; it is also suggested that these be considered/assessed at a seasonal time period. It should also be noted that there are numerous cross-references in this section and others to the Level 1 and 2 Hydrolgeological Assessment; for completeness and readability it is suggested that relevant details be repeated in this document to improve the flow of content.	Refer to response to Comment 68. The wetland water balance has been completed on a daily time step for a period of 22 years (1998 to 2019) to consider seasonality. The Wetland Characterization Tables enclosed include the relevant conclusions and recommendations of the various reports in one location.	Please refer to JART responses for Comments #25 and #60.	The results of the integrated surface and ground water model, feature-based wetland water balance and outlet-based water balance analysis along with the conclusions of the Natural Heritage Assessment are included in the Level 1 and Level 2 Hydrogeological and Hydrological Impact Assessment (Earthfx, April 2020), Surface Water Assessment (Tatham Engineering Limited, April 2020), the Level 1 and Level 2 Natural Environment Technical Report (Savanta, April 2020), the Wetland and Watercourse Characterization Tables, the revised AMP and subsequent materials presented/submitted in response to JART and MNDMNRF comments.	As noted it would be helpful to include this information in the updated Surface Water Report.
74.	Given that only 4 years of data have been used for model performance review it is respectfully suggested that the analysis be re-titled to "Water Balance Validation" as 4 years of data would be considered insufficient for the purpose of model "calibration".	Refer to response to Comment 39.	Response is not acceptable.	Refer to response to Comment 39.	Refer to response to Comment 39.
75.	This section indicates that the basis for the calibration (validation) was founded on the wetland discharge parameters rather than any of the runoff generating parameters. Tatham states that this is due to a review of the results which suggests this approach was "reasonable and did not warrant adjustment". Further it is unclear as to how the "correction factors" were established, along with the storage discharge curves and the "broad crested weir equation". Wetland discharge relationships are inherently complex and it is unclear as to how these have been represented accurately. Can Tatham offer more details?	Refer to Response to Comment 39.	Please see JART response to Comment #39. Response is not acceptable.	Refer to response to Comment 39. The discharge curves were developed directly from the topographic survey of each wetland's outlet using approved broad crested weir equations.	Refer to response to Comment 39. As noted, given the unknowns and the inherent assumptions in the applied methodology, the reliance on the correction factors may be skewing the results and therefore the runoff parameters.
76.	The differences between observed and modelled hydro periods ranges between 7 and 10 days - has the Nelson Team's ecological specialists weighed in on the adequacy of this predictive range?	The spring hydro period has generally been predicted within seven days or less and the fall hydro period within 10 days or less. It is our opinion the daily water balance is a reasonable predictor of the wetland hydro period and can be used to predict potential impacts from the proposed quarry extensions and dewatering. It needs to be kept in mind that the simulation compares proposed conditions to existing to evaluate any potential adverse impacts caused by the proposal.	The 7-10 day shortening could have impact on wetland function over the long term. Additional years of modelling data would improve the understanding and provide guidance for appropriate mitigation measures.	Additional monitoring data will be collected and used to establish appropriate wetland hydro period thresholds and mitigation measures.	Resolved per AMP.
79.	Table 19 results for some years indicate more runoff than precipitation (e.g. 2009). Can Tatham advise as to the rationale?	There are no locations presented in Table 19 where runoff volume exceeds precipitation.		RESOLVED	Resolved.
80.	The surface-groundwater model has assumed the quarry discharge as fixed at 67.0 liters/second. It is questioned whether this assumption is valid and what the range of discharge rates are based on actual monitoring?	Quarry discharge was fixed in an earlier version of the baseline model. Because the model had to be capable of predicting quarry discharge under future conditions, the model was modified so that it could predict quarry discharge on a daily basis. The value calculated depended on simulated groundwater and surface water inflows (precipitation and runoff) inflows. The model was calibrated so that it reasonably matched the recorded discharges from the quarry which averaged 67 L/s.	These details should be included in the updated reporting.	The details are provided in our response to the JART first submission comments which we feel is sufficient to address this comment.	As noted it would be helpful to include this information in the updated Surface Water Report.
81.	Are the flows reported in Table 20 based on the calibrated (validated) modelling?	The flows depicted in Table 20 are results from the calibrated existing condition integrated surface and groundwater model.	Thank you for the clarification, comment addressed	RESOLVED	Resolved.

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83.	Can a modelling schematic be provided for the OTTHYMO modelling?	VO model schematics are enclosed for reference.	Comment addressed; no further comments.	RESOLVED	Resolved.
84.	For the surface water assessment for the hazard and erosion impact assessment why has a simplistic event based model been used rather than a more complex and comprehensive modelling approach (continuous simulation)? It is suggested that continuous modelling will provide a better and more representative result for the surface water flow regime, including sub-annual events. Further, the SCS CN methodology has been used for this assessment which again tends to be limiting and more black box in its methodology. Other time varying approaches for soil properties applied in long term continuous modelling are considered more accurate and superior to SCS and also eliminate bias when using design storm-based methodologies.	The flood and erosion hazard limits have been established in accordance with the Provincial Policy Statement and the MNRF Natural Hazard Technical Guides (Flooding and Erosion Hazard Limits).	Tatham should consider documenting how the work is consistent with the PPS and Technical Guidelines.	We confirm the flood and erosion hazard limits have been established in accordance with the PPS and Technical Guides and additional documentation will not be provided.	As noted it would be helpful to include this information in the updated Surface Water Report.
90.	It is noted that the MTO IDF has been selected - have these values been compared to local data available from the City of Burlington and CH?	Refer to response to Comment 86.	It appears as if the COB data are more conservative for the 15 minute to 12 hour range – why have these not been applied?	The 24-hour design storm distribution produces the greater peak flows. The MTO IDF data has been used as it is more conservative for the 24-hour storm.	Resolved.
92.	It is noted that Table 21 reports on the SCS 24-hour distribution but unclear as to why that distribution has been reported rather than the Chicago 4 hour which is also noted to have been executed - please advise; also the time step is not documented in this section - please advise and outline supporting rationale for its selection	The SCS 24-hour design storm distribution produces greater peak flows than the Chicago 4- hour design storm distribution and therefore the SCS flows have been reported. Refer to response to Comment 85.	Thank you for the clarification; can test beaded to the report accordingly and also include reference to the time step and selection rationale?	Clarification was provided in our response to the JART first submission comments which we feel is sufficient to address this comment.	As noted it would be helpful to include this information in the updated Surface Water Report.
93.	Why was the quarry discharge not included in the event-based results from Quarry Sumps 100 and 200?	The simplistic SCS event based hydrologic model was used to estimate the volume of storage required on-site during operations and post rehabilitation for the various design storms and Regional Storm. The volume of storage provided on-site is the greater of the storage estimated through the event based and continuous simulations. The results represent the surface runoff, and only surface runoff, draining to each outlet.	Still unclear why sump discharges have not been included?	The event-based simulation was completed to estimate the volume of water entering the quarry to establish the volume of storage required on-site to manage the quarry water during each phase of operation and rehabilitation. The sump discharges from the quarry, removing flow from the sump. The quarry discharge does not contribute flow to the on-site storage system. The volume of water discharged from the quarry sumps during a 24-hour period is relatively small compared to the surface runoff entering the quarry during the 1:100-year return frequency design storm and Regional Storm.	So this is in essence a conservative estimate? Has the revised approach eliminating the external diversion of the Colling Rd drainage been incorporated into the updated storage calculations? As noted it would be helpful to include this information in the updated Surface Water Report.
99.	Why was the flood hazard assessment restricted to the West Arm? Should not all outlets be examined for potential impacts due to the alteration of quarry surface water changes?	The Natural Hazards Assessment has been completed for the West Arm of the West Branch of the Mount Nemo Tributary of Grindstone Creek to confirm the proposed extraction limit does not encroach into the existing natural hazards on-site. There are no other natural hazards identified on-site requiring a Natural Hazards Assessment.	Comment addressed.	RESOLVED	Resolved.
100.	It is suggested that a Stream Morphologist be retained to review the erosion thresholds associated with the current predicted flow regime.	Refer to response to Comment 58.	Response to Comment 58 does not provide a reply to stated concern.	The integrated surface and groundwater model is a continuous simulation which generally predicts minor reductions in total streamflow through the unnamed tributary of Willoughby Creek, Willoughby Creek and the West Arm of the West Branch of the Mount Nemo Tributary of Grindstone Creek as a result of the quarry expansion. The quarry discharge from Sumps 0100 and 0200 is not proposed to be altered and, as the model predicts minor reductions in flow, the duration and frequency of the exceedances in the erosion threshold flow rates are not expected to increase. As such, we do not feel an erosion and sediment transport assessment is warranted.	Respectfully disagree; as a minimum the findings, conclusions and recommendations should be reviewed by a qualified SM.

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108.	Tatham references an "iterative" process to Site Plan development - for completeness and a more fulsome understanding of the process followed by the Nelson Team, can the iterative changes/adjustments be documented for the record?	Refer to response to Comment 42.	We respectfully disagree – the documentation of the iterative process is considered important to gain an understanding of the applicants work leading to the current proposal – please reconsider.	Refer to response to comment 42.	Refer to reply to comment 42.
109.	Per earlier comment on section 3.1.1. pg. 28 - can Nelson provide details on the process to-date on establishing a diversion along Colling Rd?	Refer to response to Comments 64 and 65.	Please see JART responses to Comments #64 and #65.	A preliminary design of the Colling Road diversion was submitted as part of the response to JART first submission comments. The implications of the diversion have been considered along the unnamed tributary of Willoughby Creek and Willoughby Creek. The results of the integrated surface and groundwater model are included in the Level 1 and Level 2 Hydrogeological and Hydrological Impact Assessment (Earthfx, April 2020), the Watercourse Characterization Tables, and subsequent materials presented/submitted in response to JART and MNDMNRF comments. The Colling Road diversion is not central to the management of quarry water.	Refer to reply to comments 64 and 65
111.	For the South extension it states that the quarry water is being treated at rates "set to mimic existing conditions"; can Tatham elaborate on how this is going to be operationalized?	The proposed temporary settling pond will be designed to treat the discharge from the south extension in accordance with the effluent criteria established in the ECA. The discharge rates will be established to mimic existing flow rates and volumes in the West Arm of the West Branch of the Mount Nemo Tributary of Grindstone Creek. Additional rationale and details regarding off-site discharge will be provided as the AMP is refined in consultation with the agencies moving forward.	Details need to be elaborated on and included in updated reporting.	Preliminary settling calculations demonstrate that a three-cell settling pond, with 40 m long and 25 m, 15 m, and 5 m widths, will provide sufficient treatment for the proposed discharge rate of 3,000 L/min. The preliminary settling calculations were previously submitted. The design of the settling pond will be completed as part of the ECA amendment process with the MECP.	The earlier response states that: “Additional rationale and details regarding off-site discharge will be provided as the AMP is refined in consultation with the agencies moving forward.” The later response provides further details but these do not appear to be included in the updated AMP (June 2022) nor any amended Surface water report.
112.	Can Tatham provide additional details as to how the 50.0 liters/second was established as a limit for pumping? This approach assumes a rate but has there also been a check on volumes? To this end can calculations and assumptions be provided for the 1800.0 cubic meters settling pond sizing?	Refer to response to Comment 111. The settling pond has been sized to settle the anticipated particle size distribution in the quarry effluent in accordance with the effluent criteria of the ECA for a flow rate of 50 L/s. The settling calculations are enclosed for reference.	Please refer to JART response to Comment #111.	The discharge rate was established from a review of the available streamflow monitoring data and from the results of the West Arm hydraulic analysis. The streamflow monitoring data collected to date illustrates that existing flows rates typically vary between 20 and 90 l/s during the year. The results of the hydraulic analysis confirm the limiting capacity of the West Arm’s low flow channel is 270 l/s. A discharge rate of 50 l/s was selected to remain within the typically streamflow range while ensuring the low flow channel has sufficient capacity to convey the flow within its banks downstream.	Refer to reply to response to Comment 111.
113.	The report states that 5.0 hectares is a threshold condition for extraction which triggers implementation of a new sump; can Tatham provide details on this determination? Why 5.0 hectares?	The 5.0 hectare threshold was established based on the required floor area to construct a sump with 1800 m^3 of available storage while providing sufficient space for operations. This threshold will be re-evaluated as the discharge rate from the south extension is finalized.	When is it planned to re-evaluate the stated threshold?	The thresholds will be reevaluated and finalized prior to site operations in the south extension in accordance with the revised AMP.	It is unclear from the AMP how this detail is being addressed.
114.	What is the source of the 350.0 meter dimension from the face as a point of comparison?	The reference to 350 m is incorrect. The drawdown in water levels, as per the integrated surface and groundwater model, is less than 2.0 m at a distance of 500 m from the active quarry face.	Comment addressed.	RESOLVED	Resolved.
115.	As a means of mitigating impacts to off-site systems Tatham is proposing a "replica" pond. This appears to be a long linear feature extending approx. 3/4 of the distance between No. 2 SR to Colling Rd. From the available documentation it appears that there is no preliminary design for this feature, rather it is shown as a concept in plan form on the Site Plan, with basic sections only. Given the importance which Tatham places on this "replica" facility to service off-site systems and maintain overall water balance can Tatham provide additional design details to ensure that the facility as conceptualized is feasible, particularly in light of its length and the number of inlets and outlets.	The preliminary design of the infiltration pond is illustrated on the Site Plans. The preliminary pond includes the proposed pond grading, the diversion pipe invert elevations and alignment, and the outlet pipe location. We believe the information provided on the Site Plans is sufficient to confirm the feasibility of the infiltration pond and additional details will be provided at detailed design.	Reply to follow discussions with Nelson regarding the infiltration ponds.	Please refer to our previous response to comment 115.	While in the opinion of the reviewer the level of detail remains more conceptual than preliminary this can be addressed at a future time; that said it should be noted that the red-lined Site Plan does not depict the infiltration pond

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116.	It is postulated by Tatham that reducing flows to the roadside ditch and ultimately the Medad Valley and Willoughby Creek is positive for the function of the ditches however no comment is provided as to the potential environmental impact to the Medad Valley and Willoughby Creek - has this been assessed by Nelson's ecologist?	Refer to response to Comment 70. The potential adverse impacts were identified in the Level 1 and 2 Hydrogeological and Hydrological Impact Assessment Report, the Surface Water Assessment, and the Level 1 and 2 Natural Environment Technical Report. Additional information regarding the potential impacts and mitigation measures are included in the Watercourse Characterization Tables enclosed.	Please see JART response to Comment #25.	As presented during the meetings held the week of May 16, 2022, additional analysis has been completed to assess the potential impacts the proposed quarry extension will have on the Medad Valley and Willoughby Creek. The analysis also assessed the proposed infiltration pond's ability to mitigate these potential impacts. The supplemental material prepared in support of the meetings should be reviewed for additional clarification regarding comment 127. Additional instrumentation (both shallow groundwater and streamflow monitoring stations) is proposed as part of the updated AMP to confirm our understanding of the surface water and groundwater regimes through the Medad Valley and confirm the results of the integrated surface and groundwater model.	Based on a review of the PowerPoint material available during the May, 2022 meetings model predictions have been provided as to the water quantity impacts on the Medad Valley; however, these impacts do not appear to have been considered in terms of the natural ecology of the area along with potential adaptive management.
119.	All of the mitigation relies on the diversion of external flow along Colling Rd.; has Tatham considered a back-up or alternate strategy should this not be feasible or approved?	Refer to response to Comment 37.	Please refer to JART response to Comment #37.	The Colling Road diversion is not central to the management of quarry water. If the diversion is not approved, the surface runoff from north of Colling Road will continue to drain through the quarry as it currently does and the on-site settling ponds will be expanded to accommodate this additional surface runoff.	Refer to reply to response to Comment 37.
120.	Can Tatham confirm the statement that all surface drainage catchments draining to the wetlands under assessment will not change in area or use over the course of the extraction and post extraction?	The south extension extraction area has been refined during the project to ensure the catchment areas of the wetlands east and south of the south extension will not be altered. As discussed in the Surface Water Assessment, the catchment areas to Wetlands 13200, 13201, 13202 and 13203 will be altered through extraction in the south and west extensions and mitigation measures have been prescribed accordingly.	Will the statement be amended?	Clarification was provided in our response to the JART first submission comments which we feel is sufficient to address this comment.	As noted it would be helpful to include this information in the updated Surface Water Report.
121	Tatham indicates that for 7 of the 10 years analyzed the hydro period would be delayed 5 days or less; can Tatham indicate why the other 3 years have not been reported.	All ten years analyzed have been reported in Table 24.	Comment addressed.	RESOLVED	Resolved.
123.	This section is understood to document the impacts to the runoff regime to the various outlets from the Quarry Study area; the last sentence in para. 2 in this section indicates that "if necessary, mitigation measures have been developed that could	You are correct, the sentence should refer to the outlets or watercourses.	AMP details will need to be developed sooner than later.	The revised AMP outlines the proposed surface water monitoring program, streamflow and temperature thresholds and mitigation measures.	Resolved.
124.	Can Table 28 be re-structured to include a comparison between existing and proposed runoff volume at the respective outlets? Further can a table be added which provides a monthly or seasonal comparison at the outlets?	Refer to response to Comment 59. Table 28 has been revised accordingly.	Depending on the modelled year there are significant differences in runoff volume under existing and proposed conditions – the ecological implications of these changes need to be discussed in the reporting.	The results of the integrated surface and ground water model, feature-based wetland water balance and outlet-based water balance analysis along with the conclusions of the Natural Heritage Assessment are included in the Level 1 and Level 2 Hydrogeological and Hydrological Impact Assessment (Earthfx, April 2020), Surface Water Assessment (Tatham Engineering Limited, April 2020), the Level 1 and Level 2 Natural Environment Technical Report (Savanta, April 2020), the Wetland and Watercourse Characterization Tables, the revised AMP and subsequent materials presented/submitted in response to JART and MNDMNRF comments.	As noted it would be helpful to include this information in the updated Surface Water Report.
125.	Can Tatham provide details on how the system would be performing while the Lake is filling and how long this is predicted to take?	During filling of the lake, the discharge to the Unnamed Tributary of Willoughby Creek and the West Arm of the West Branch of the Mount Nemo Tributary of Grindstone Creek will continue from sumps 0100 and 0200. Water not needed to maintain discharge to the surface water systems will be pumped into the south extension, which will supplement the groundwater influx and direct precipitation to fill the lake. Currently the existing quarry stores approximately 1 billion liters of water. It will take 3 billion liters to fill the south extension. It is reasonable to suggest that Nelson could pump 5,000 L/min from the existing quarry to the south quarry extension. At this rate, the south extension would fill in 417 days, assuming no inputs from groundwater or direct precipitation. However, the downstream water demands and available water in the Quarry need to be considered. Recognizing the quarry currently holds approximately 1 billion liters of water, 3 billion are required, and the discharge from sump 0100 and 0200 need to be maintained, it is estimated it will take 2 to 5 years to fill the lake.	Will these details and associated calculations be included in the updated report?	The requested details were provided in our response to the JART first submission comments which we feel is sufficient to address this comment.	As noted it would be helpful to include this information in the updated Surface Water Report.

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129.	Can Table 30 be re-structured to include a comparison between existing and proposed runoff volume at the respective outlets? Further can a table be added which provides a monthly or seasonal comparison at the outlets?	Refer to response to Comment 59. Table 30 has been revised accordingly.	Depending on the event and location peak flows vary significantly under existing and proposed conditions – the ecological impacts need to be reported and considered.	The ecological impacts have been reviewed and considered as part of the natural heritage assessment conducted for the project.	As noted it would be helpful to include this information in the updated Surface Water Report.
136.	It is unclear if under the rehabilitated condition whether the water balance will change in the vicinity of the replica pond - can Tatham advise?	As noted, the infiltration pond will remain active and receive a portion of the discharge used to maintain low groundwater levels within the excavated area. This water will infiltrate the shallow bedrock and raise groundwater levels in its vicinity. Some of the infiltrating water would flow back into the excavation while the remainder would discharge to the Medad Valley. Simulated changes in the water balance in nearby streams and wetlands are discussed in the Level 1 and 2 Hydrogeological and Hydrological Impact Assessment Report.	Suggest that Additional details to be added to updated report.	As presented during the meetings held the week of May 16, 2022, additional analysis has been completed to assess the potential impacts the proposed quarry extension will have on groundwater levels, the Medad Valley and Willoughby Creek. The analysis also assessed the proposed infiltration pond's ability to mitigate these potential impacts. The supplemental material prepared in support of the meetings should be reviewed for additional clarification regarding comment 136.	As noted it would be helpful to include this information in the updated Surface Water Report
132.	Section 5.2 makes reference to a new rehabilitation plan which proposes to convert the Burlington Quarry into a landform rather than a lake. Drawing 3 of the Site Plan set outlines the proposed rehabilitation for the west extension however no plan(s) are provided for the existing Burlington Quarry. In order to fully understand the drainage patterns and operations affecting surface water, a plan should be provided at this stage which illustrates the full rehabilitation plan, including the existing quarry.	Refer to response to Comment 13.	In the reply to comment #13 Tatham indicates that "…Tatham assisted with the water management components of the rehabilitation design for the existing quarry and proposed extension." Can further details be provided?	The proposed surface water mitigation strategy for the quarry aims to maintain the existing form and function of the natural heritage features, specifically the unnamed tributary of Willoughby Creek and Willoughby Creek, which have received quarry discharge for over 60 years. The cessation of the quarry discharge from sump 0100 as approved under the current quarry ARA license will alter the streamflow rates and patterns through the unnamed tributary of Willoughby Creek and Willoughby Creek, altering the form and function of these natural heritage features. A recommendation of the Tatham report was to amend the rehabilitation plan for the existing quarry to maintain the current pumping regime to protect adjacent features from negative impacts. As part of this recommendation, Tatham assisted with the proposed design of the pond, lakes and discharge points to ensure the proposed rehabilitation plan includes a landform capable of maintaining the current pumping regime.	As noted it would be helpful to include this information in the updated Surface Water Report.
133	Tatham references an "iterative" process to Site Plan development - for completeness and a more fulsome understanding can the iterative changes/adjustments be documented for the record	Refer to response to Comment 42.	Please refer to JART response to Comment #42.	See response to Comment # 42.	Please refer to reply to response to comment 42.
134.	This section describes long term water management objectives for the Quarry but does not provide any indication as to the overall water budget nor the needs for each of the proposed features requiring water. Can Tatham outline the water demands and associated tolerances for each element cited and also provide an indication of sustainability?	The long-term water management objective of the Quarry is to maintain the existing discharge (rate and volume) to the Unnamed Tributary of Willoughby Creek and the West Arm of the West Branch of the Mount Nemo Tributary of Grindstone Creek. Also, the discharge of quarry water into Wetland 13201 via the bottom draw outlet and the infiltration pond is required to maintain the wetland hydro period. The wetland hydro period will be established as additional baseline monitoring data is collected from the wetland. Also, the wetland water balance will be updated and recalibrated to identify the water demands to the wetland long-term.	Suggest that Additional details to be added to updated report.	The details are provided in our response to the JART first submission comments which we feel is sufficient to address this comment.	As noted it would be helpful to include this information in the updated Surface Water Report.
135	Tatham indicates that a water level control is not proposed for the lake - can the reason and rationale be provided? It is suggested that without some form of control adaptive management opportunities may be compromised	Based on the results of the integrated surface and groundwater model, the lake will fill to an elevation of 271.0 m. Minimum existing grade around the proposed south extension lake is 272.0 m and the grade will be raised via earthworks to contain the pond water level. An overflow weir will be installed to discharge water from the lake to the West Arm of the West Branch of the Mount Nemo Tributary of Grindstone Creek, preventing failure of the lake banks in case of an emergency. Although, the overflow weir is not expected to be used. If streamflow mitigation is required in the West Arm, there are opportunities to construct an outlet to the watercourse. However, discharge from quarry sump 0200 to the West Arm is proposed long-term and may also be adjusted to mitigate adverse impacts in the West Arm. The AMP will be refined moving forward in collaboration with the review agencies establishing appropriate mitigation measures for the watercourses.	Suggest that Additional details to be added to updated report.	The details are provided in our response to the JART first submission comments which we feel is sufficient to address this comment.	As noted it would be helpful to include this information in the updated Surface Water Report.

SURFACE WATER EXPERT COMMENTS

136.	It is unclear if under the rehabilitated condition whether the water balance will change in the vicinity of the replica pond - can Tatham advise?	As noted, the infiltration pond will remain active and receive a portion of the discharge used to maintain low groundwater levels within the excavated area. This water will infiltrate the shallow bedrock and raise groundwater levels in its vicinity. Some of the infiltrating water would flow back into the excavation while the remainder would discharge to the Medad Valley. Simulated changes in the water balance in nearby streams and wetlands are discussed in the Level 1 and 2 Hydrogeological and Hydrological Impact Assessment Report	Suggest that Additional details to be added to updated report.	The details are provided in our response to the JART first submission comments which we feel is sufficient to address this comment.	As noted it would be helpful to include this information in the updated Surface Water Report.
137.	Tatham notes that a bottom draw outlet control will be maintained post extraction and monitoring of the wetland will be completed to maintain the hydro period; can Tatham advise on the triggers for adaptive management and the adjustments which may be required if those triggers are not met?	The AMP will be refined moving forward in collaboration with the review agencies establishing appropriate thresholds and mitigation measures for Wetland 13201.	Details should be developed sooner than later.	The wetland monitoring program, hydro period thresholds and mitigation measures are provided in the revised AMP.	Resolved.
138.	Can Table 36 be re-structured to include a comparison between existing and proposed runoff volume at the respective outlets? Further can a table be added which provides a monthly or seasonal comparison at the outlets?	Refer to response to comment 59. Table 36 has been revised as requested.	Depending on the event and location peak flows vary significantly under existing and proposed conditions – the ecological impacts need to be reported and considered.	The ecological impacts have been reviewed and considered as part of the natural heritage assessment conducted for the project.	As noted it would be helpful to include this information in the updated Surface Water Report.
139.	Can Table 37 be re-structured to include a comparison between existing and proposed peak flows at the respective outlets?	Table 37 has been revised as requested.	Depending on the event and location peak flows vary significantly under existing and proposed conditions – the ecological impacts need to be reported and considered.	The ecological impacts have been reviewed and considered as part of the natural heritage assessment conducted for the project.	As noted it would be helpful to include this information in the updated Surface Water Report.
140.	Revisit and revise the Surface Water Management Strategy in conjunction with addressing the feedback on the Surface Water Assessment and other supporting studies.	The surface water management strategy will be revised as necessary through the development/refinement of the AMP in consultation with the agencies.	Agreed.	RESOLVED	Resolved.
141.	Can Tatham provide a basis for the range in active storage requirements - i.e. 700,000.0 to 800,000.0 cubic meters?	Refer to response to Comment 40.	So for clarity is Tatham stating that this represents the difference between the results from the 2 modelling approaches? If so consider including this detail in the updated report.	Clarification was provided in our response to the JART first submission comments which we feel is sufficient to address this comment.	As noted it would be helpful to include this information in the updated Surface Water Report.
142.	For clarity can Tatham indicate which gauges were installed for this study and which will remain and which will be added post extraction? Suggest adding these details to Tables 38 and 39.	The existing and proposed surface water monitoring locations are illustrated on the Existing and Proposed Surface Water Monitoring Locations Plans (Drawings SW-1 and SW-2).	Comment addressed.	RESOLVED	Resolved.
143.	Can Tatham outline the elements of the adaptive management plan which will potentially be available to meet the environmental management goals?	The AMP will be refined moving forward in collaboration with the review agencies to satisfy the environmental management goals.	Details should be developed sooner than later.	RESOLVED	Resolved.
144.	Can Tatham outline the elements of the adaptive management plan which will potentially be available to meet the environmental management goals?	The AMP will be refined moving forward in collaboration with the review agencies to satisfy the environmental management goals.	Details should be developed sooner than later.	The elements are outlined in the revised AMP.	Resolved.
145.	Can Tatham describe the methodology proposed for Nelson to establish a long-term discharge protocol?	All discharge to Wetland 13201 should be recorded and analyzed overtime to identify any trends in discharge. If trends are identified, a discharge protocol should be established to further protect the wetland and reduce the reliance of the weekly recommended monitoring to identify impacts on hydro period.	Consider adding these details to the updated reporting.	The methodology is described in the revised AMP.	Resolved.

Proposed Burlington Quarry Expansion
JART COMMENT SUMMARY TABLE – Transportation

Please accept the following as feedback from the Burlington Quarry Joint Agency Review Team (JART). Fully addressing each comment below will help expedite the potential for resolutions of the consolidated JART objections and individual agency objections. **Additional, new comments may be provided once a response has been prepared to the comments raised below and additional information provided.**

	JART Comments (February 2021)	Reference	Source of Comment	Applicant Response (June 2021)	JART Response (December 2021)	Applicant Response (June 2022)	JART Response (June 2023)
Report/Date: Transportation / Haul Route Study, February 2020				**Author: Paradigm Transportation Solutions Limited**			
1.	In addition to the provided comments, the Transportation Planning Department provided the following background studies, with corresponding links, for the TIS to consider in its growth rate assumptions and overall background traffic characterization: • Dundas Corridor Study - Brant St to Bronte Rd - MCEA Study: (2015) https://www.halton.ca/For-Residents/Roads-Construction/Municipal-Class-Environmental-Assessment-Studies/Dundas-Corridor-Study-Brant-Stto-Bronte-Rd-(1) • Hamilton - Waterdown/Aldershot Transportation Master Plan – East-West Corridor Study – (2012) https://www.hamilton.ca/cityplanning/master-plans-classeas/waterdownaldershot-transportationmaster-plan	General	Halton Region	The growth rates used in the Dundas Corridor Study and the Hamilton - Waterdown/Aldershot Transportation Master Plan are consistent with the growth rate used in the February 2020 traffic report prepared for the proposed Burlington Quarry Extension. The generalized background traffic growth assumes an annual growth rate of 2% per annum. This growth rate is considered conservative (i.e., high) for the study area. In general terms, peak hour traffic growth is driven by urban development trends and in this area, the new urban development for the next few years is the Waterdown urban expansion, urban Burlington intensification and north Oakville urban expansion. These urban development trends would indicate that traffic growth is most likely to increase in the eastbound and westbound directions along Dundas Street with limited growth along the north/south arterial roadways of Guelph Line and Cedar Springs Road, south of Dundas Street.	2% per annum is considered conservative and is acceptable	Addressed. No Action	
2.	Perform safety analysis for the future crossing of No. 2 Side Road. This is where the access to the proposed southern expansion will align with the existing access and large trucks will be crossing city road.	General	City of Burlington	**True North Safety (TNS**) has prepared a safety analysis for the crossing of No. 2 Sideroad. This report has been provided to JART under separate cover.	The study is related to No. 2 Sideroad and there are no additional comments as the safety issues have been addressed as part of the safety review.	Addressed. No Action	
3.	Provide information that the applicant's traffic consultant used to come up with the traffic generated by the quarry. It is needed to confirm the number of vehicles, where these vehicles are coming from and travelling to.	General	City of Burlington	**Appendix A** in the February 2020 Traffic Study contains confidential data provided by Nelson Aggregate Co. This data was provided to the JART peer reviewer (CIMA Canada Inc.) in November 2020 subject to a Non Disclosure Agreement (NDA) with Nelson Aggregate Co. We understand the City of Burlington is relying upon the peer reviewer to conduct the review on behalf of the City of Burlington.	Confirmed that the numbers provided correspond with the information in the report.	Addressed. No Action	
4.	With regard to deemed right of way widths and widening requirements, under the current official plan, the following information is provided, please be advised however that through the application process, through review of the traffic studies, etc., by vested departments/agencies, it may be necessary for additional lands to be dedicated for additional lanes, turning lanes, daylight and visibility triangles etc., Site Engineering defers to the expertise of the City's Transportation department and the Region's Transportation department to confirm requirements.	General	City of Burlington	See MHBC cover letter for response to Comments #4-#14	The deemed rights-of-way should be shown on the site plan with the right of ways clear of quarry operations and facilities.	The existing and future rights-of-way are clear of quarry operations and facilities. The ARA Site Plans, attached as Tab 1, identify the existing right of ways. The Region and City have no authority to take land for the future right-of-ways as part of the proposed application to permit the proposed Burlington Quarry Extension since Site Plan Approval or Plan of Subdivision approval from the City and Region is not required.	
5.	No. 2 side Road is a City of Burlington owned road, the deemed right of way is 30.0 metres, the actual width varies from +/- 20.0 metres to 25.0 metres. In order to meet the deemed width a variable widening of up to +/- 5.0 metres would be required. The widening would be dedicated (free of charge and all legal and survey costs would be the responsibility of the applicant) through the planning application process. Only an Ontario Land Surveyor (OLS) would be able to accurately determine the actual dimensions and prepare a drawing which accurately shows the deemed right of way/widening.	General	City of Burlington	Refer to Comment Response #4.	Refer to JART Comment Response #4.	Refer to Comment Response #4.	Not resolved.
6.	Colling Road is a City of Burlington owned road, the deemed right of way is 20.0 metres, the actual width meets deemed, no widening required.	General	City of Burlington	Refer to Comment Response #4.	Refer to JART Comment Response #4	Refer to Comment Response #4.	Not resolved.
7.	Cedar Springs Road is a City of Burlington owned road, the deemed right of way is 30.0 metres, the actual width varies from +/- 20.0 metres to 30.0 metres. In order to meet the deemed width a variable widening of up to +/- 5.0 metres would be required. The widening would be dedicated (free of charge and all legal and survey costs would be the responsibility of the applicant) through the planning application process. Only an Ontario	General	City of Burlington	Refer to Comment Response #4.	Refer to JART Comment Response #4	Refer to Comment Response #4.	Not resolved.

	Land Surveyor (OLS) would be able to accurately determine the actual dimensions and prepare a drawing which accurately shows the deemed right of way/widening.						
8.	Guelph Line is a Region of Halton owned road, please contact the Region for deemed width and any widening and daylight triangle requirements.	General	City of Burlington	Refer to Comment Response #4.	Refer to JART Comment Response #4	Refer to Comment Response #4.	Not resolved.
9.	Official Plan/Transportation Master Plan Right-of- Way Requirements: Any lands within 17.5 metres (57.4 feet) of the center line of the original right-of-way of Guelph Line (Regional Road 1) that are part of the subject property shall be dedicated to the Regional Municipality of Halton for the purpose of road right- of-way widening and future road improvements.	General	Halton Region	Refer to Comment Response #4.	Refer to JART Comment Response #4.	Refer to Comment Response #4.	The previous JART response to Comment #4 still stands. The deemed rights-of-way should be shown on the site plan with the right of ways clear of quarry operations and facilities.
10.	Municipal Class Environmental Assessment Study/Environmental Study Report (Transportation Planning) Right-of-Way Requirements Guelph Line (Regional Road 1): Any additional lands that are part of the subject property and have been identified as required for the future widening of Guelph Line (Regional Road 1), as identified in a future Municipal Class Environmental Assessment Study/Environmental Study Report, shall be dedicated to the Regional Municipality of Halton for the purpose of road right- of-way widening and future road improvements. Currently, a Municipal Class Environmental Assessment has not been completed.	General	Halton Region	Refer to Comment Response #4.	Refer to JART Comment Response #4.	Refer to Comment Response #4.	Refer to JART Comment Response #9.
11.	Detail Design Project (Engineering & Construction) Right-of-Way Requirements - Guelph Line (Regional Road 1): Any additional lands that are part of the subject property and have been identified as required for the future widening of Guelph Line (Regional Road 1), as identified in a future Detailed Design Project, shall be dedicated to the Regional Municipality of Halton for the purpose of road right- of-way widening and future road improvements. Currently, a Detail Design has not been completed.	General	Halton Region	Refer to Comment Response #4.	Refer to JART Comment Response #4.	Refer to Comment Response #4.	Refer to JART Comment Response #9.
12.	A daylight triangle measuring 15.0 metres along Guelph Line (Regional Road 1) and 15.0 metres along Colling Road shall be dedicated to the Regional Municipality of Halton for the purpose of road right-of-way widening and future road improvements.	General	Halton Region	Refer to Comment Response #4.	Refer to JART Comment Response #4.	Refer to Comment Response #4.	The previous JART response to Comment #4 still stands. The deemed rights-of-way including the daylight triangles should be shown on the site plan with the right of ways and daylight triangles clear of quarry operations and facilities.
13.	All lands to be dedicated to Halton Region shall be dedicated with clear title (free and clear of encumbrances) and a Certificate of title shall be provided, in a form satisfactory to the Director of Legal Services or his/her designate.	General	Halton Region	Refer to Comment Response #4.	Refer to JART Comment Response #4.	Refer to Comment Response #4.	Refer to JART Comment Response #9.
14.	Please provide a draft reference plan detailing all of the proposed widening (and daylight triangle) dedications. The quarry lands (both the expansion and existing quarry) north of No. 2 Side Road, are, or will be one property, therefore the widening dedications would be taken on both the expansion and existing quarry lands, as well as for the frontage of the south expansion lands.	General	City of Burlington	Refer to Comment Response #4.	Refer to JART Comment Response #4.	Refer to Comment Response #4.	Not resolved.
15.	Mitigation Measures –Future Operational Analysis Various movements at intersections within the study area were identified as operating at or above capacity during Total Traffic Conditions. There port does not specifically	General	CIMA Canada Inc.	The following critical movements, per the Halton Region TIS guidelines, are forecast to occur under Total Traffic conditions. Dundas Street and Guelph Line • Eastbound left-turn (capacity issue) • Eastbound through (capacity issue)	**Partially Addressed** The effects of the site traffic on the identified future total critical movements are minimal. However, as per the Halton Region	As noted the effects of site traffic to critical movements are minimal and are a result of existing and planned traffic levels. Although these mitigation measures are not a	Acknowledged. We are assuming that the requested information will be included in the addendum letter.

	identify how critical movements operating over capacity attributable to the proposed development can be improved. For example, eastbound and northbound through movements during the AM peak hour at Guelph Line and Dundas Street, are expected to operate above capacity. The eastbound through movement is expected to be addressed by the Dundas Street road widening outlined in the **Region's Transportation Master Plan** (TMP). However, no specific improvements are recommended for northbound movements on **Guelph Line by the report or the Region's TMP.** Further information is required regarding proposed improvements for alleviating movements that are expected to operate at or above capacity attributable to the traffic generated by the proposed development			• Westbound left-turn (capacity & queueing issue) • Westbound through (capacity issue) • Northbound left-turn (capacity & queueing issue) • Northbound through (capacity issue) Dundas Street & Cedar Springs Road/Brant Street • Eastbound through (capacity issue) • Westbound left-turn (capacity & queueing issue) • Northbound left-turn (capacity & queueing issue) Guelph Line and 2 Side Road • Eastbound Left-Turn Lane (capacity issue) • Westbound approach (capacity issue) Site generated traffic is not creating any new critical movements at the above noted intersections. Site generated traffic is expected to contribute volumes to only the following critical movements: Dundas Street and Guelph Line • Eastbound left-turn – AM peak hour = 4 PCE, PM = zero • Northbound through – AM peak hour = 7 PCE, PM = zero Dundas Street & Cedar Springs Road/Brant Street • Eastbound through – AM peak hour = 4 PCE, PM = zero Guelph Line and 2 Side Road • Eastbound Left-Turn Lane – AM peak hour = 21 PCE, PM = 4. Of the four critical movements identified as being a concern under the total traffic horizon where site traffic contributes volumes, the following movements are also considered critical under the background traffic horizon (i.e. no site traffic): Dundas Street and Guelph Line • Eastbound left-turn – (capacity issue) • Northbound through – (capacity issue) Dundas Street & Cedar Springs Road/Brant Street • Eastbound through – (capacity issue) Guelph Line and 2 Side Road • Eastbound Left-Turn Lane (capacity issue) Site traffic related to a 2.0 million tonnes per annum extraction limit has negligible impact on traffic operations. Of the four critical movements identified to occur under total traffic operations, site traffic is expected to have very little impact on intersection operations beyond the 2 Side Road intersection with Guelph Line. **Table 1** below summaries the change in delay per vehicle, v/c ratio and queue length between total traffic operations and background traffic operations. The generalized increase in background traffic growth (2% per annum) is expected to have a greater impact on intersection operations than site traffic generated by the site. **TABLE 1: OPERATION SUMMARY – CRITICAL MOVEMENTS IMPACTED BY SITE TRAFFIC**	Transportation Impact Study Guidelines, when the operations of Regional intersection movements exceed acceptable levels, the TIS is required to investigate how to mitigate the impact of the Proposed Development. The report should identify all movements requiring mitigation measures, even if not as a direct result of the proposed development. A section is required in the revised Transportation Impact Study which provides a summary of the recommendations in accordance with Halton Region Guidelines.	requirement for Nelson to implement, as requested Paradigm will provide an addendum letter outlining potential remedial measures that could be considered by the road authorities. Timing for the addendum letter is approximately 4-5weeks.	

Intersection/ Movement		Horizon Year	Intersection Operations							Change					
			AM Peak Hour				PM Peak Hour			AM Peak Hour			PM Peak Hour		
			LOS	Delay	v/c	Q	LOS	Delay	v/c	Q	Delay	v/c	Q	Delay	v/c	Q
Dundas Street & Guelph Line	EBL	Existing	C	25	0.44	51	F	125	0.89	41						
		Background	C	28	0.53	60	F	176	1.02	47	3	0.09	9	51	0.13	6
		Total	C	28	0.54	62	F	176	1.02	47	0	0.01	2	0	0.00	0
	NBT	Existing	B	14	0.31	58	C	27	0.88	289						
		Background	F	182	1.32	208	E	62	0.84	115	168	1.01	150	35	-0.04	-174
		Total	F	187	1.32	210	E	62	0.84	115	5	0.00	2	0	0.00	0
Dundas Street & Brant Street	EBT	Existing	C	33	0.94	195	C	25	0.41	63						
		Background	E	57	1.04	288	C	26	0.44	70	24	0.10	93	1	0.03	7
		Total	E	58	1.04	229	C	25	0.24	10	1	0.00	-59	-1	-0.20	-60
Guelph Line & 2 Side Road	EBL	Existing	D	29	0.53	24	F	53	0.57	24						
		Background	E	41	0.70	40	F	93	0.80	38	12	0.17	16	40	0.23	14
		Total	F	121	1.08	94	F	100	0.83	41	80	0.38	54	7	0.03	3

16.	Mitigation Measures – Queue Lengths Some of the 95th percentile queues reported are expected to exceed the available storage length (e.g., 2024 PM peak hour northbound and westbound left turning movements at Guelph Line & Dundas Street are expected to exceed available storage by 106.0 and 214.0 metres, respectively). The eastbound through movement is expected to be addressed by the Dundas Street road widening outlined in the Region's Transportation Master Plan (TMP) as previously mentioned; however, no mitigation measures are recommended to address the excessive northbound left queues. Assess and provide mitigation measure to address the excessive 95th percentile queues that are expected to exceed available storage at Guelph Line & Dundas Street.	General	CIMA Canada Inc.	The following queue lengths are forecast to exceed the available existing storage at the signalized intersection of Dundas Street and Guelph Line under total traffic conditions. • Westbound left-turn • Northbound left-turn Site generated traffic is not expected to contribute volumes to these two movements. Both turning movements are identified as critical movements under existing conditions and are expected to remain critical with or without the approval of the quarry extension. It is anticipated that the storage requirements for the westbound left-turn movement from Dundas Street to Guelph Line will be addressed by the Dundas Street road widening outlined in the Region's Transportation Master Plan (TMP). The existing storage lane length for this movement is approximately 115 m. The forecast queue length is approximately 400 m. The forecast volume for this movement is approximately 715 PCE during the PM peak hour. The forecast volume suggests the need for dual westbound left-turn lanes. The existing storage lane length for the northbound left-turn lane is 50 m. Guelph Line between Dundas Street and Driftwood Drive/Coventry Way is currently designed as a 5 lane cross-section with a painted centre median measuring approximately 5 m in width. The Carncastle Gate intersection with Guelph Line operates as a right-in/right-out connection with left-turns restricted by a raised centre median. There are no private driveways or intersections along Guelph Line between Dundas Street and Driftwood Drive/Coventry Way. This would allow the road authority to repaint the existing center median to provide additional storage for the northbound left-turn movement. The analysis contained in the February 2020 report suggests a storage lane length of approximately 190 m is needed for this movement. The additional storage can be accommodated by repainting the existing center median to provide the additional storage. **Table 2** below summarizes the operational conditions for the Dundas Street and Guelph Line intersection under total traffic conditions with the implementation of a dual westbound left-turn lane with 115 m of storage (existing storage) and northbound left-	**Addressed** The following mitigation measures are provided at Guelph Line & Dundas Street to address the forecasted queuing issues: • Dual westbound left-turn lanes; and • Extending the northbound left-turn lane storage lane capacity to 190 metres. Table 2 outlines the 2024 total traffic operations with the proposed mitigation measures.	**Addressed. No Action**	

turn lane with 190 m of storage.

The additional storage for the northbound left-turn lane and dual westbound left-turn lanes would address the forecast queueing issues expected to occur under the five-year horizon (year 2024). Site generated traffic is not expected to contribute volumes to these two movements.

TABLE 2: TOTAL TRAFFIC OPERATIONS – WITH REMEDIAL MEASURES (DUNDAS STREET & GUELPH LINE)

Analysis Period	Intersection	Control Type	MOE	Direction / Movement / Approach																				OV
				Eastbound				Westbound				Northbound				Southbound								
				Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach					
AM Peak Hour	Guelph Line & Dundas Street	TCS	LOS	C	F	C	**F**	E	B	>	**C**	D	F	>	**F**	D	D	D	**D**					**F**
			Delay	28	118	23	**100**	79	14	>	**31**	37	202	>	**184**	46	48	43	**47**					**99**
			V/C	0.54	1.16	0.31		0.83	0.35	>		0.39	1.38	>		0.69	0.45	0.05						**1.10**
			95th	62	402	53		63	67			43	218			54	64	5						
			Storage	100	-	70		155	-	>		190	-	>		70	-	70						
			Avail.	38	-	17		52	-	>		147	-	>		16	-	65						
PM Peak Hour	Guelph Line & Dundas Street	TCS	LOS	F	C	C	**D**	C	D	>	**D**	F	E	>	**F**	D	E	D	**D**					**D**
			Delay	171	34	27	**39**	23	42	>	**37**	168	62	>	**96**	44	58	49	**53**					**50**
			V/C	1.02	0.58	0.14		0.77	0.98	>		1.22	0.84	>		0.62	0.77	0.37						**1.00**
			95th	250	134	24		75	380			156	115			48	98	50						
			Storage	100	-	70		115	-	>		190	-	>		70	-	70						
			Avail.	50	-	46		40	-	>		34	-	>		23	-	21						

MOE - Measure of Effectiveness *V/C - Volume to Capacity Ratio*
> - Shared Right-Turn Lane
TCS - Traffic Control Signal *95th - 95th Percentile Queue Length* *< - Shared Left-Turn Lane*
TWSC – Two-Way Stop Control *LOS - Level of Service*

17.	Safety Analysis It is suggested for the terms of reference that a 'Safety Analysis' section will be included in the report to discuss potential safety or operational issues (per Region's TIS Guidelines, Section 3.6.2) in the study area. Even if there are no safety issues, a review should be completed and documented in the TIS report. Include a Safety Analysis section in the report to discuss potential safety or operational issues.	General	CIMA Canada Inc.	True North Safety prepared a safety analysis for No. 2 Sideroad which has been provided to JART under separate cover. Guelph Line is a Regional Road that has been designed to accommodate truck traffic and is the existing haul route and the only haul route available for the proposed Burlington Quarry Extension. Refer to Comment Response #18.	**Addressed** A Safety Analysis Report is provided by the True North Safety Group.	**Addressed. No action**	

<table>
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<td>18.</td>
<td>Haul Route Study
Although the Report states that there are no changes to the proposed haul route and no new impacts to the road network are anticipated, the Report does not mention the preparation of a Haul Route Study. It should be noted that the request for a Haul Route Study was identified by the Region’s report LPS08-20 – Proposed Expansion to the Burlington Quarry (Nelson), Pre- Consultation Meeting.

Complete a Haul Route Study following the requirements identified by the Region’s Aggregate Resources Reference Manual for the preparation of a Transportation/Haul Route Study.</td>
<td>General</td>
<td>CIMA Canada Inc.</td>
<td>The Burlington Quarry has been producing aggregate since 1953. The proposed quarry extensions will allow the Burlington Quarry to continue to produce aggregate at its existing location. The haul route used to ship material to market will remain unchanged. All material shipped to market, except local deliveries, will travel east to/from Guelph Line (Regional Road 1). The Regional Road network will support the movement of goods to market including the resources produced at the Burlington Quarry. All Regional roads are classified and designed to accommodate truck traffic[1].

All trucks hauling material to market are expected to follow and adhere to the existing, and future, truck route network. Local deliveries may require a deviation from identified truck routes.

To the west of the subject site there is an existing truck prohibition which limits truck traffic on No 2 Sideroad. No changes to the truck prohibition are proposed. The existing prohibition was established by Council Resolution CC-83-05. The existing truck prohibition requires all quarry truck traffic to travel to/from Guelph Line. No other haul route options are available to the subject site. The site driveway for heavy vehicles is located approximately 350 metres from the Regional road network. The existing haul route provides the shortest most direct route to the Regional road network while limiting impacts to local roadways.

The rock trucks shipping material across No 2 Sideroad from the South Extension lands will be contained to the driveway intersection. The South Extension driveway is located approximately 485 m west of Guelph Line. Rock trucks will not travel along No 2 Sideroad. Rock trucks will only cross No 2 Sideroad until the South Extension is exhausted.</td>
<td>Addressed
The proposed extension does not change the existing haul routes. The February 2020 traffic report and PTSL’s June 2021 response addressed the criteria outlined in the Transportation/Haul Route Study Objectives listed in the Section 4.9 of the Region’s Aggregate Resource Reference Manual.</td>
<td>Addressed. No action</td>
<td></td>
</tr>
<tr>
<td>19.</td>
<td>Travel Demand
Figure 2.1 shows that the highest traffic volumes during the PM peak occurs between 2:00 PM and 3:00 PM. This is confirmed by the statement in Section 2.2.3 that says: “Shipping actively begins to taper off around 3PM”. However, the TMCs provided in Appendix B for the driveway site show that the highest PM peak hour occurs between 4:30 and 5:30 PM. Please confirm and update the report as necessary to be consistent.

Please update Sections 2.2.1 and 2.2.3 to a

If the PM peak hour at the site is the same as the Guelph Line peak hour, no changes in the traffic hour at the site occurs between 2:00 and 3:00 PM, it is recommended to conduct an additional PM peak operational analysis.</td>
<td>Section 2.2.1, Section 2.2.3, Figure 2.1, and Appendix B</td>
<td>CIMA Canada Inc.</td>
<td>Although the site traffic tapers off around 3PM the AM and PM hour of the adjacent street was used to provide a

At Guelph Line & No 2 Side Road the entering volume during the PM peak hour is 1,156 vehicles. During the 3:00 PM hour the entering volumes are 356 vehicles per hour lower at 800 vehicles per hour.

Table 3 below summarizes the two-way traffic volumes on Guelph Line at No 2 Side Road and the two-way volumes using the site driveway for the AM and PM count periods. Highlighted cells indicate the peak hour for Guelph Line and the site driveway. The two-way volumes using both Guelph Line and the site driveway peak at the same time during the AM count period. During the PM count period, two-way volumes using the site driveway peak prior to Guelph Line. The peak hour for the network is the adjacent street PM peak hour

Off peak analysis is not expected to result in the identification of any new capacity issues vs. the findings of the February 2020 Traffic Report.

TABLE 3: TWO-WAY VOLUME SUMMARY

<table>
<tr><th>Period</th><th>Time Ending</th><th>Guelph Line Two-Way</th><th>Driveway Two-Way</th><th>SUM</th></tr>
<tr><td rowspan="5">AM</td><td>08:00</td><td>781</td><td>79</td><td>860</td></tr>
<tr><td>08:15</td><td>839</td><td>84</td><td>923</td></tr>
<tr><td>08:30</td><td>850</td><td>88</td><td>938</td></tr>
<tr><td>08:45</td><td>846</td><td>80</td><td>926</td></tr>
<tr><td>09:00</td><td>821</td><td>83</td><td>904</td></tr>
<tr><td rowspan="9">PM</td><td>16:00</td><td>732</td><td>41</td><td>773</td></tr>
<tr><td>16:15</td><td>784</td><td>33</td><td>817</td></tr>
<tr><td>16:30</td><td>884</td><td>28</td><td>912</td></tr>
<tr><td>16:45</td><td>977</td><td>28</td><td>1,005</td></tr>
<tr><td>17:00</td><td>1,037</td><td>27</td><td>1,064</td></tr>
<tr><td>17:15</td><td>1,090</td><td>23</td><td>1,113</td></tr>
<tr><td>17:30</td><td>1,078</td><td>19</td><td>1,097</td></tr>
<tr><td>17:45</td><td>1,067</td><td>17</td><td>1,084</td></tr>
<tr><td>18:00</td><td>1,022</td><td>10</td><td>1,032</td></tr>
</table>
</td>
<td>Addressed

Comment indicates that the PM peak hour at Guelph Line & Number 2 Side Road was used (as shown in Section 2.2.1) and not the peak hour of the Site access.</td>
<td>Addressed. No action</td>
<td></td>
</tr>
<tr>
<td>20.</td>
<td>Trip Generation
In Section 2.2.3 the report provides details of heavy vehicle generation in recent years at the existing site. It is noted that the Nelson Quarry does not own or operate any trucks for the transportation of materials from the point of origin to the quarry or to an end use location; rather, it is the customer and their contractors that transports material. Given the report examines the customers’ truck fleet, outlines are given for typical truck sizes, trailer configurations and average net load per outgoing trip. However, to determine the estimated truck trips generated by the proposed site expansion, the proponent’s consultant conducted a review of detailed shipping records from 2014 to 2018. The report indicates that records used for the review are confidential and only available upon request.

The details provided in Section 2.2.3 of the report are satisfactory; however, a review of the detailed shipping records would be beneficial to provide more details on truck types and material loads to verify the typical truck sizes and load volumes to be expected as part of the Quarry’s operations. As such, it is recommended that the Region should request the detailed shipping records from Appendix A.</td>
<td>Section 2.2.3 and Appendix A</td>
<td>CIMA Canada Inc.</td>
<td>Appendix A in the February 2020 Traffic Study contains confidential data provided by Nelson Aggregate Co. This data was provided to the JART peer reviewer (CIMA Canada Inc.) in November 2020 subject to a Non-Disclosure Agreement (NDA) with Nelson Aggregate Co. We understand the Region of Halton is relying upon the peer reviewer to conduct the review on behalf of the Region of Halton.</td>
<td>Addressed
Nelson Aggregate Company’s quarry trucking details were provided for review in November 2020.</td>
<td>Addressed. No action</td>
<td></td>
</tr>
</table>

21.	Trip Distribution Future quarry activity estimates are based on the turning movement count done in October 2019 and factored to the maximum quarry production of 2.0 million tonnes per annum. The TMC data indicates 84 AM peak hour trips with 28 (98 passenger car equivalents (PCE)) two-way additional heavy vehicle trips and 15 PM peak hour trips with 1 (4 PCE) two-way additional heavy vehicle trip. No justification is provided for the number of estimated additional two-way trips. Additionally, the trip distributions shown in Figures 4.2A and 4.2B require further explanation or adjustments. For example, Figures 4.2A indicates 28 additional inbound trips are making southbound right-turns from Guelph Line but there are only 21 outbound trips making an eastbound left-turn onto Guelph Line. Please provide further justification for the number of additional trips estimated in Table 4.1. Additionally, update Figure 4.2A and 4.2B to reflect outbound trips returning on the same path as the inbound trips or provide justification for the different origin/destination points. Any changes to the future operations should be reflected in the future improvement scenario	Table 4.1 and Figures 4.2A and 4.2B	CIMA Canada Inc.	Nelson does not own or operate any trucks for the shipping of material to market; rather, customers and their contractors transport the material from the quarry by truck. The site's trip generation for 2 million tonnes has been estimated by prorating the existing extraction rate 1.5 million tonnes. "*the estimated total future truck levels shown in Table 4.1 of the subject TIS are appropriate estimates for the future peak hour truck volumes."* - Refer to comment #23 As Nelson does not own or operate any of the trucks shipping material to market, vehicles may not return to the site onthe same path. The estimated trip distribution pattern reflects existing travel patterns as documented under existing conditions. **Table 4** below, summarizes the estimated trip distribution. **TABLE 4: ESTIMATED TRIP DISTRIBUTION** **Origin/Destination** / **AM Peak Hour** / **PM Peak Hour** **In** / **Out** / **In** / **Out** North via Guelph Line: 60% / 40% / 60% / 75% South via Guelph Line: 15% / 30% / 20% / 15% South via Brant Street: 0% / 5% / 0% / 0% East via Dundas Street: 20% / 15% / 20% / 10% West via Dundas Street: 5% / 10% / 0% / 0% **Total**: **100 %** / **100%** / **100%** / **100 %** No update to the site traffic assignment or the site trip generation for a 2.0 million tonne license limit is recommended at this time The haul route used to ship material to market will remain unchanged from existing. All material shipped to market, except local deliveries, will travel east to/from Guelph Line (Regional Road 1). The Regional Road network will support the movement of goods to market including the resources produced at the Burlington Quarry. All Regional roads are classified and designed to accommodate truck traffic[2].	**Addressed** Based on the review of the data provided in Appendix A, the estimated total future truck levels shown in Table 4.1 of the subject TIS are appropriate estimates for the future peak hour truck volumes. The comments section provides justification for the trip distributions (shown in Figures 4.2A and 4.2B of the report) in Table 4: Estimated Trip Distribution.	**Addressed. No action**	
22.	Paradigm Methodology Paradigm reviewed the detailed shipping records, provided in Appendix A, that contain shipping details from 2014 to 2018. Based on the shipping details, they estimated trucking levels for a 2.0 tonnes per annum scenario. This scenario includes three distinct types of truck trips entering and exiting the quarry. The first distinct type, which accounts for all the outbound trips, is aggregate material that is mined and processed in the quarry. The second and third distinct types, which are incoming trips to the quarry, are clean fill and recycling materials. Estimates of approximately 50.0% to 58.0% of the incoming trucks with clean fill and recycling material between 2014 and 2017 also left with a load of aggregate. In 2018, the proportion these incoming trucks leaving with aggregate increased by about 23.0%. The estimates were used to calculate the annual inbound and outbound truck trips from 2014 to 2018. Additionally, estimates of the future increase to truck volumes were calculated based on the details shipping records. The estimates were developed by adding the truck volumes from the October 2019 site driveway turning movement count to the volumes estimated from the average daily trucks served in 2018. The volumes from the TMC as well as the estimated volumes are shown in Table 4.1 of the TIS report.	Table 4.1 and Appendix A	CIMA Canada Inc.	Acknowledged**.**	Refer to JART Comment response #20.	**Addressed. No action**	
23.	Peer Review Findings Based on the review of the detailed data provided in Appendix A, CIMA verified that the estimated 50.0% of the clean fill and recycling trips that left with aggregate, was used to calculate annual inbound and outbound truck trips from 2014 to 2017, while 77.0% was used for 2018. Based on the review of the detailed 2018 data provide in Appendix A, the estimated total future truck levels shown in Table 4.1 of the subject TIS are appropriate estimates for the future peak hour truck volumes From Table 4.1, the future estimated truck volume is 29, which is added to the existing TMC volumes. To verify the estimated volumes CIMA examined the 2018 month-by-month total (aggregate, clean fills and recycling trips) average daily trucks served in 2018. The total average daily trucks served averaged for the year was 31 trucks (rounded up). The value is fairly close to the 29 total	Table 4.1 and Appendices A and B	CIMA Canada Inc.	Appendix B of the February 2020 TIS contains the existing turning movement counts. The TMC data provides a breakdown of vehicle classification.	**Partially Addressed** Appendix B provides a detailed breakdown of vehicle types for the AM peak hour. However, it does not provide the breakdown of heavy vehicles for the PM peak hour. Additionally, attachment 3 provides a breakdown of vehicle class for all study area intersections except for at Gravel Pit & Number 2 Side Road intersection.	**Tab 2** contains the detailed breakdown break down of TMC data collected at the existing site driveway. Vehicles are classified as • Motorcycles • Cars & light goods • Buses • Single-unit trucks • Articulated trucks • Bicycles on road • Bicycle on crosswalk • Pedestrians	Addressed. Consultant has provided full breakdown of vehicle types for Gravel Pit & Number 2 Side Road as requested.

	trucks estimated by Paradigm. However, CIMA was unable to verify the distribution of the estimated 29 total trucks between the AM and PM peak hours. The subject TIS distributes 28 trucks (evenly distributed between inbound and outbound) to the AM peak hour and 1 outbound truck to the PM peak hour. Based on the TMC volumes shown in Table 4.1, 15.0% of the estimated 29 added trucks, or 4 trucks, should be allocated to the PM peak hour. The TMC provided in Appendix B, does not include a detailed breakdown of the vehicles in the PM peak hour. A detailed breakdown of the vehicle types entering and exiting the site, such as the one for the AM peak hour, is needed to verify the added truck volumes in PM peak hour of the subject TIS. In summary, the process used to estimate the added future truck volumes for both peak hours was verified; however, the distribution of the added truck volumes could not be verified. It is recommended that a detailed breakdown of PM peak hour TMC data be provided, similar to the data provided for the AM peak hour.						
24.	Future Traffic Operations Tables 4.2 and 4.3 show future traffic operations at all study area intersections. Signalized and unsignalized intersections are together in the same table. Signalized and unsignalized intersections should not be in the same table as the level of service for a stop-controlled intersection differs from a signalized intersection. Please provide separate tables for signalized and unsignalized intersections for all traffic operational analyses.	Tables 4.2 and 4.3	CIMA Canada Inc.	Acknowledged. Separate tables are not required to summarize operational conditions. The tables contained in the February 2020 TIS reflects the different LOS thresholds for unsignalized and signalized intersections. **Attachment 1** contains the requested separate operational tables for ease of review.	**Addressed** Attachment 1 provides the separate tables for signalized and unsignalized intersections.	**Addressed. No action**	
25.	Mitigation Measures – Traffic Signal Warrant A traffic signal warrant analysis was undertaken for the intersection of Guelph Line & No. 2 Sideroad. The report mentions that the traffic signal was not warranted. However, the volumes used for the traffic signal warrant did not match those in Figures 4.3A/B (Total Traffic Conditions). It is recommended to review the volumes used for the traffic signal warrant and update the analysis as necessary.	Figures 4.3A and 4.3B	CIMA Canada Inc.	OTM warrants utilize total count volume forecast for the intersection with no PCE factor applied. **Attachment 2** contains supplementary OTM Warrant analysis with a PCE factor applied. Traffic control signals at the intersection of Guelph Line & No. 2 Sideroad are not warranted using OTM Book 12 Justification 7.	**Addressed** Attachment 2 provides a supplementary signal warrant analysis. The results indicate that signalization is not warranted.	**Addressed. No action**	
26.	Access Road In Section 5.2.1 the second bullet point for site operational assumptions indicates the expected number of working days per year will be 208. However, in Table 5.1 the number of operating days used for calculating average tonnage per year is 250.	Section 5.2.1 and Table 5.1	CIMA Canada Inc.	The difference between Section 5.2.1 and Table 5.1 accounts for the theoretical maximum tonnage of 2.0 tonnes per annum. The table assumes the 2.0 million tonne per annum limit is comprised of only new material extracted from the South Extension. The traffic impact assessment has been completed based on the proposed limit of 2.0 million tonnes per annum and considers asphalt production, aggregate recycling and clean fill imported for rehabilitation. With the existing 208 working days per year the tonnage would be approximately 1.75M tonnes where 250 working days per year equates to approximately 2.1M tonnes.	**Partially Addressed** Table 5 in the comments provides an updated table with 208 working days per year. However, no explanation is provided for the change in two- way truck traffic crossing Number 2 Side Road (from 85 PCE vehicles to 90 PCE vehicles during the AM during the PM) from the AM peak hour to the PM peak hour. Finally, reference is made for the Number 2 Side Road access to the Halton Region Access Management Guidelines. The Number 2 Side Road access is over 400 metres from Guelph Line. The Halton Region Access Management Guidelines for a full movement access indicates a spacing between 300 to 400 metres.	The 90 PCE is a typographical- error. The PCE calculation for two-way truck trips is 84 (24 x 3.5) Actual truck trips may vary depending on operations and service rates for vehicles hauling material over the roadway. Vehicles may not return to the southern pit extension within the same hour. Additionally, the hauling operation over the roadway may taper off during the afternoon hours, similar to the pit's overall operation. Number 2 Side Road is under the City of Burlington's Jurisdiction. Halton Region Access Management Guidelines apply to Regional Roads. Nevertheless, the space between the driveway and Guelph Line is noted to be over 400 metres and satisfies the Halton Region Access Management Guidelines.	Addressed. Consultant has provided the required detail for PCE calculation and access spacing. This detail should be provided in the report.
	Additionally, Table 5.1 shows the number of two- way truck trips is 24 per hour (84 PCE). However, the number of PCE vehicles per hour increase form 85 PCEs in the AM peak to 90 PCEs in the PM peak without any further background. Finally, Section 5.2.1 mentions that the South Extension Access Road will be designed to accommodate the heavy truck design vehicle (CAT 775 70-tonne rock truck) and will be stop- controlled, however no reference to the requirements of Halton Region's "Access Management Guidelines" is presented as part			Although this adjustment was made, the number of working days per year has no effect on the truck trip generation as the generation based on the number of trucks, trips per hour and hours of operation. **Table 5** below provides an updated table with 208 working days. **TABLE 5: ESTIMATED SOUTH QUARRY EXTENSION CROSSING TRAFFIC**		No further JART comment. This is assumed to be addressed.	

	of the report. Update Table 5.1 with the proper estimate for the working days per year and update the affected calculations. Please provide clarification for the change in two- way truck traffic crossing Number 2 Side Road from the AM peak hour to PM peak hour. Please refer to Region's Access Management Guidelines for the South Extension's Access Road design considerations.			*limited by amount.* **Measure / Units / Input / Calculation** CAT 772 Trucks — Trucks — 4 One Way Trips per Hour — Trips/Hour — 3 Operating Hours per Day — Hours/Day — 10 One way Truck Trips — Truck Trips/Day — 120 Operating Days per Year — Days/Year — 208 One way Truck Trips — Truck Trips/Year — 24,960 Average Load per Truck — Tonnes/Truck — 70 Average Tonnes per Year — Tonnes/Year* — 1,747,200 Loaded Inbound Trips — Trucks/Hour — 12 Empty Outbound Trips — Trucks/Hour — 12 **Total Two-Way Truck Trips** — **Trucks/Hour** — **24** **Extraction license* The No. 2 Side Road driveway is proposed approximately 485 m west of Guelph Line. No. 2 Side Road is under the City of Burlington jurisdiction and is classified as a collector roadway[3]. Halton Region Access Management Guidelines do not apply to this City roadway. But the proposed spacing between the site driveway and Guelph Line exceeds the minimum spacing guideline outlined in the Regional document. "The general spacing guidelines for a full movements access is 300 metres to 400 metres[4]." For additional information regarding the No. 2 Sideroad crossing, please see the True North Safety study provided to JART under separate cover. It is expected that the South Extension Access Road will be designed to accommodate the heavy truck design vehicle and that the northbound and southbound approaches will operate under stop control. Additional signage and/or gates to restrict the Access Road to authorized vehicles only should be considered.		
27.	Provision of Confidential Truck Counts In Appendix A, an NDA has been requested for release of Confidential Truck Count Data by Nelson Aggregated to the Region. The Region would like to pursue this request to allow for confirmation of TIS analysis and results, including peer review consultant permissions to view the data. Without the held data the Trip Generation assumptions about the typical truck sizes and load volumes to be expected as part of the Quarry's operations based on truck types and material loads cannot be verified. (Note: Planning's direction/assistance on how to proceed with the NDA process will be required.)	Appendix A	Halton Region	**Appendix A** in the February 2020 Traffic Study contains confidential data provided by Nelson Aggregate Co. This data was provided to the JART peer reviewer (CIMA Canada Inc.) in November 2020 subject to a Non-Disclosure Agreement (NDA) with Nelson Aggregate Co. We understand the Region of Halton is relying upon the peer reviewer to conduct the review on behalf of the Region of Halton.	Refer to JART Comment response #20.	Refer to JART Comment response #20. **Addressed. No Action.**	
28.	Peak Hour Factor The intersection of No. 2 Side Road and the Quarry driveway was the sole TMC to provide a 15-minute volume breakdown. CIMA was not able to verify the peak hour factor (PHF) for the other study area intersections due to the provided TMCs not having 15-minutes volume breakdowns. Please provide the full TMC for all study area intersections in Appendix B.	Appendix B	CIMA Canada Inc.	The PHF was established using existing traffic data as per the Region of Halton TIS guidelines. Full 15-minute volume breakdown TMC's for all locations are provided in **Attachment 3**.	**Addressed** Full 15-minute volume breakdown TMCs for all locations are provided in Attachment 3.	**Addressed. No Action.**	
	JART Site Plan Comments (December 2021)	**Reference**	**Source of Comment**	**Applicant Response (May 2022)**			**JART Response (June 2023)**
29.	The northbound and southbound approaches to Side Road No. 2 shall be controlled by stop sign control. Comment: The information presented in the Site Plan corresponds with the recommendation provided in Section 5.2.1. of the Burlington Quarry Extension Traffic Report (February 2020) and reconfirmed by the Safety Review of the Proposed Access Plan completed by True North Safety Group (TNS) in June 2021.		CIMA Canada Inc.	**Addressed. No action.**			
30.	The new roadway crossing will be located on the crest on Side Road No. 2 (in the location shown on the plan view) with a clear sight distance of at least 215 metres in each direction along Side Road No. 2 for both the northbound and southbound approaches. Comment: The information presented in the Site Plan corresponds with the recommendation provided in Section 5.2.2. of the Burlington Quarry Extension Traffic Report (February 2020). However, the information presented in Section 2.4.5. of the TNS report indicates a recommended sight distance of 220 in each direction for the 70-tonnes trucks.		CIMA Canada Inc.	TNS reviewed the location of the proposed crossing and confirmed in Section 2.4.5 "Drivers in these trucks would have available sight distances of oncoming traffic along No 2 Side Road greater than the recommended 220 m." The TNS is included as **Tab 3**.			Provided TNS report as part of Tab 3 confirms the required 220 m sight distance. This should be updated on the site plan.

31.	The roadway geometry and road bed structure will be designed to accommodate the rock trucks that the licensee plans to operate Comment: Information contained in the Site Plan should include the recommendation presented in Section 2.4.4. of the TNS report.		CIMA Canada Inc.	Section 2.4.4 of the TNS report addresses “Approach Site Distance”. The following note will be added to the proposed Burlington Quarry Extension ARA Site Plan (March 2022) and the proposed existing Burlington Quarry Site Plans: “The haul truck crossing approaches on No. 2 Sideroad shall be designed and constructed to provide an approach sight distance (i.e., visibility triangle) extending, at a minimum of 25 m on each crossing approach to a point 50 m east and west on No 2 Side Road.” The TNS is included as **Tab 3**.	Addressed. Consultant has agreed to add excerpt from TNS report to the Site Plan as requested.
32.	Prior to extraction commencing in the South Extension, the licensee will be responsible to upgrade the crossing on Side Road No. 2 to municipal standards. During operations in the South Extension, the licensee will be responsible for maintaining this crossing. The licensee is responsible for all costs associated with the crossing, including signage at the crossing. (Financial Report). Comment: No comments. Side Road No. 2 is under municipal jurisdiction.		CIMA Canada Inc.	**Addressed. No action.**	
33.	Various notes on the proposed site plan should reflect the integrated nature of the operation desired by the proponent. This includes, but not limited to, capping the maximum number of vehicle trips across all licensed areas (current and proposed). The maximum number of vehicle trips shall be cumulative across all licensed areas (current and proposed).		Halton Region	The ARA Site Plans for the Extension and Existing Quarry reflect the integrated nature of the operation and includes the maximum number of vehicle trips. Regarding the maximum number of on-site trucks between the two site please see proposed Existing Quarry Site Plans (February 2022) page 2 – “On-site Operations” Notes 7 and 8 and the proposed Burlington Quarry Extension Site Plans (March 2022) – page 2 “Noise” 3 E. See **Tab 4** for the Existing Quarry Site Plans (February 2022).	Drawing 2 of 4 of the Redlined version of the Draft Operational Plan, Revised September 21, 2022 shows the requested information. It should be noted that the Burlington Quarry Extension Site Plan, Revised September 2022 does include any notes about the maximum number of vehicle trips and should be updated with this information.

Proposed Burlington Quarry Expansion
JART COMMENT SUMMARY TABLE – Visual Impact

Please accept the following as feedback from the Burlington Quarry Joint Agency Review Team (JART). Fully addressing each comment below will help expedite the potential for resolutions of the consolidated JART objections and individual agency objections. **Additional, new comments may be provided once a response has been prepared to the comments raised below and additional information provided**.

	NEC Comment on behalf of JART (December 2020)	Applicant Response (June 2021)	NEC Response on behalf of JART (December 2021)	Applicant Response (June 2022)	JART Response (June 2023)
1.	• Photo Methodology: Detailed methodology for photography was not provided. The following information is required: o camera lens o camera height o panorama production (i.e. photo overlap, angle of view)	Section 3.0 (Methodology) has been updated explaining the camera specs and photo methodology. See updated report dated June 2021.	The detailed methodology is generally satisfactory, however, 180 degree panoramic photos are not ideal as they provide a distorted representation of the view in the field, for example, straight roads appear to bend behind the viewer. New photographs may be needed for the production of photo simulations to ensure the greatest possible accuracy is achieved.	New photos were taken in order to perform the photo simulations. See updated methodology section. See updated report dated May 2022.	Photo methodology comment has been addressed. Photo simulations comments are provided below.
2.	• Policy: NEP Policies are noted in the Background Section but there are some errors in the formatting of policy excerpts (see report section 2.4.3, 2.4.4, 2.6). Report should also reference NEP 2.9.3 j), which was not included. Reference should also be made to NEP Definitions relating to visual impact assessment as outlined in the 2019 Draft VIA Technical Criteria.	Updated formatting of referenced policy sections. Added Section 2.9.3. Added definitions to report appendix and made reference to definitions in Section 1.0. See updated report dated June 2021.	The NEC VIA Technical Criteria document referred to in VIA Section 1.0 and Appendix A was finalized in November 2020 and is available on the NEC website. Please update the references to this document and ensure that any definitions in the VIA are taken directly from the Niagara Escarpment Plan (NEP) not the Technical Criteria. Add the NEP definition of *open landscape character* to the list of Definitions.	Definitions have been taken directly from the NEP. Open landscape character definition has been added. See Appendix A See updated report dated May 2022.	Addressed.
3.	• Landscape Character: A more detailed description of existing landscape character is required. Provide this descriptive detail in the Photo Record and/or provide an additional map to document the landscape features that are referred to in the text. Findings from related reports (i.e. Cultural Heritage Impact Assessment Report) should be considered when describing the landscape character.	Added section on existing landscape character (Section 6.1) See updated report dated June 2021.	Section 6.1 provides a description of “existing landscape character and context” but there is no specific reference to *open landscape character*. Build in references to open landscape character in this section of the VIA.	Specific references to landscape open landscape character in relation to the provided definitions have been added to section 6.1 and various other sections throughout the report (7.3, 7.7, 8.0, and 10.0). See updated report dated May 2022.	Addressed.

4.	• Summary of Visual Impacts: Identifying and evaluating the physical changes resulting from development is a critical aspect of visual impact assessment. Table 1 summarizes visual impacts in terms of visibility to the subject lands, level of impact, and proposed mitigation but there is insufficient assessment of how the existing views will be changed by the proposed development and quarry operations on the subject lands. For all views with low to high impact, provide further description of the anticipated physical changes (i.e. distant tree line will be removed, vegetation thinned, clubhouse and outbuildings will be removed, proposed noise berm will be visible through roadside vegetation, trees to be planted, etc.). Photos may be further annotated to describe these changes. Furthermore, the VIA must consider any visual impact associated with the development of the proposed water feature near Cedar Springs Road.	A section on the explanation of the types of impacts has been provided in the table. The properties that may or will be able to view the proposed water feature pond have been noted. As noted in the report, we are of the opinion that this pond can be viewed as a restorative feature in the visual landscape as it is characteristic of the existing golf course water features that runs through approximately half of the existing golf course. By having the pond between the road and extraction area, a semblance of the former landscape can be retained and provide views with a similar visual experience. See updated report dated June 2021.	Comments and questions on VIA findings are detailed below.		Comments below (#13)
5.	• Analysis: NEP policy was referenced but no analysis has been provided. In addition, scenic ranking per NEC's Landscape Evaluation Study was referenced but there was no analysis of potential impacts on the scenic quality of the landscape unit(s). These analyses are required in the VIA report.	Section on analysis of the landscape evaluation study has been added in Section 7.6. Section on NEP policy analysis has been provided in Section 7.5. See updated report dated June 2021.	Section 7.5 of the VIA does not clearly address how the proposed quarry and associated mitigation measures conform to the following NEP policies that relate to scenic resources and open landscape character: NEP Purpose and Objectives Escarpment Rural Area Objective 1.5.1.1 Mineral Extraction Area Objective 1.9.1.2 Mineral Resource Extraction Development Criteria 2.9.3.c, d, and j Scenic Resources and Landform Conservation 2.13 Objective Statement	Section 7.7 has been updated to respond to how the report addresses these policy sections. In addition, clarifications have been provided in relation to various adjectives used to describe the conditions. In particular, it is noted that adjectives describing "maintaining" the visual landscape are related to during quarry operations where adjectives related to enhancing the open landscape character of the area related to post quarry operations through the implementation of the rehabilitation plan. See updated report dated May 2022.	Addressed.

			There is some inconsistency between the analysis and the conclusions with respect to open landscape character. For example, open landscape character has been alternatively described as being 'maintained' (pg. 36), 'strengthened and enhanced' (pg. 36), 'enhanced' (pg. 33) and 'changed' (pg. 32). Please clarify VIA findings in the context of relevant policies and NEP terminology including *open landscape character* and *scenic resources*		
6.	• Recommendations: Supplementary visual screening is referenced in the recommendations but there is no indication of where small or large species are indicated. Vegetation retention is referenced but there is limited detail provided on the extent of tree protection. Future landscape plans and vegetation protection plans will be required to reflect the findings of the VIA.	Areas for large and small plantings has been clarified on the Mitigation Plan. See updated report dated June 2021.	This comment has not been sufficiently addressed. Section 9.0 discusses recommended mitigation measures which include retention of existing vegetation, berms and planting but there is insufficient information on how and where existing vegetation will be protected, monitored and managed during berm construction and quarry operation. Existing vegetation along Sideroad 2, Cedars Springs Road, and Colling Road is providing an important screening function. Should that vegetation be damaged by construction activities or otherwise impacted by disease, pests, storms, etc., the effectiveness of this screening may be impacted. Per NEP 2.9 policies, screen plantings should be properly maintained to ensure continued survival and good growth rates and natural screening is to be protected. How will this be addressed during implementation and in the long term? Detailed	Additional notes have been added to the mitigation plan and further clarifications have been provided in Section 9.0 "Recommendations". The revised recommendations include: • A schematic planting layout to complement the existing planting recommendations (See Planting Detail Found in Section 9.0) • Figure 5A includes additional tree protection fencing. • Figure 5B Showing detail mitigation measures at the 2 Side Road crossing. See updated report dated May 2022. The ARA site plans will be updated to reflect these revised recommendations.	Mitigation Plan (Figure 5): Berm planting hatching is not clearly visible. Labels indicate that there are two areas of planting however the report describes mitigation planting on the north side of Sideroad 2 at the proposed quarry entrance and cross sections indicate proposed planting in front of all berms. Clarification is needed on the location of all planting areas and these areas must be shown on this plan. Figure 5A: Recommended tree protection fence layout is conceptual at this scale. Information on fence layout, fence detail, and fence installation and maintenance notes will be required on a detailed landscape and vegetation protection plan that is coordinated with ARA site plans. Figure 5B: Proposed planting is cut off on the left side of the plan. A detailed landscape plan showing a keyed plant layout with plant list, planting details, planting notes, guarantee notes, and maintenance and monitoring notes will be required,

			planting and vegetation protection plans are required for review. It is noted that a recommendation for detailed information is not included in the Natural Environment Report either.		including monitoring plans for areas of existing vegetative screening. Schematic Planting Detail: Figure number is required. Proposed plant sizes and spacings do not meet NEC's minimum plant sizes for screen planting. This figure is not drawn to-scale so plant quantities cannot be verified. Proposed plant species will need to be listed on a detailed landscape plan for NEC review. Note: all tree, shrub and seed mix species are to be native species. Clarification is needed on the intent of this planting – is this intended to screen views of the quarry operation or screen views of the berm? Natural shaping of berms will need to be demonstrated on a grading plan and be coordinated with other site plans/reports and on the ARA site plans.

	JART VIA Comments (December 2021)	**Applicant Response (June 2022**)	**JART Response (June 2023)**

7.	- Methodology has been updated
	  o Camera Lens noted as 50mm lens @ F2.8.
	  o 180 degrees panorama not required; no issue with the photos being stitched together so long as original resolution is maintained.
	  o Photos completed during 'leaf-off' conditions as required.
	- Bruce Trail has not been identified in open landscape character or land use description.
		Sections on the Bruce Trail has been added to Existing land use description (5.4) and Existing Landscape Setting and Context (6.1).
		
		See updated report dated May 2022.
			Addressed.

8.	**NEC Supplementary Comments** **A comprehensive review of the second VIA submission (June 2021), including the review of some new information that was provided in this submission, has raised further questions and comments which are noted below.** Figure 2 needs to be updated to include the overlay of the Minor Urban Centre of Mount Nemo.	Figure 2 has been updated to shown the minor urban centre. See updated report dated May 2022.	Addressed.
9.	The VIA refers to an at-grade crossing on Sideroad 2 for the purposes of processing (in Section 4.0) but there is no information provided on what work will be undertaken on the north side of the road to accommodate this crossing. Visual impacts related to the construction of an intersection at this location, including the removal of berm and vegetation on the north side of the road have not been assessed. Further information on the proposed crossing and associated visual impacts is required. Additional photography and photo simulations should be provided for both the north and south side, and amelioration of the visual impact on the southern entrance to the south extension by gradation of berms. There is some lack of clarity in the Planning Justification Report and inconsistency between the PJR and the Traffic Study (2020 and 2021). The Traffic study recommends a crossing of No. 2 Side Road from the south extension to the north side of the road for processing (2020: pages 35, 38). The Planning Justification Report makes similar statements that aggregate from South Extension Phases 1 & 2) will be transported by this crossing, but also makes ambiguous statements (pages 1, 11, Figure 3) that "the extracted aggregate will be transported to the existing Burlington Quarry for processing and shipping to market utilizing the existing entrance/exit…".This matter needs clarification by the provision of details in the VIA and Site Plan of the work proposed on the north side of No. 2 Sideroad.	Section 7.4 and Figure 5B have been added to the report. This section deals with how the at grade crossing will be treated. It is emphasized that views into the quarry will be limited to being directly in front of the vehicular crossing and is not considered to be of significant impact to the larger open landscape character of the area. See updated report dated May 2022.	Addressed. Comments on the at-grade crossing photo simulations below (#13). Comments on the proposed screening planting surrounding the at-grade crossing above (#6).
10.	Please note that any changes to the proposed Site Plan or Operations Plan (including berms, changes in extraction footprint, etc.) may have implications for the VIA. In the event of any changes, the VIA should be reviewed to ensure that conclusions and recommendations remain applicable and that the most current plans are referenced.	The updated Site Plans for the Burlington Quarry Extension (March 2022) have been reviewed. Based on this review and consideration of JART's comments the recommendation section of the VIA has been updated. See updated report dated May 2022. The ARA site plans will be updated to reflect these revised recommendations.	Noted: when will the ARA site plans be updated to reflect revised recommendations.
11.	The VIA refers to the proposed pond as a restoration of a characteristic feature of the site. As documented in this report and in the archaeology and cultural heritage impact reports, the existing golf course is a relatively recent feature in this Escarpment Rural Area and the creation of a water feature does not appear typical of the escarpment's open landscape character in the surrounding area. More information is needed on the proposed condition of the pond. Is the pond intended to be a naturalized or will it be a maintained landscape feature? Provide further description in Section 7.3 and illustrate the proposed pond in the photo simulations described below (Photo 22 and 32).	A description as to why the proposed infiltration pond is an acceptable addition to the landscape character of the area has been expanded on in section 7.3. The proposed infiltration pond is shown in the simulations, however given the proposed hydrological berms, the permanent water line is not visible. This is further shown in the proposed sections. See updated report dated May 2022.	Addressed.
12.	Table 1 states that the proposed pond may be visible from Colling Road (see Photo 43, 57 and 58). This appears to be an error: please clarify	Mention of possible views has been removed. See updated report dated May 2022.	Addressed.

13.	Several viewpoints were assessed in the VIA as being moderately or highly impacted by aggregate operations and mitigation was recommended (see Table 1, Photo 13, 17, 22-23, 28-33, 43, 50, 57-58). Visual impact assessment must assess any physical changes including berming and rehabilitation, not just extraction operations. Further study is required to fully understand visual impacts associated with proposed mitigation measures (pond and berm) and changes to the open landscape character for several key views of concern. Please provide photo simulations for these representative viewpoints and address these outstanding issues with further analysis in the VIA: • **View from Cedar Springs Road to hilly terrain and vegetation (Photo 22 - shown below with JART mark-up)** – What are the visual impacts associated with constructing a pond here? How will existing landform be altered? What vegetation will be lost? Will the proposed berm be visible beyond the pond? Is a pond really needed here to mitigate visual impacts? • **View from Cedar Springs Road to golf course and forests beyond (Photo 32 - shown below with JART mark-up)** – What are the visual impacts of constructing a berm and pond here? What will the pond look like? How will the berm be screened from view? • **View from Colling Road southwest across wetland towards golf course (Photo 43 right side - shown below with JART mark-up)** – What is the impact to open landscape character? What is the visual impact associated with constructing a berm here? How will the berm be screened from view? • **View from No. 2 Sideroad south to quarry entrance (Photo 50 - shown below with JART mark-up)** – What is the visual impact of constructing such large berms so close to the road? How will proposed vegetation mitigate the impacts? What will the large opening between berms look like? Does it need to be that large? What visual impacts will be associated with a crossing? What will the north side of the road look like? Note: Some photos may need to be re-shot or cropped for use in the production of photo simulations to ensure technical accuracy. A terms of reference outlining the detailed methodology for the production of photo simulations will be required for NEC review prior to a re-submission. NEC has prepared a redline of key photos to accompany this request for photo simulations as attached. Refer to the redline for areas of interest to target in the photo simulations.	Expected changes to views as a result of implementing the rehabilitation plan has been added. Photo simulations have been provided to show proposed mitigation measures. Photos have been re-taken to correct the accuracy issues resulting from the panoramic photo bases. It is noted that the infiltration pond is not being proposed for visual mitigation purposes, but for hydrological purposes. Due to the berms around the pond, it will be screened from view. See sections and photo simulations. See updated report dated May 2022.	Photo simulations require accompanying photos of existing conditions and a key map showing the precise photo location and direction of view.
14.	There are a few technical issues with the cross sections provided in the VIA: • The accuracy of the Section H sight line is not reliable as shown. A section break has been used to fit the long section onto the page but it does not appear to have been similarly applied to the sight line. Please demonstrate that the berm is effective at blocking sight lines into the quarry without a break in the section line. • Section C and Section D are not correctly located on the key plan, and the road in Section D is mislabeled as Cedar Springs Road but appears to be No. 2 Sideroad. • Section E, F, G, H do not sufficiently illustrate proposed changes to the subject lands, which include landform alteration and the construction of a pond.	The scale of the section has been changed to allow for it to be fully shown on the drawing. Labels have also been updated. In addition the infiltration pond and pond berming has been added to the sections. See updated report dated May 2022.	Addressed.
15.	The VIA describes future rehabilitation as including the removal of visual and noise berms and re-establishment of views into the quarried lands with a goal to ‘enhance the existing open landscape character of the area’ (see Section 8.0). Further study is required to demonstrate how this will be achieved. Please provide photo simulations showing proposed rehabilitation conditions for views of concern (Photo 22, 32, 43, and 50 - shown below with JART mark-up).	Photo simulations showing the conditions at the four locations for the proposed rehabilitation plan have been added. See updated report dated May 2022.	Noted. Comments on photo simulations provided above (#13)

Proposed Burlington Quarry Expansion
JART COMMENT SUMMARY TABLE – AMP

Please accept the following as feedback from the Burlington Quarry Joint Agency Review Team (JART). Fully addressing each comment below will help expedite the potential for resolutions of the consolidated JART objections and individual agency objections. **Additional, new comments may be provided once a response has been prepared to the comments raised below and additional information provided**.

	JART Comments (February 2021)	Reference	Source of Comment	Applicant Response	JART Response (June 2023)
Report/Date: Adaptive Management Plan, April 2020			**Author: EarthFX Incorporated, Savanta and Tatham Engineering**		
1.	Staff recommends the Adaptive Management Plan be revisited and updated once significant issues with the Level 1 and Level 2 Natural Environment Technical Report, Surface Water Assessment, Phase 1 and 2 Hydrogeological and Hydrological Study, other reports and After Use have been resolved.	General	Conservation Halton	See applicant response dated June 27, 2022 and the Preliminary Adaptive Management Plan dated June 2022	On January 1, 2023, Ontario Regulation 596/22 came into effect. As a result, technical review services for planning and development applications previously provided by Conservation Halton (CH) under Memorandums of Understanding with municipalities (e.g., technical reviews related to natural heritage and select aspects of stormwater management) can no longer be provided. O. Reg. 596/22 does not affect CH's mandatory programs or services. CH has only reviewed this comment based on natural hazard, and wetland matters, per Ontario Regulation 686/21 and Ontario Regulation 162/06. CH has no further comment from a regulatory perspective. We defer any remaining natural heritage related comments to the other JART members to confirm whether it has been addressed. Halton Region staff have reviewed Nelson's response and provided the following JART response: The original comment still stands as the significant issues remain and the Adaptive Management Plan should be revisited and updated when these issues are resolved.
2.	The Adaptive Management Plan (AMP) should identify securities to be posted by the applicant to protect the public agencies from financial liability for performance of the mitigation requirements and any on-going management over the long term, in the event the owner fails to do so.	General	Conservation Halton	See applicant response dated June 27, 2022 and the Preliminary Adaptive Management Plan dated June 2022	Noted.
3.	The wetland AMP/monitoring program should be based on modelled baseline water levels within the wetlands, not just the hydroperiod start dates, in order to confirm if the proposed quarry activities impact the wetlands.	General	Conservation Halton	See applicant response dated June 27, 2022 and the Preliminary Adaptive Management Plan dated June 2022	Please see Response to Comment # 1.
4.	The AMP must consider all items listed in Section 4.11 of the Region's Aggregate Resource Reference Manual.	General	Conservation Halton	See applicant response dated June 27, 2022 and the Preliminary Adaptive Management Plan dated June 2022	On January 1, 2023, Ontario Regulation 596/22 came into effect. As a result, technical review services for planning and development applications previously provided by Conservation Halton (CH) under Memorandums of Understanding with municipalities (e.g., technical

					reviews related to natural heritage and select aspects of stormwater management) can no longer be provided. As such, we defer this comment to the other JART members to confirm whether it has been addressed. Halton Region staff have reviewed Nelson's response and note that the comment still stands.
5.	A general comment is that the groundwater triggers should be more clearly explained by a graphic such as a flow chart. A clear indication of timelines between the trigger and the remedial action should be provided, as it appears from this analysis that the timeline could be a year or more.	General	North-South Environmental Inc.	See applicant response dated June 27, 2022 and the Preliminary Adaptive Management Plan dated June 2022	This comment still stands.
6.	The AMP does not contain any monitoring of anything other than groundwater and surface water. Biological monitoring of remaining features should be proposed.	General	North-South Environmental Inc.	See applicant response dated June 27, 2022 and the Preliminary Adaptive Management Plan dated June 2022	This comment still stands.
7.	The AMP chart should clearly identify targets for monitoring (which should include biota), thresholds against which monitoring will be measured, and concrete, meaningful actions to be taken should there be a clear indication that the quarry is affecting biota through impacts on surface or groundwater. The actions should include potential cessation of extraction.	General	North-South Environmental Inc.	See applicant response dated June 27, 2022 and the Preliminary Adaptive Management Plan dated June 2022	This comment still stands.
8.	The most important, central mitigation technique proposed by the Adaptive Management Plan to mitigate future surface water deficits in wetlands or streams is to maintain them by pumping water from the quarry. This means that if there is uncertainty as to the ability to maintain the pumping in perpetuity then it affects the entire mitigation plan. There are concerns about the uncertainty of relying so heavily on the ability to maintain pumping, considering uncertainty regarding so many factors (e.g., continued water supply and its quality, land ownership, financial viability) decades in the future.	General	North-South Environmental Inc.	See applicant response dated June 27, 2022 and the Preliminary Adaptive Management Plan dated June 2022	This comment still stands.
9.	No water quality discussion or threshold levels for groundwater quality are included. See comments on surface water report.	General	Norbert M. Woerns	See applicant response dated June 27, 2022 and the Preliminary Adaptive Management Plan dated June 2022	Partially Addressed. Water quality monitoring is included in the AMP however there is no discussion of water quality thresholds and the need to meet the Ontario Drinking Water Quality Standards for the proposed infiltration pond Surface water thresholds have been identified within the existing Environmental Certificate of Approval. These are limited to few parameters and do not consider that the discharge water will be infiltrated and used for drinking water purposes. The proposed water quality monitoring for groundwater and surface water is inadequate considering the quarry discharge water is intended to be infiltrated and used as a potable water source for downgradient wells.
10.	Prior to the surrender of the existing ARA licence the licence is required to provide confirmation that any long term monitoring, pumping, or mitigation will not result in a financial liability to the public. Due to the uncertainty of the proposed mitigation measures for the proposed expansion, this should be confirmed prior to the issuance of the ARA licence.	General	Norbert M. Woerns	See applicant response dated June 27, 2022 and the Preliminary Adaptive Management Plan dated June 2022	Unresolved. There is no information provided to address financial liability within the AMP.
11.	What options are available and what process will be followed if a suitable replacement well cannot be installed on properties where adverse well interference from quarry operations has been confirmed?	General	Norbert M. Woerns	See applicant response dated June 27, 2022 and the Preliminary Adaptive Management Plan dated June 2022	Unresolved. No information is provided in the AMP to address alternatives to well replacement apart from providing a cistern. The cistern option is only at the request of the landowner. A cistern

					is not generally considered an acceptable long term solution to domestic water supply.
12.	How will the effects of current climatic conditions on groundwater levels be evaluated?	General	Norbert M. Woerns	See applicant response dated June 27, 2022 and the Preliminary Adaptive Management Plan dated June 2022	Unresolved. It is not clear how climate has been addressed within the AMP. The proposed method of establishing threshold water levels relies on three years of background water level monitoring. This implies that the climatic conditions during the establishing of background water levels are 'normal' or representative of background conditions. Climatic data does not appear to have been incorporated into the establishment of background water levels.
13.	No water level thresholds have been provided for shallow monitoring wells nor for existing wells shown on Figure 4 and 6 that have less than 5.0 metres of available drawdown.	General	Norbert M. Woerns	See applicant response dated June 27, 2022 and the Preliminary Adaptive Management Plan dated June 2022	Partially addressed. Shallow wells have been included in the monitoring program outlined within the AMP. However, there is no discussion of shallow private wells with less than 5 metres of available drawdown and whether they will be deepened prior to quarry expansion.
14.	The AMP should identify measures required to address the current decline in groundwater levels in the vicinity of sensitive receptors.	General	Norbert M. Woerns	See applicant response dated June 27, 2022 and the Preliminary Adaptive Management Plan dated June 2022	Unresolved. Existing quarry impacts have not been addressed.
15.	The AMP does not fully recognize the interests of local agencies and municipalities in the protection of private water supplies and ecological features. Details are missing with respect to AMP implementation oversight and ongoing data access with these agencies.	General	Norbert M. Woerns	See applicant response dated June 27, 2022 and the Preliminary Adaptive Management Plan dated June 2022	Partially Resolved. The AMP identifies a Stakeholders Liaison Committee including a number of agencies and community representatives. It appears as though the Stakeholders Liaison Committee will be provided with information of the quarry operation. It is not clear how any stakeholder concerns will be addressed.
16.	The long-term financial implications of the recommended final site rehabilitation scenario have not been addressed.	General	Norbert M. Woerns	See applicant response dated June 27, 2022 and the Preliminary Adaptive Management Plan dated June 2022	Unresolved. There is no information provided in the AMP to address the long term financial implications of the proposed site rehabilitation
17.	The use of available drawdown as criteria for implementation of mitigation measures does not consider existing well conditions such as well productivity or water quality issues and is inadequate for assessing negative impact on private wells.	General	Norbert M. Woerns	See applicant response dated June 27, 2022 and the Preliminary Adaptive Management Plan dated June 2022	Unresolved. Factors other than available drawdown have not been considered in the proposed mitigation measures.
18.	The AMP approach to mitigation is reactive and should be proactive especially with respect to residential wells at high risk of potential well interference.	General	Norbert M. Woerns	See applicant response dated June 27, 2022 and the Preliminary Adaptive Management Plan dated June 2022	Unresolved. No information has been provided as proactive measures to prevent impacts to vulnerable wells such as shallow wells. See comment 13 above.
19.	There is no figure/map showing the location of wetland or stream monitoring locations (surface water stations).	General	Daryl W. Cowell & Associates Inc.	See applicant response dated June 27, 2022 and the Preliminary Adaptive Management Plan dated June 2022	Original Comment Stands.
20.	Report appears to be incomplete (see previous comment) and section numbers referenced in the text do not correspond to actual numbers (e.g., references to Section 6).	General	Daryl W. Cowell & Associates Inc.	See applicant response dated June 27, 2022 and the Preliminary Adaptive Management Plan dated June 2022	Original Comment Stands.
21.	Although titled "Adaptive", this plan is not so – there is no reference to how the monitoring would be adjusted/revised based on results, particularly in the event of unanticipated impacts. One particular fault is the absence of any contingency recommendations in the event of impacts such as shifting or halting quarry operations.	General	Daryl W. Cowell & Associates Inc.	See applicant response dated June 27, 2022 and the Preliminary Adaptive Management Plan dated June 2022	Original Comment Stands.
22.	The Level 1 and 2 Hydrogeology Assessment notes that the Medad Valley is a "significant groundwater discharge area" (Level 1 and 2 Hydrogeology Assessment report). These discharges occur via springs located near the base of the Goat Island/Gasport formations. The locations of springs and one round of discharge	General	Daryl W. Cowell & Associates Inc.	See applicant response dated June 27, 2022 and the Preliminary Adaptive Management Plan dated June 2022	Original Comment Stands.

	estimates (March 2006) had been documented by Dr. Worthington. Given the noted significance of the springs, why are there no plans to monitor spring flows in the valley? There should be background monitoring and on-going monitoring for several springs over at least 2 years prior to quarrying. Estimated impacts are derived via an EPM model even though, as Dr. Worthington notes (Worthington 2006), each spring represents a discrete “karstic groundwater basin” (page 5) of varying sizes – a very specific anisotropic condition.				
23.	The purpose of the Adaptive Management Plan (ADM) was to provide Nelson Aggregate Co. with the information needed to verify that the quarry is operating without causing adverse impacts to the natural environment or private water supplies. The ADM states that the monitoring data to date shows that the tributary to Willoughby Creek and West Arm depend on quarry discharge for much of their flow. Recommendations from the ADM is to establish streamflow and water temperature thresholds from historic surface water monitoring. If baseflows are detected to drop below minimum thresholds, then applicable mitigation measures will be implemented while the cause for potential impact is evaluated to determine if these were related to quarry dewatering or extraction. Discharge rates will also be adjusted to compensate for the reduction of flow subject to permissible discharge rates in Nelson’s PTTW. When temperature thresholds are exceeded, the quarry discharges offsite will be reduced to reduce the influence of the discharge on the water temperature of the receiving watercourse. This pumping scenario indicated above does not appear to be simple in terms of moving forward. If this is to be done in perpetuity, the following details should be clarified: (a) Are there assurances that trained operators will be available to apply the operational rules for pumping as noted in the ADM? (b) How will trigger levels detected in pumping be responded to as changes are experienced over time? (c) Based on the preferred rehabilitation scenario, potential to downstream fisheries impacts need to be clarified. For example, when the when lake is filling up with water, how will flow supplementation with pumping be maintained for the downstream fish habitat? Another concern is how will the overflows from newly created lake be discharged into the downstream watercourses?	General	Matrix Solutions Inc.	See applicant response dated June 27, 2022 and the Preliminary Adaptive Management Plan dated June 2022	These items are addressed in the updated AMP provided by the applicant. It is understood that downstream water flows to fish habitat will be maintained in the AMP, but details regarding how this is done simultaneously during lakefilling was not provided.
24.	Second paragraph should note the Region of Halton directly as a consulting agency with regard to the AMP.	Cover Letter (dated April 23, 2020) and Page 2	Daryl W. Cowell & Associates Inc.	See applicant response dated June 27, 2022 and the Preliminary Adaptive Management Plan dated June 2022	Original Comment Stands.
25.	Purpose of the AMP is to “verify that the quarry is operating without causing adverse impacts”. No, the purpose of the AMP is to determine whether or not quarry operations impact ground and surface waters, to determine the nature of any impacts and take corrective actions.	Page 2 3rd Paragraph	Daryl W. Cowell & Associates Inc.	See applicant response dated June 27, 2022 and the Preliminary Adaptive Management Plan dated June 2022	Original Comment Stands.
26.	If the site not developing acceptably, then “Adjust/Refine/Modify”; this does not speak directly to quarry operations but could refer to only the monitoring. There should be a step involving quarry operational responses (e.g., stop quarrying). Without this, the plan is not “Adaptive” in any way.	Figure 1	Daryl W. Cowell & Associates Inc.	See applicant response dated June 27, 2022 and the Preliminary Adaptive Management Plan dated June 2022	Original Comment Stands.
27.	“Dewatering post extraction will also lower groundwater levels surrounding the west extension.” What are the implications for the karstic subwatersheds feeding the springs in the Medad Valley? What is the final groundwater elevations?	Page 4 3rd Paragraph	Daryl W. Cowell & Associates Inc.	See applicant response dated June 27, 2022 and the Preliminary Adaptive Management Plan dated June 2022	Original Comment Stands.

28.	'Prior to the surrender of the *Aggregate Resources Act* licence, the licencee will provide, to the satisfaction of the MNRF, confirmation that any long-term monitoring, pumping, or mitigation will not result in a financial liability to the public.' Public financial liability. How will this be addressed? There is no discussion of how this will be addressed in this document. This should be demonstrated prior to approval of the licence application.	Page 4 Section 2.2. West Extension 3rd Paragraph	Norbert M. Woerns	See applicant response dated June 27, 2022 and the Preliminary Adaptive Management Plan dated June 2022	Unresolved See comment 16 above.
29.	"The AMP will become a condition referenced on the approved ARA Site Plans". The most recent version of the site plans does not incorporate the AMP and does not show monitoring locations.	Page 5 2nd Paragraph	Daryl W. Cowell & Associates Inc.	See applicant response dated June 27, 2022 and the Preliminary Adaptive Management Plan dated June 2022	Original Comment Stands.
30.	This reference is intended to direct Earthfx's whole approach to setting thresholds. What are this author's qualifications and experience? Has this been peer-reviewed? There must be much greater discussion in the validity of this thesis than just throwing-off a single paper that is not fully reviewed, assessed or further discussed in the AMP.	Page 5 Footnote	Daryl W. Cowell & Associates Inc.	See applicant response dated June 27, 2022 and the Preliminary Adaptive Management Plan dated June 2022	Original Comment Stands.
31.	Further to comment 30, reference to a discussion regarding setting targets in Section 6 is confusing as Section 6 is titled "Jefferson Salamander Breeding Ponds'.	Page 6 1st Paragraph	Daryl W. Cowell & Associates Inc.	See applicant response dated June 27, 2022 and the Preliminary Adaptive Management Plan dated June 2022	Original Comment Stands.
32.	Groundwater quality monitoring should be at least quarterly (as shown in Table 6 for surface water).	Page 6 Section 4.1 and Table 10	Daryl W. Cowell & Associates Inc.	See applicant response dated June 27, 2022 and the Preliminary Adaptive Management Plan dated June 2022	Original Comment Stands.
33.	'the domestic water wells, which will be incorporated into the AMP shall be constructed to comply with Ontario Regulation 903 (as amended).' Does this mean only private wells meeting this requirement will be included in the AMP and monitoring program?	Page 7 3rd Paragraph Section 4.2. Off-Site Domestic Water Wells	Norbert M. Woerns	See applicant response dated June 27, 2022 and the Preliminary Adaptive Management Plan dated June 2022	Unresolved. The AMP does not specifically address the issue of private wells not meeting the Ontario Regulation 903 requirements.
34.	Impact assessments will only be undertaken during the first 5 years (of 10) of quarrying (?). The monitoring and assessment, particularly associated with wetlands should be undertaken throughout and following quarrying.	Page 7 Section 4.3	Daryl W. Cowell & Associates Inc.	See applicant response dated June 27, 2022 and the Preliminary Adaptive Management Plan dated June 2022	Original Comment Stands.
35.	What is the scientific justification for using thresholds based on a "worst-case" scenario? Thresholds need to reflect actual real-time climatic situations and be set accordingly.	Page 7 Section 4.3	Daryl W. Cowell & Associates Inc.	See applicant response dated June 27, 2022 and the Preliminary Adaptive Management Plan dated June 2022	Original Comment Stands.
36.	'The impact assessment has been developed for the initial 5 years of quarry operation' The above statement appears to contradict the modelling scenarios that were completed. Please clarify.	Page 7 Section 4.3. Groundwater Impact Assessment Methodology 2nd Paragraph	Norbert M. Woerns	See applicant response dated June 27, 2022 and the Preliminary Adaptive Management Plan dated June 2022	Unresolved. It is unclear what is meant by impact assessment as this was to have been completed by the Level 1 and Level 2 Hydrogeological and Hydrological Impact Assessment (April 2020).
37.	'The predictive-based approach relied upon the simulated water level drawdowns in the bedrock aquifers resulting from both climatic conditions and quarry dewatering. The predicted water levels during drought conditions represent a worst-case scenario that may be encountered during the initial phases of quarry operation (Phase 1 and 2).' There is no discussion or predictions regarding the potential for water quality impacts.	Page 7 Section 4.3. Groundwater Impact Assessment Methodology 4th Paragraph	Norbert M. Woerns	See applicant response dated June 27, 2022 and the Preliminary Adaptive Management Plan dated June 2022	Partially Resolved. Water quality monitoring has been included within the AMP however there is no discussion of water quality thresholds beyond that included within the existing ECA which is limited to surface water discharge. There is no discussion of the importance of meeting Ontario drinking water standards for the proposed infiltration pond.
38.	A private well at 2377 Colling Road is proposed to be used as background monitoring well. The well is located 350.0 metres away from the existing quarry and is potentially within the existing quarry zone of influence. How many years of data is available for this well? In addition to the above, a private well should not be used as a background monitoring well as there is no guarantee it will not be decommissioned during extraction due to, for example, property sale or changes to water taking requirements	Page 7 Section 4.3.1. Monitoring of Background Groundwater Conditions	Conservation Halton	See applicant response dated June 27, 2022 and the Preliminary Adaptive Management Plan dated June 2022	On January 1, 2023, Ontario Regulation 596/22 came into effect. As a result, technical review services for planning and development applications previously provided by Conservation Halton (CH) under Memorandums of Understanding with

	on the property. Private well water taking can also change, which could impact the reliability of the groundwater level data.				municipalities (e.g., technical reviews related to natural heritage and select aspects of stormwater management) can no longer be provided. As such, we defer this comment to the other JART members to confirm whether it has been addressed. Norbert Woerns has reviewed Nelson's response and provided the following JART response: PARTIALLY ADDRESSED- Background monitors separate from private wells have been identified although a number of these have yet to be installed and monitored.
39.	'Background monitoring well is a domestic water well located north of the existing quarry at 2377 Collins Road (referred to as DW2; Figure 2. This background monitoring well has shown to have no drawdown from the proposed quarry extension.' What is the period of record available for this well? No water level or water quality data was found in the reports for this well. Has this well been impacted by the existing quarry? This well is shown on figure 7 not figure 2.	Page 7 Section 4.3.1. Monitoring of Background Groundwater Conditions 1st Paragraph	Norbert M. Woerns	See applicant response dated June 27, 2022 and the Preliminary Adaptive Management Plan dated June 2022	Unresolved. No details were provided on this well. An alternate background monitoring well has been proposed. See comment 38.
40.	It seems obvious that the proposed monitoring well has shown "no drawdown" from the proposed quarry extension when quarrying has not yet occurred?	Page 8 1st Paragraph	Daryl W. Cowell & Associates Inc.	See applicant response dated June 27, 2022 and the Preliminary Adaptive Management Plan dated June 2022	Original Comment Stands.
41.	What is the proof for this statement? Even so what if there are false positives – better to be prepared than surprised!	Page 8 Section 4.3.2. 2nd Paragraph	Daryl W. Cowell & Associates Inc.	See applicant response dated June 27, 2022 and the Preliminary Adaptive Management Plan dated June 2022	Original Comment Stands.
42.	Not clear what this says – it seems evident that there should be concern if levels drop "below a minimum reported".	Page 8 Section 4.3.2. 3rd Paragraph, Last Sentence	Daryl W. Cowell & Associates Inc.	See applicant response dated June 27, 2022 and the Preliminary Adaptive Management Plan dated June 2022	Original Comment Stands.
43.	It is noted that "trigger values set based on the traditional approach have caused numerous false positive trigger exceedances". Have these "false positives" been noted within the existing Nelson Quarry itself or is this a comment that applies to quarries in general? It would be helpful if the groundwater triggers could be more clearly explained by a graphic.	Page 8 4th Paragraph	North-South Environmental Inc.	See applicant response dated June 27, 2022 and the Preliminary Adaptive Management Plan dated June 2022	This comment still stands.
44.	It is stated that "Prolonged climatic changes mean sustained periods of departure from "normal" precipitation amounts, for example droughts." Climatic changes that result in greater rainfall, or more extreme rainfall events, have also been predicted as a result of climate change. Both these eventualities should be referenced. It is stated that short-term trends (seasonal) "should not cause a concern if an exceptionally dry year results in water levels that drop below a minimum reported pr predicted water level". As noted previously, breeding amphibians depend on "good" years that allow high levels of reproduction that compensate for bad years, and so the number of years with extreme low levels of water in breeding ponds must not increase. This should be taken into account when providing thresholds. It appears that several years would be needed to determine the thresholds that would indicate whether there are impacts on groundwater. This means the potential period of inaction would likely be much longer than one year. If groundwater is increasingly affected by the quarry extensions, there is the possibility that the known salamander	Page 8 5th Paragraph	North-South Environmental Inc.	See applicant response dated June 27, 2022 and the Preliminary Adaptive Management Plan dated June 2022	The threshold hydroperiod value does not provide a range through which the variation in hydroperiod from year to year can be assessed. Threshold values should reflect the needs of the biota that depend on the wetland, rather than establishing a date that indicates when remediation should occur. For example, if the threshold is May 15th, and water remains in the wetland only until May 31st for several years in a row, the detrimental effects to breeding salamanders would likely be high as they require standing water until July to be able to transform. There is very little reported about the biotic function of wetlands that are supported by seepage in the Medad Valley. It was noted that

	pond southeast of the quarry could be affected before any action is taken. A clear graphic of the timelines should be provided, and scenarios, based on potential impacts on Jefferson Salamander and taking into account climate change impacts, should be provided to help resolve triggers as quickly as possible. Triggers described here refer only to groundwater and surface water parameters. Since the objectives from the Region's guidelines specifically refer to terrestrial features and functions, the triggers should go beyond surface water and groundwater and include monitoring of biota. The objectives of the Aggregate Resources Reference Manual (Section 4, page 34) specifically require that "features and functions (including implications on terrestrial systems) be identified and that meaningful observation data should be collected relative to each to ensure that the observed data are evaluated relative to effects on these features and functions" (Region of Halton, undated).				monitoring locations did not always correspond with wetlands in the Medad Valley. Trigger values should be informed by the species that have been found in all monitoring conducted since the early 2000s.
45.	Either this is self-evident or needs explanation as to how quarrying operations can be the "confirmed reason" for decreasing trends – please detail and indicate what operating adjustments are intended.	Page 9 Section 4.3.3. 1st Sentence	Daryl W. Cowell & Associates Inc.	See applicant response dated June 27, 2022 and the Preliminary Adaptive Management Plan dated June 2022	Original Comment Stands.
46.	'Data collected from existing domestic water wells along No. 2 Sideroad, which are within 80.0 metres of the quarry, show that wells constructed in the hydrostratigraphy layer beneath the quarry floor (Layer 8) can meet peak domestic water demands with between 2.0 and 5.0 metres of available drawdown.' No data was provided in the report to substantiate this conclusion.	Page 10 2nd Paragraph Section 4.3.4. Proposed Ground Water Mitigation Measures	Norbert M. Woerns	See applicant response dated June 27, 2022 and the Preliminary Adaptive Management Plan dated June 2022	Unresolved. No data were provided for these wells within the Preliminary Adaptive Management Plan.
47.	'Compensation must be acceptable to the homeowner and the quarry operator and could include all or part of the costs associated with drilling of a new well, deepening a well, and abandonment of the old well.' Does this also include a permanent supply of water if suitable well cannot be drilled on the property?	Page 10 3rd Paragraph Section 4.3.4. Proposed Ground Water Mitigation Measures	Norbert M. Woerns	See applicant response dated June 27, 2022 and the Preliminary Adaptive Management Plan dated June 2022	Unresolved The alternative to deepening, enlarging, or drilling a new well has not been adequately addressed. A cistern is proposed only at the request of the landowner. This alternative is not generally accepted as a long term solution as a replacement water supply.
48.	Please provide details of this mounding and to what degree it will be maintained during quarrying despite an approximately 20.0 metre lowering of the bedrock surface combined with pumping. Please provide a description of the height and extent of mounding (now and once new infiltration pond is created).	Page 10 Section 4.3.4. Last Paragraph (and Page 28 Last Paragraph)	Daryl W. Cowell & Associates Inc.	See applicant response dated June 27, 2022 and the Preliminary Adaptive Management Plan dated June 2022	Original Comment Stands.
49.	'Interference will be in part masked or, coupled by local climatic conditions. Key groundwater monitoring locations that have over 7 years of water level data have been selected to act as the long-term sentry wells to ensure the influence on the groundwater regime is consistent with the predicted influence from quarry operations (Figure 3).' How will the effects of current climate on groundwater levels be evaluated? Will the proposed background well/monitor at 2377 Collins Road be used as baseline? Groundwater monitoring sentry wells will likely also be influenced by the quarry and the climate. How will quarry effects be distinguished for current climate conditions?	Page 10 Section 4.4.1. Groundwater monitoring Program 1st Paragraph	Norbert M. Woerns	See applicant response dated June 27, 2022 and the Preliminary Adaptive Management Plan dated June 2022	Unresolved The impact of climate on groundwater levels has not been discussed. It remains unclear how the monitoring program will identify quarry induced water level changes versus climate induced water level changes.
50.	Extreme drought based on existing data or simulated?	Page 11 Table 1, Right Column (and Table 3)	Daryl W. Cowell & Associates Inc.	See applicant response dated June 27, 2022 and the Preliminary Adaptive Management Plan dated June 2022	Original Comment Stands.
51.	'Level 1 Threshold conditions occur when the measured water level falls below the Threshold 1 value (10th percentile) for a 15-day period. Level 2 conditions occur when the water level falls below the Threshold 2 value (5th percentile) for a 15-day period. These threshold levels are set as early warning water level elevations were the	Page 15 Section 4.4.2. Groundwater Thresholds	Norbert M. Woerns	See applicant response dated June 27, 2022 and the Preliminary Adaptive Management Plan dated June 2022	Unresolved. No response to this concern can be found in the applicant response.

	cumulative influence of drought conditions and quarry dewatering have lowered the water levels to an early warning threshold, where local private wells (adjacent to or in close proximity to the quarry) may start to notice a decrease in well yield.' If the 15 day period of simulation represents worst case drought conditions (i.e., 2015/2016 drought conditions) it may be limited as an early warning threshold of quarry impacts under normal climatic conditions.	2nd Paragraph			
52.	No threshold values are assigned to intermediate level 'B' series monitoring wells or 'C' series shallow wells. This does not take into account potential interference with private wells completed into shallow bedrock zones or overburden.	Page 15 Section 4.4.2. Groundwater Thresholds Table 2 Groundwater Threshold Values	Norbert M. Woerns	See applicant response dated June 27, 2022 and the Preliminary Adaptive Management Plan dated June 2022	Unresolved. It is unclear what the status is of shallow monitoring wells and the role they play in providing an early warning of groundwater level impacts of the proposed quarry expansion.
53.	'notify the SLC, MECP and MNR in writing;' What does SLC represent?	Page 15 Section 4.4.2. Groundwater Thresholds 2nd Last Bullet	Norbert M. Woerns	See applicant response dated June 27, 2022 and the Preliminary Adaptive Management Plan dated June 2022	Resolved. SLC represents Stakeholders Liaison Committee
54.	For the southern extension groundwater levels 'Preliminary groundwater threshold values have been assigned to key Sentry Wells that are located outside of the extraction area.' AMP page 15 section 4.4.2 1st paragraph. However, for the west extension "No groundwater thresholds are proposed until enough groundwater monitoring data is collected to establish baseline conditions." AMP page 17, section 4.5.3, 1st paragraph. Groundwater level thresholds for the west extension are missing from the report.	Page 15 Section 4.4.2. 1st Paragraph and Page 17 Section 4.5.3 1st Paragraph	Norbert M. Woerns	See applicant response dated June 27, 2022 and the Preliminary Adaptive Management Plan dated June 2022	Unresolved. No threshold levels have been provided for groundwater monitors in the west extension.
55.	What's the point of simply repeating the process? This should trigger a change in operations (e.g., full stop or re-direction)?	Page 16 2nd Paragraph	Daryl W. Cowell & Associates Inc.	See applicant response dated June 27, 2022 and the Preliminary Adaptive Management Plan dated June 2022	Original Comment Stands
56.	'Groundwater monitoring at several monitoring wells on the West Extension commenced in 2018 and 2019. The monitoring of water levels and water quality shall continue for the duration of this AMP. Data collected will represent background conditions for as long as Phases 3-6 remain undisturbed.' This assumes that the extraction of phase 1 and 2 will not impact background conditions around the proposed phases 3 to 6. This will represent baseline conditions affected by phase 1 and 2.	Page 16 Section 4.5.2. Groundwater monitoring Program 1st Paragraph	Norbert M. Woerns	See applicant response dated June 27, 2022 and the Preliminary Adaptive Management Plan dated June 2022	Unresolved. It remains questionable whether the baseline conditions established during the Phase 1 and 2 South Extension are appropriate for establishing baseline conditions as they may be influenced by the impacts of the Phase 1 and 2 Southern Extension.
57.	'The extraction of the proposed West Extension (Phase 3 through to 6) is scheduled to commence approximately 10-years following the issuance of the ARA licence. No groundwater thresholds are proposed until enough groundwater monitoring data is collected to establish baseline conditions.' This suggests that currently there is insufficient groundwater monitoring information to establish threshold levels. As noted in comment 56 above, the additional monitoring will represent a baseline that is affected by the Phase 1 and 2 extraction and not represent an undisturbed condition. How will the additional monitoring data affect the AMP?	Page 17 Section 4.5.3. Groundwater Thresholds 1st Paragraph	Norbert M. Woerns	See applicant response dated June 27, 2022 and the Preliminary Adaptive Management Plan dated June 2022	Unresolved. See Comment 56.
58.	This process/commitment has to be included in the Site Plans.	Page 17 Section 4.5.3	Daryl W. Cowell & Associates Inc.	See applicant response dated June 27, 2022 and the Preliminary Adaptive Management Plan dated June 2022	Original Comment Stands.

59.	Well contractor must be independent; if both pump condition and over-pumping is ruled out, then licensee's (note spelling in document) operations should be the default.	Page 20 Complaint Protocol	Daryl W. Cowell & Associates Inc.	See applicant response dated June 27, 2022 and the Preliminary Adaptive Management Plan dated June 2022	Original Comment Stands.
60.	Why would stations be removed? Presumably they have been selected for specific purposes for impact assessment.	Page 23 Section 5.2	Daryl W. Cowell & Associates Inc.	See applicant response dated June 27, 2022 and the Preliminary Adaptive Management Plan dated June 2022	Original Comment Stands.
61.	Explain why there is no threshold value for SW14 in the Medad valley, located directly downflow from the west quarry extension.	Table 7	Daryl W. Cowell & Associates Inc.	See applicant response dated June 27, 2022 and the Preliminary Adaptive Management Plan dated June 2022	Original Comment Stands.
62.	Note that flows go to "0.0 litre/second" for SW6 and SW29 – the timing of this "threshold" in the year is important and what is the impact to Lake Medad/Grindstone Creek?	Table 7	Daryl W. Cowell & Associates Inc.	See applicant response dated June 27, 2022 and the Preliminary Adaptive Management Plan dated June 2022	Original Comment Stands.
63.	Typographical errors. There are references to Section 6.4. These should be Section 5.4.	Page 25 Section 5.3.1. Streamflow and Water Temperature Thresholds	Norbert M. Woerns	See applicant response dated June 27, 2022 and the Preliminary Adaptive Management Plan dated June 2022	Unresolved Typographical error.
64.	If year-round baseflow in the West Arm of the West Branch of the Mount Nemo Tributary is required, why is the threshold for SW6 dry (0.0 litre/second)?	Page 25 2nd Paragraph, Last Sentence	Daryl W. Cowell & Associates Inc.	See applicant response dated June 27, 2022 and the Preliminary Adaptive Management Plan dated June 2022	Original Comment Stands.
65.	"Mitigation is discussed in Section 6.4" – correction, this should read "Section 5.4"	Page 25 3rd Paragraph and 4th Paragraph	Daryl W. Cowell & Associates Inc.	See applicant response dated June 27, 2022 and the Preliminary Adaptive Management Plan dated June 2022	Original Comment Stands.
66.	'Its recommended that the wetland hydroperiod thresholds be established from the results of the historic surface water monitoring, existing condition water balance and integrated surface water groundwater model completed in support of the proposed quarry extension. Specifically, dates when the wetlands must remain wet should be established from the monitoring data and water balance and integrated surface water groundwater model results.' How does the retained consultant know whether the current hydroperiod for the wetlands hasn't been altered from historical operations of the existing quarry and whether this represents appropriate baseline conditions for a quarry impact assessment and for determining a preferred rehabilitation option?	Page 26 Section 5.3.2. Wetland Hydroperiod Thresholds 2nd Paragraph	Norbert M. Woerns	See applicant response dated June 27, 2022 and the Preliminary Adaptive Management Plan dated June 2022	Unresolved. Issue of impact from existing quarry has not been addressed.
67.	These hydroperiod thresholds (0.0 metre of water level) seem to be reached very early in the year given the belief that the Halton Till is an "aquitard".	Table 8	Daryl W. Cowell & Associates Inc.	See applicant response dated June 27, 2022 and the Preliminary Adaptive Management Plan dated June 2022	Original Comment Stands.
68.	'Downstream of each quarry discharge location (SW2 and SW10), water quality thresholds will be established to identify impacts on the water quality of the surface water features resulting from the quarry discharge. Its recommended that the water quality thresholds be established from the results of the historic water quality sampling completed in support of the proposed quarry extension. Specifically, maximum and minimum concentration limits should be established from the sample results collected while considering the Provincial Water Quality Objectives (PWQO) and role water quality plays in the Natural Heritage Features.' A portion of the discharge from Sump 100 is currently directed to the golf course irrigation ponds and is proposed to be directed to future infiltration ponds for purposes of recharging the groundwater system and the maintenance of groundwater levels for down gradient private wells. Water quality monitoring for this discharge should be	Page 28 Section Water Quality Thresholds 3rd Paragraph	Norbert M. Woerns	See applicant response dated June 27, 2022 and the Preliminary Adaptive Management Plan dated June 2022	Unresolved. The Preliminary Adaptive Management Plan June 2022 does not address this water quality concern. No monitoring of water quality of proposed infiltration pond has been identified. Also, no water quality threshold levels have been identified beyond the existing ECA approvals for quarry discharge water which are proposed to continue.

	evaluated against Ontario Drinking Water Standards since the infiltrated discharge is expected to ultimately impact drinking water supplies.				
69.	Are these measures intended to be maintained post-closure if the wetland hydroperiod/stream flow thresholds are exceeded?	Page 29 Additional Mitigative Measures	Daryl W. Cowell & Associates Inc.	See applicant response dated June 27, 2022 and the Preliminary Adaptive Management Plan dated June 2022	Original Comment Stands.
70.	It is noted in Section 7.3 on Page 38 that should pumping cease in the West Arm of the West Branch of the Mount Nemo Tributary of Grindstone Creek, fish habitat would be affected. It should also be noted that the small amphibian breeding pond associated with this tributary meets the criteria for Significant Wildlife Habitat. This breeding pond must also be maintained. Water quality of quarry water as a mitigation measure needs to be monitored, as quarry water may have high conductivity, and amphibian larvae are highly sensitive to increased conductivity. Conductivity should be monitored in ponds maintained by quarry discharge.	Page 38 Section 7.3	North-South Environmental Inc.	See applicant response dated June 27, 2022 and the Preliminary Adaptive Management Plan dated June 2022	Conductivity monitoring has been proposed. However, there is no information on how groundwater conductivity triggers would be developed, given that pumping of quarry water will be the only mitigation available should wetlands need to be supplemented. An additional issue has been identified as the water volumes to be pumped will be very large, and will potentially flush out the pond. This would make it less functional as amphibians cannot breed in moving water.
71.	Any revisions should be based on review of the data/trends and should be separately identified for the southern and western extensions. Why would the AMP be revised for the western extension when only the southern extension is being extracted? This needs to be more clearly defined as it will eventually be part of the Site Plans.	Page 39 AMP Revisions	Daryl W. Cowell & Associates Inc.	See applicant response dated June 27, 2022 and the Preliminary Adaptive Management Plan dated June 2022	Original Comment Stands.
72.	Section 1 Introduction: I note in the second paragraph that Halton is not included as one of the agencies that Nelson Aggregates Co. intends to consults with in order to finalize the AMP. It appears any additional charges, amendments, or additions required by Halton will need to be established during the Hearing Process.		Daryl W. Cowell & Associates Inc.		Original Comment Stands.
73.	Section 3.1 South Extension: paragraph 3 notes that the “lake will fill to an elevation of 271 m.” However, paragraph 1 notes that this is the elevation of the floor in Phase 1A?		Daryl W. Cowell & Associates Inc.		Original Comment Stands.
74.	Table 2 West Extension: I understand that wells BS-01 through 07 have been drilled and information is provided for location and well depth but why no information “Top of Casing”?		Daryl W. Cowell & Associates Inc.		Original Comment Stands.
75.	Section 5.4.1 Monitoring of Background Groundwater Conditions: I note that the background monitoring well is located east of the existing quarry in close proximity to the Niagara Escarpment. I do not believe this setting is representative of groundwater conditions in the areas of the southern or western extensions. The Niagara Escarpment on the east is much further fractured (vertically and horizontally) due to many cycles of glaciation (deep crevice caves are well documented) whereas the ‘escarpment’ farming the Medad Valley is a much younger feature created post-glacially and had not been subject to direct glacial loading after information. Hydrogeological conditions in the two settings are significantly different.		Daryl W. Cowell & Associates Inc.		Original Comment Stands.
76.	Table 4 Groundwater Quality: TSS and turbidity should be included.		Daryl W. Cowell & Associates Inc.		Original Comment Stands.
77.	Section 5.4.3 Groundwater Thresholds: I am not familiar with the ‘percentile method’ for groundwater monitoring but am not opposed. However, we need to understand what actual elevations these represent in order to evaluate the threshold relative to quarry floor elevations and surrounding surface water features.		Daryl W. Cowell & Associates Inc.		Original Comment Stands.

78.	Section 6.1.3 MECP PTTW and ECA Requirements: The second paragraph on page 19 indicates that Nelson will be seeking to permanently increase the maximum allowable discharge rate based on seasonal changes. It is not clear what discharge amount(s) is being sought. Is this greater than the existing 8,200 L/minute maximum? Is so, how much? The amount(s) are important because the operation of sump 0100 effectively re-routes groundwater causing it to enter the Medad Valley (via Willoughby Creek) much further to the north. This will have an effect on groundwater recharge to the central portion of the valley and much be assessed with regard to impacts to the Medad Valley PSW.		Daryl W. Cowell & Associates Inc.		Original Comment Stands.
79.	Section 6.2.2 Wetland Hydroperiod Thresholds: Second paragraph on page 21..."the wetlands are **generally perched**" (my emphases). What is this? Either they are perched or they are not perched but have a higher hydraulic conductivity.		Daryl W. Cowell & Associates Inc.		Original Comment Stands.
80.	Table 8 Environmental Compliance Approval Effluent Limits: Turbidity should be included as well-not the same as TSS, especially in karst/fractured rock settings.		Daryl W. Cowell & Associates Inc.		Original Comment Stands.
81.	Section 6.2.5 Surface Water Mitigation Measures: First paragraph identifies general mitigation measures including "adjusting quarry discharge rates", however the document does not indicate specific measures associated with specific non-compliance events.		Daryl W. Cowell & Associates Inc.		Original Comment Stands.
82.	Section 6.2.5, third paragraph, page 23: This describes a mitigation strategy involving a bottom draw outlet to feed water to wetland 13201. Please provide a schematic of this system. Also, how are rate and quality controlled/determined? Is this directly tied to a piezometer? Does this simply involve someone interpreting data and turning on the hose?		Daryl W. Cowell & Associates Inc.		Original Comment Stands.
83.	Section 6.2.5, fourth paragraph page 23 and first paragraph page 24: Design details please...see above comment.		Daryl W. Cowell & Associates Inc.		Original Comment Stands.
84.	Section 6.2.5 page 24, first bullet: Design details please.		Daryl W. Cowell & Associates Inc.		Original Comment Stands.
85.	Page 24, second bullet: How is temperature regulation achieved, as presented, it appears to be by 'trial and error'.		Daryl W. Cowell & Associates Inc.		Original Comment Stands.
86.	Page 24, third bullet: What happens if water quality doesn't 'adhere' to effluent limits? What does 'adheres' mean?		Daryl W. Cowell & Associates Inc.		Original Comment Stands.
87.	Page 24, fourth bullet: "If the second sample confirms the results of the first, the quarry sump and settling pond will be **reviewed** and the **necessary** modifications will be made to address the effluent limits (my emphasis). Please indicate what kind of review and what are 'necessary modifications'. As written, this is not a mitigation measures.		Daryl W. Cowell & Associates Inc.		Original Comment Stands.
88.	Page 24, fifth bullet: same comment as 87.		Daryl W. Cowell & Associates Inc.		Original Comment Stands.

89.	Page 25, last bullet: Notes that “mitigation measures implemented will cease and operations will return to normal.” This is the first mention of mitigation measures involving quarry operations (quarrying?) - please provide specifics on how quarry operations will be modified for each non-compliance of each threshold.		Daryl W. Cowell & Associates Inc.		Original Comment Stands.
90.	Section 9 Water Management and Mitigation Plan: This section (and elsewhere in the AMP) does not provide any detailed design information pertaining how water management will be undertaken (pipes, hoses, discharge valves) nor how mitigation volumes are determined and translated to flows and durations.		Daryl W. Cowell & Associates Inc.		Original Comment Stands.
91.	Section 9.1.2 West Extension, first paragraph: Please detail how “enhanced permeability” will be achieved.		Daryl W. Cowell & Associates Inc.		Original Comment Stands.
92.	Section 9.1.2, third paragraph: How exactly is the test conducted to demonstrate that groundwater recharge is occurring? What constitutes a successful test? Further, a water balance involving changes in pond storage does not provide an indication of where the water is going relative to pre-gold course conditions or relative to the existing irrigation pond (which we don’t know anyway).		Daryl W. Cowell & Associates Inc.		Original Comment Stands.
93.	Section 9.1.2, third paragraph: What mitigation measure(s) will be implemented if it is determined that the infiltration pond does not function as designed in regard to the Medad Valley wetland groundwater flows.		Daryl W. Cowell & Associates Inc.		Original Comment Stands.
94.	Section 9.1.2, fourth paragraph: Again, please provide design/control details		Daryl W. Cowell & Associates Inc.		Original Comment Stands.
95.	Section 11 Medad Valley and ANSI and PSW, third paragraph: A hydrogeologist should be involved in the surveys.		Daryl W. Cowell & Associates Inc.		Original Comment Stands.
	JART SITE PLAN COMMENTS (June 2023)				
96.	Missing information: Other than the location of the ‘bottom draw outlet’ at the southern end of the proposed infiltration ponds, there is no detail regarding the “Water Management” system (Section 9 of the AMP) on the Site Plans. The location and detailed design of all water lines, valves and other infrastructure as well as operational methodology should be provided on these plans as they become an enforceable component of the applicant's license.		Daryl W. Cowell & Associates Inc.		Original Comment Stands.