- DST Consulting Engineers Inc. 2018. Blast Impact Assessment - Proposed North Perimeter Aggregates Quarry, Rural Municipality of Rosser, Province of Manitoba. Final report to Broda Properties Inc. October 25, 2018. Sudbury

Broda has instructed MLi3 Inc. to develop these documents (MLi3 2019 a, b, c, d, e, f) (and review those prepared by others) to support its application for rezoning of its property within the RM of Rosser. The MLi3 Inc. documents have been considered, adopted and committed to by Broda (Broda *pers comm.* 2018). All the documents will be formally filed in support of Broda's request for rezoning of its property.

This AMPRP was developed in relation to the same Project Description considered in: (i) the required Sound Impact Assessment (SIA) component of an integrated SIMPVIA document; (ii) the required Visual Impact Assessment (VIA) component of an integrated VIMPVIA document; and (iii) Broda's Preliminary Environmental Monitoring Plan (EMP), which is now in preparation (MLi3 2019f; confidential, in prep.).

This document is proactive. While its preparation is intended to satisfy two formal requirements of the RM of Rosser, it is not formally required by any other regulatory body. It has been prepared at Broda's instruction to support compliance with corporate environmental due diligence policies, satisfaction of a By-law 8-15 requirement and, most importantly, to honour previous corporate commitments to Broda's neighbours and to provincial Mines Branch regulators.

The elements of the activities outlined in this corporate AMPRP rely on published non-peer-reviewed research reports and data, published peer-reviewed reports and data, common sense, regulatory practice and precedent in Manitoba, extensive relevant professional multidisciplinary experience, academic research, and communications with and guidance from provincial regulators.

2.0 PURPOSE

The development and operation of an aggregate quarry will create impacts on the closely proximate groundwater and surface water. Landowners living beside quarries, especially those operations that are older and poorly capitalized, can and do complain of nuisance, even health impacts, because of perceived and measured they rely on. For parties living beside such industrial activity, the implications for their well-being can be significantly negative (e.g., OSSGA 2010, USGS undated, Green *et al* 2005) unless the proponent takes suitable effective steps to prevent and minimize unavoidable impacts.

Accordingly, Broda commissioned (i) the Sound Impact Management Plan component of its Sound Impact Management Plan and Sound Impact Assessment (SIMPSIA); (ii) the Visual Impact Management Plan component of its Visual Impact Management Plant and Impact assessment (VIMPVIA); (iii) the draft Conceptual Operating Plan; (iv) the draft Preliminary Environmental Monitoring Plan (EMP); (v) the Transportation Plan (TransPlan); and (vi) this Adaptive Management and Progressive Rehabilitation Plan (AMPRP) as fully integrated components of the project. It also commissioned a Blasting Impact Assessment (DST 2018), findings and recommendations from which are addressed in this AMPRP. A Noise Impact Assessment prepared for another recent quarry re-zoning application within the RM (HGC 2018) was also examined for useful content in preparing this AMPRP.

This AMPRP is intended to integrate all the preliminary environmental monitoring data for the site and immediate region in an initial framework for ongoing and evolving adaptive management of the site and its operations. In relation to Manitoba Mines Branch (MMB) requirements for progressive real-time site rehabilitation, the adaptive management component of this AMPRP facilitates the execution of voluntary corporate commitments to fulfill requirements of the *Quarry Minerals Regulation* applicable to quarry developments on Crown land. Data generated from actions prescribed in the Preliminary Environmental Monitoring Plan (MLi3 2019f in prep.) will support execution of the AMPRP in an evidence-based manner.

Proactive execution of these plans noted in s. 1.4.1. above will contribute to the corporate satisfaction of: (i) provincial requirements for protection of worker health, neighbourhood health and the ambient groundwater and surface water environments (i.e., the specific requirements of the Manitoba Workplace Safety and Health Division and Manitoba Sustainable Development [“MSD”, through the former Water Management Branch]); (ii) relevant requirements of RM of Rosser By-law 8-15, (iii) proactive execution of the Development Agreement that Broda advises it will negotiate with the RM, and (iv) various corporate commitments Broda made in prior years to: (a) the reactivated local volunteer Citizens Advisory Committee, (b) participants at public Open Houses from 2004-2010, (c) public hearings administered by the RM of Rosser in 2010 about the proposed project, (d) several landowners adjoining the Broda property; (e) Manitoba Mines Branch (MMB), and; (f) the Water Management Branch (WRB) of Manitoba Sustainable Development (MSD).

The impact-prevention and -mitigation components of these plans embody the ‘state of the art’ in proactive management of a modern, well-capitalized, and well–operated quarry during its operational phase. They are intended to develop and maintain positive relations with the site’s workers, neighbours (through planned ongoing constructive engagement with the CAC), and the project’s regulators.

This document is filed in support of Broda’s request for a change in the zoning of its lands. Its filing adds to the weight of evidence filed to demonstrate satisfaction of the applicable requirements set out in *The Inland Port SPA Planning Regulation* MR 48/2016 that allows a quarry as a permitted land use within the Heavy Industrial Zone (Class 3; "I3") on the CentrePort land base.

3.0 PERFORMANCE OBJECTIVES

The text below sets out qualitative performance objectives and, where applicable and possible, measurable performance metrics established by Broda, to satisfy the relevant requirements of the various regulatory and planning regimes and jurisdictions. These objectives can be used by any party to determine whether the Plan is working, and having the desired effect(s).

3.1 NUISANCE AND IMPACT PREVENTION AND MANAGEMENT

The performance goals and objectives of this AMPRP are consistent with the current state-of-the-art in the management and prevention of ‘nuisance’ and ‘impact’, as strictly defined (e.g., Manitoba Environment Act’s 2015 Proposal Report Guidelines, based on the *Licensing Procedures Regulation (Manitoba Regulation No. 163/88*), especially in respect of industrial developments. They were also selected having regard to very similar work done elsewhere in the world where nuisance and impact prevention and mitigation were the purposes of evidence-based quarry planning and management (e.g., Manoj and Prasannakumar 2002). They are:

- Complete the Preliminary Environmental Monitoring Plan during the quarry's construction and execute the plan during the site-operations phase to create the evidence needed to optimize operations of the proposed project, thereby to prevent or mitigate the potential for adverse effects on the ambient sonic and visual environments (i.e., potential adverse effects on the health of site workers, the comfort of neighbours, or habitat use by fauna on-site).
- Use credible public-domain analytical tools and methods in this phase best able to support identification and tracking of significant, persistent, post-mitigation effects of the project.
- Use the operating-phase monitoring data from the AMPRP (and other plan components; e.g., EMP) in optimizing and executing the above-noted impact-prevention and/or -mitigation plans.
- Render the potential for project nuisance or impact effects for workers or neighbours to "non-significance" in the judgement of professional national and provincial regulators, including through evolution of Broda's current conceptual (pre-notified) Blasting Plan (allowed by the QMR and the Rosser By-law) or improvements in aggregate-processing methods.
- Use the monitoring data, and public responses to these data, to evolve and refine the AMPRP over the operating years, especially for issues of consistent public and neighbour concern (e.g., insufficient springtime capacity in municipal ditches to accommodate runoff), in conjunction with inputs from MSD staff, and through dialogue with the CAC, responding proactively and thoroughly to any expressions of environmental concern or suggestions for improved surveillance methods, data interpretations and public and regulatory accountability.
- Complete development of a Site End-Use Plan (SEUP) and a Site Rehabilitation Plan (SRP) acceptable to regulators, the RM and the CAC.
- Complete rehabilitation of the site for socially acceptable and/or desired amenity uses after the operating life of the quarry has concluded, working in consultation with the RM and regulators to facilitate execution of Broda's SEUP and SRP.

3.2 PUBLIC AND REGULATORY ACCOUNTABILITY

In addition to collaboration with regulators, Broda will maintain a collaborative approach with its neighbours to execute and refine its AMPRP. Broda intends to reactivate and maintain collaborative dialogue with the Citizens Advisory Committee (CAC) that Broda created in 2005. Broda supported several meetings with the CAC through 2006 to explore its needs for information and input to project planning until Committee members declined to participate after the project was rejected by Rosser Council in 2010. New participants in the Committee will be sought to augment the core of members willing to maintain their participation from the earlier years. Attendance at the CAC meetings will remain under an "open-door" policy. The former mechanisms for public accountability will be strengthened with new digital techniques. These will provide for public input to and surveillance of quarry operations, and new techniques (e.g., interactive website, record logs [n=5]) for public and regulatory accountability.

3.3 ADAPTIVE MANAGEMENT

The performance objectives and metrics for this corporate-performance goal are:

- Evolving the SEUP agreed-upon with the RM, and the SRP agreed upon with Manitoba Mines Branch and the RM, as opportunities for efficiency, habitat-creation and adding intrinsic economic value to the site present themselves.

- Evolving the SEUP and the SRP to increase use of native plant materials, visual screening for neighbours and soils conservation wherever possible.
- Evolving the SEUP and the SRP based on lessons learned from ongoing monitoring of the actions of others doing similar activities (e.g., Stonewall Quarry Park, Quarry Oaks Golf Course, Silver Fox Estates – Birds Hill, etc.).
- Evolve the Blasting Plan allowed by the QMR and the Rosser Bylaw in conjunction with staff from MMB, and through dialogue with a (CAC) that Broda will create and maintain, to respond effectively to concerns or suggestions for improved processing methods.
- Evolve the Preliminary Environmental Monitoring Plan (MLi3 2019f; confidential, in prep.), especially for issues of consistent public and neighbour concern with staff from MSD, and through dialogue with the CAC, to respond effectively to any environmental concerns or suggestions for improved surveillance methods, data interpretations and public or regulatory accountability.

3.4 PROGRESSIVE REHABILITATION

During operations, and after they cease, Broda has publicly committed (Broda *pers comm.* 2010) to progressively decommission the site to voluntarily satisfy the intent of relevant sections of the MMB regulations and to meet a mutually agreed-upon SEUP. One key element of the necessary actions is satisfaction of a portion of The *Quarry Minerals Regulations,* which states in Part V, s.38, that:

"(1) Every operator of a quarry shall stockpile on the parcel of land or within the area of the quarry mineral disposition, all topsoil and overburden stripped in the process of excavating the quarry."

During operations, Broda has publicly committed to "progressive rehabilitation", which will be an important component of routine ongoing operations as contemplated in the Conceptual Operating Plan (reference Appendix A). The site cannot be developed for any other purpose until the aggregate resource has been fully exploited and the site rehabilitated for its intended next use. (This progressive rehabilitation commitment was a key early promise to meet some of the initial concerns raised early in the planning of the project by the CAC). Clean waste aggregate material recovered during the initial site preparation, especially from the removal of the underlying bedrock materials, will be saved as a valuable site-berming and site-rehabilitation material. It will be used to create strategically located earthen berms to prevent significant off-site noise dissemination and to backfill the small, progressively-moving 'open face' of the pit as the Continuous Surface Miner used in quarry operations progresses across the site to create excavation channels (see Appendix B). The empty trench volume behind the 'working face' of the excavation channels will be backfilled with this clean stockpiled material. Consistent with Best Practice elsewhere, Broda will accept clean fill from pre-approved off-site sources (e.g., from City of Winnipeg) to help restore the final profile of the rehabilitated site to that specified in the SEUP. Broda will accelerate such material acquisition if its sound-impact mitigation program e.g., construction of earthen berms to deflect working-face sound into the vertical plane) requires stimulus to satisfy concerns of its neighbours.

Dialogue with MMB has resulted in provincial willingness to engage with Broda in the joint design of a real-time rehabilitation approach to site closure and rehabilitation, including the use of fast-growing native plant materials (see Appendix C). Such an approach is encouraged by Clause 189(1) of the *Mines and Minerals Act*. It is also a requirement under the SPA Regulation. On this basis, Broda will develop and submit a conceptual SEUP and SRP to MMB after receiving approval of the requested zoning change to satisfy the intent of Clause 188(1) of the *Mines and Minerals Act.* Both plans will reflect the dialogue on this subject that Broda will have with the CAC. Broda will also commit to such a real-time approach to rehabilitation in the Development Agreement it will negotiate with the RM, consistent with Rosser Bylaw 8-15.

Consistent with an early commitment to the then-active CAC, Broda still intends to return the site to agricultural, recreational or other use, consistent with the CentrePort planning regime (e.g., *The Inland Port SPA Planning Regulation* MR 48/2016). It will seek concurrence with the proposed final land use by the RM before finalizing the SEUP and the SRP.

The Winnipeg Airport Authority (WAA) has expressed concerns in the past (at the 2010 CUA public hearings) regarding any possible creation of on-site ponds within flight paths to the George Richardson International Airport (GRIA). In past decades, it was common that decommissioned quarries were left to fill with water. Habitat was thereby created for waterfowl. While such an end use, usually an ecological benefit, is often desired by both project proponents and neighbours, it would be very counter-productive for this region because the site is near the final approach to the GRIA for Runway 18-36. Ponds attracting waterfowl could pose a safety issue for aircraft (New York Times 2009). Broda has acknowledged this issue. While Broda's Water Management Plan (MLi3 2019e) outlines intention for a temporary pond, Broda will not create any large new permanent surface-water storage ponds during operations.

The performance objectives and /or metrics for this goal are:

- Developing and securing formal MMB approval of a conceptual SEUP and SRP submitted to MMB after receiving approval of the requested zoning change thereby satisfying the intent of Clause 188(1) of the *Mines and Minerals Act*.
- Stockpiling and using site-sourced spoil materials, and pre-approved off-site clean waste, as aggregate material for constructing sound-absorbing berms and to backfill the progressively moving 'open face' of the pit as the quarry operation progresses across the site.
- Satisfying all concerns and responding effectively to all suggestions for operational improvements received from the CAC.
- Returning the site to agricultural, recreational or other use, consistent with the CentrePort planning regime and/or the proposed final land use desired by the RM.
- Preventing the creation of any new permanent surface-water storage ponds during operations, and minimizing any temporary ponds during the annual spring and fall waterbird migrations.

4.0 WORK DONE TO DATE

4.1 ADAPTIVE MANAGEMENT

Relevant work to date to help develop this portion of the Plan includes the following:

- Completed review of meeting records from 2005-2006 with the CAC for issues it expressed, to guide the more recent data-gathering and impact-prevention activities completed to date.
- Completed new site groundwater-level surveys and interpretations (KGS 2010) to better understand seasonal, annual and even decadal groundwater dynamics, for better planning of site layout, operations and infrastructure placement, and options thereto, in case adaptation of site planning is needed, especially if in response to unexpected site conditions or events (e.g., sustained rise in groundwater table).
- Completed new site topographic surveys to better understand site topography, for better planning of site layout and infrastructure placement, and options thereto, in case adaptation of site planning is needed.
- Established pre-development conditions of neighbouring private wells so that in the unexpected event of perceived impacts on these wells (e.g., from occasional blasting), their benchmark conditions are known and

thus how best to adapt, replace or even fix the wells, if impacts are attributable to operations, is better understood.

- Established pre-development site environmental conditions so that in the unexpected emergence of need to create unexpected localized impacts on these resources (e.g., having to clear an area of the remnant oak forest), benchmark knowledge of the site attributes can support planning of ecologically appropriate, high-value "offsetting" mitigation measures (e.g., the best size, location and approach to recreating these lost habitats elsewhere on a lesser-valued area of the site).
- Completed an initial working draft of a Conceptual Operating Plan to establish the foundation for expected site-operating procedures, which plan includes initial conceptions of site layout (see Appendix A).
- Committed to the RM of Rosser to negotiate a Development Agreement that helps the RM to better meet its duties, including actions that could be completed by Broda to free up annual budget, human capital or machinery for other RM priorities, creating much more operational flexibility for the RM capital and/or O&M programs.

4.2 PROGRESSIVE REHABILITATION

Relevant work to date to implement this portion of the Plan includes the following:

- Completed comprehensive assessment of the site's aggregate resource in 2015, because of such requirements for sites designated as being of 'high' quality, so that the amount of marketable aggregate is much better known, the fractions of the various material qualities are known more precisely, and the masses and types of non-marketable material that can be used as clean fill for backfilling and progressive site rehabilitation are also much better known (Stantec Consulting 2015). In so doing, this action satisfies Rosser secondary plan aggregate policy number 7.2.1.
- Began dialogue with respected and experienced suppliers in both Manitoba (Prairie Habitat Inc.) and Saskatchewan (HELP International) of native plant materials, custom native seed harvesters, and special application methods and technologies for using native plant materials (Appendix C) so that use of native species occurs as site rehabilitation is conducted across the site. Although local farmers use 'lure crops' to attract waterfowl to their lands to support local hunting (RM Rosser Website [www.rmofrosser.com]), Broda will not use such species in any ongoing and future site rehabilitation because the adjacent airport seeks to avoid bird attractants.
- Developed a conceptual visual-screening concept built around the requirements for; (i) progressive rehabilitation of the site, (ii) material-stockpiling areas, (iii) use of native grasses, forbs and shrubs and (iv) preservation of remnant native species assemblages on the site.
- Shared the draft conceptual site-screening planting scheme with one of the candidate service providers for native planting and seed sources, so cost and scheduling estimates could be provided to Broda.

5.0 ADDITIONAL WORK TO BE DONE

While much preparatory work has been done to develop this Plan, more work remains to be done. Broda has committed that this work will be completed as soon as practical. This additional work includes many important additional tasks, including the following:

- Reactivation of the CAC, solicitation of new participants, updating of previous public and regulatory accountability procedures, and creation of new citizen-directed impacts-tracking and public-accountability tools (e.g., interactive website).

- Completion of the multidisciplinary Preliminary Environmental Monitoring Plan (MLi3 2019f; confidential, in prep.) after (i) WSP Engineering completes and finalizes the draft Conceptual Operating Plan (confidential, 2019, in prep.); (ii) the RM's review of the filings in support of Broda's application, and (iii) the bilateral negotiation of a Development Services Agreement by the RM and Broda, such that its likely parameters and disclosure methods meet local and government needs for regular information on operational performance about whether corporate commitments to impact prevention are successful.
- Upgrading of dated information on groundwater-well productivity, well condition, groundwater quality and levels (Friesen 2006a; Friesen 2006b; Friesen 2009), to support assessment over time of any operations effects on these parameters.
- Solicitation of input from key government personnel to support development and finalization of the SEUP and the SRP, including (as and when needed) representation and input from (i) Community and Regional Planning Branch, (ii) Water Resources Branch, (iii) MI (iv) Manitoba Mines Branch, and (v) Manitoba Sustainable Development.
- Negotiation with (and pre-approved of) off-site sources (e.g., City of Winnipeg contractors) for occasional supplies of clean fill from off-site sources to support site acoustic berming and progressive site rehabilitation, per the prescriptions in the evolving SRP and SEUP.
- Use of new data detailing the masses and types of non-marketable material that can be used as clean fill for backfilling and progressive site rehabilitation to assist development of the SEUP and the SRP.
- Development, tendering and award of contract for sourcing of native plant materials, custom native seed-harvesting services, and use of special application methods and technologies so that native species are used as the site is systematically and progressively rehabilitated.
- Formal submission of the final SEUP and SRP to MMB within 60 days of receiving approval of the requested zoning change, consistent with Clause 189(1) of the Mines and Minerals Act, and with the approach set out in in Clause 189(1) of the Mines and Minerals Act.
- Negotiation of a mutually beneficial Development Agreement with the RM of Rosser that helps the RM to enhance its adaptive flexibility in addressing its duties, such that RM responsibilities (e.g., annual cleaning of selected municipal ditching) that could be completed by Broda will free up annual budget, human capital or machinery for other RM priorities.

6.0 MONITORING TO ASSESS PERFORMANCE

A key element of this Plan is monitoring to support adaptive management of the site and to determine the effectiveness of adaptive management in meeting the requirements set out in the approved SRP and SEUP. Monitoring will be of several types and frequencies, tracking a wide variety of parameters to support Broda's ability to evolve the Plan, as and if needed. Monitoring will track whether ecological benefits expected to be created by the project will be realized and capable of sustained measurement. One example would be protection of the site from the previous impacts from mechanized agriculture, which could create the stability needed for limestone-dependent plant species to flourish (as has happened, with occasionally astonishingly positive results beside limestone quarries; (Spears 2017). Monitoring will also address concerns for adverse effects on neighbours (e.g., well productivity and groundwater quality; Friesen 2006a; Friesen 2006b). Completion of the multidisciplinary Preliminary Environmental Monitoring Plan (MLi3 2019f, confidential; in prep.) will be important to execution of the AMPRP but must await the RM's review of the filings in support of Broda's application, and Broda and the RM's bilateral negotiation of a Development Services Agreement, among other things.

Experience demonstrates that the potential for impacts from aggregate operations are also localized (risk to workers can be substantial) but the risk can be, and usually is, being mitigated and reduced to regulated levels (Bauer and Babich undated, Bauer and Babich 2006).

Some typical expected monitoring and disclosure goals and parameters will be:

- Sustained dialogue with the CAC and with key government personnel from the (i) Community and Regional Planning, Water Resources, Mineral Resources and Historic Resources Branches (ii) MI, and (iii) Sustainable Development. who contributed ideas to finalizing the SEUP and the SRP to determine whether their respective site-management and adaptive management needs are being met.
- Sustained dialogue with site neighbours who do not or cannot participate in the CAC to determine whether their needs for respectful, adaptive site-management are being met.
- Tracking of native plant materials used in progressive site rehabilitation so that native species use is optimized, rare and endangered species are better protected and flourishing, and any necessary impact-mitigating offsets are functioning as intended (e.g., tracking whether the Beneficiated Area-to-Impacted Area ratio exceeds the target ratio of 1.0 as intended)
- Tracking the use of non-marketable site material and off-site clean fill being used as for progressive site rehabilitation guided as by an evolving SEUP and SRP over time.
- Tracking the growth, development and aesthetic appeal of the visual-screening plantings and landscape elements developed on the site over time.
- Tracking time-series trends in the data from the multidisciplinary Preliminary Environmental Monitoring Plan (MLi3 2019f, in prep.) (e.g., HIS sustainability, rare species percentage frequency of occurrence) and disclosure of trends to the CAC and regulators to facilitate public evaluation of whether corporate commitments to impact prevention are successful.
- Tracking time-series trends in the data from monitoring onsite and at property boundaries for sound-intensity levels, vibration, and air overpressure (as recommended in the Blasting Impact Assessment; DST 2018) for demonstration of sound attenuation with distance, and satisfaction of industry and government guidelines for vibration and air overpressure from routine operation (and occasional blasting). Data recorded with dedicated monitoring units will be used to evolve the Blasting Plan to design more productive blasting that doesn't disturb, or reduces nuisance to, the site's two adjacent neighbours.

7.0 PLAN CONSISTENCY WITH "BEST PRACTICE"

This Plan has been developed regarding some of the highest standards of relevant environmental and neighbour sensitivity in the world. This Plan sets out an extremely high standard of care, and corporate commitment, to the Best Practices possible for this site.

8.0 PLAN EVOLUTION

The Plan will evolve. The recent Resource Verification Study (Stantec 2015) has provided data helpful for development of an operation plan maximizing capture of the value of all the quality construction materials available on the site. In so doing, it has helped Broda to understand better the expected operation lifespan of the proposed operation, and the time dimensions of the SEUP and SRP now in development. That said, ongoing monitoring will provide data indicating the need, from time to time, to adapt the SEUP or the SRP to better meet the intentions of Bylaw 8-15 or another regulatory requirement. Data from sound- and vibration-monitoring (DST 2018), for example, will help Broda to evolve the Blasting Plan to design more productive blasting. This would reduce or preclude nuisance to the two adjoining landowners. Advice from the site's neighbours and the CAC will undoubtedly be heard and will influence evolution of the Plan. Market conditions will also have effect. Thus, the plan approved by the RM and the MMB will iterate through ongoing dialogue with the parties.

9.0 CLOSURE

This is the precursor to the Site Rehabilitation Plan and the Site End Use Plan that Broda will develop through dialogue with the RM and MMB, file for formal approval by the MMB and use to support negotiation of a Development Agreement with the RM. It embodies the "state of the art" in progressive management of a quarry during its operational phase, and to guide the planning for transition to an end use(s) desired by a reactivated and strengthened Citizens Advisory Committee and the site's neighbours and the elected officials of the RM. Its submission is to demonstrate Broda's partial completion to date, and intention to complete, all relevant and applicable portions of Rosser Bylaw 8-15 to Broda's proposed high-quality aggregate quarry in the RM of Rosser. It's development and execution is also to demonstrate satisfaction of the requirements set out in the *Inland Port SPA Planning Regulation 48/2016* that allows a quarry as a permitted land use within the Heavy Industrial Zone (Class 3; "I3") on the CentrePort land base. The Plan will also demonstrate satisfaction of previous corporate commitments to the CAC, participants at several public Open Houses and RM of Rosser public hearings about the proposed project, and directly and personally to several neighbour landowners adjoining the Broda property.

MLi3 has observed that Broda strives to set itself apart as a professionally managed, environmentally responsible corporate citizen. MLi3 is confident that Broda will take the necessary steps to ensure that it's adaptive-management and site-rehabilitation practices support this vision.

The foregoing is unbiased independent work and assessment by MLi3 Inc.

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10.2 PERSONAL COMMUNICATIONS

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Broda, G. 2018. Email communication of January 21 2018 from President of Broda Properties Inc. in reply to email communication of November 17 2017 from Michael McKernan of MLi3 Inc. to Broda Properties Inc. by confirming that the corporate commitments and statements that MLi3 Inc. made in the WNRMP document on behalf of Proda Properties Inc., that MLi3 Inc. relied on in completing its assessment of potential impact-management and -prevention measures and associated Plans (including the WNRMP), remain accurate portrayals of Plans and corporate commitments made by Broda Properties Inc.

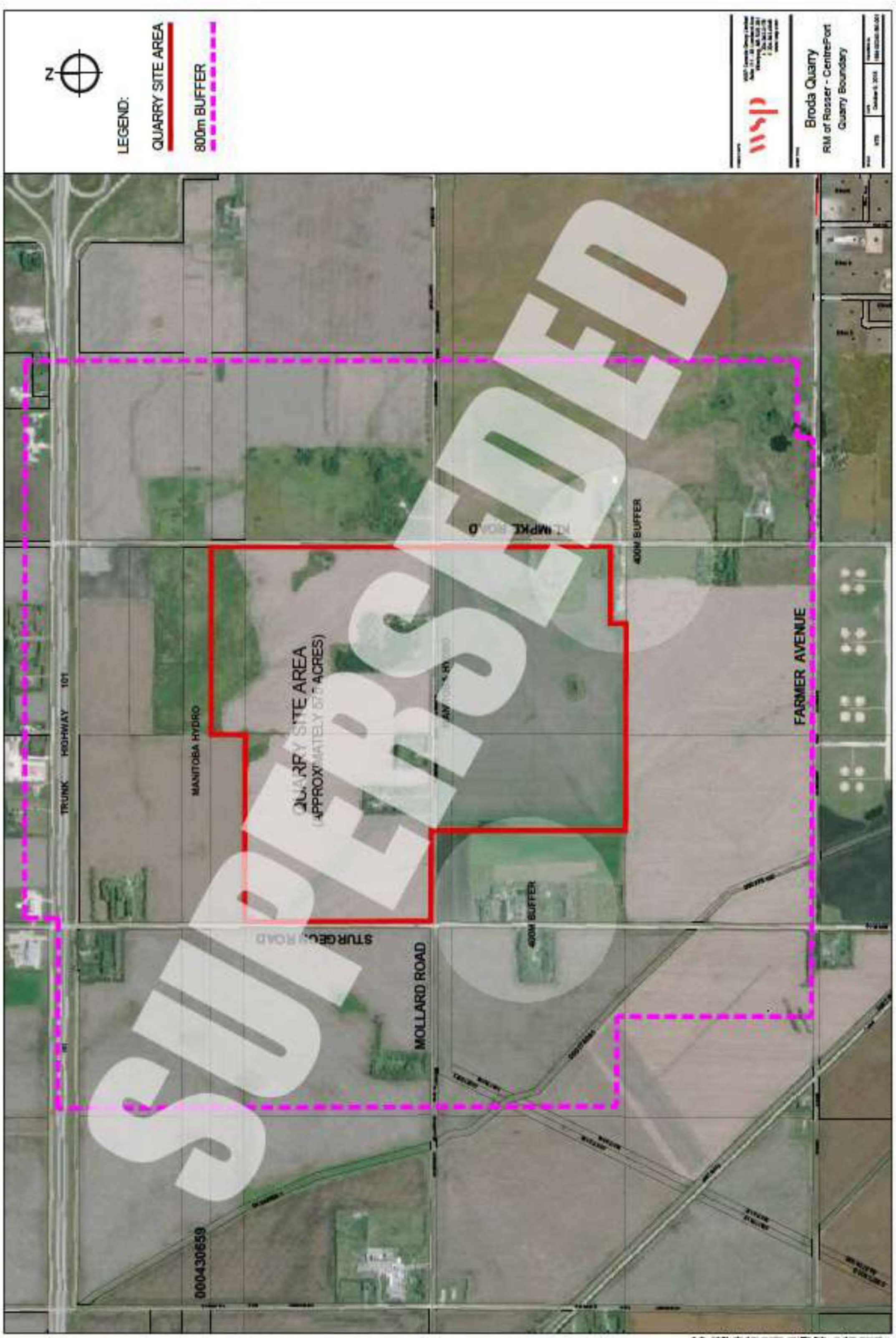
APPENDIX A CONCEPTUAL SITE OPERATING PLAN

Initial Site Layout and Development Schematics

The draft conceptual operating plan, which continues to evolve, has been built around a core commitment to the use of Continuous Surface Miner technology. A typical Surface Miner, in this case, manufactured by Wirtgen, is shown in Figure A-1 below.

Figure A-1. A Wirtgen 4200SM Surface Miner.

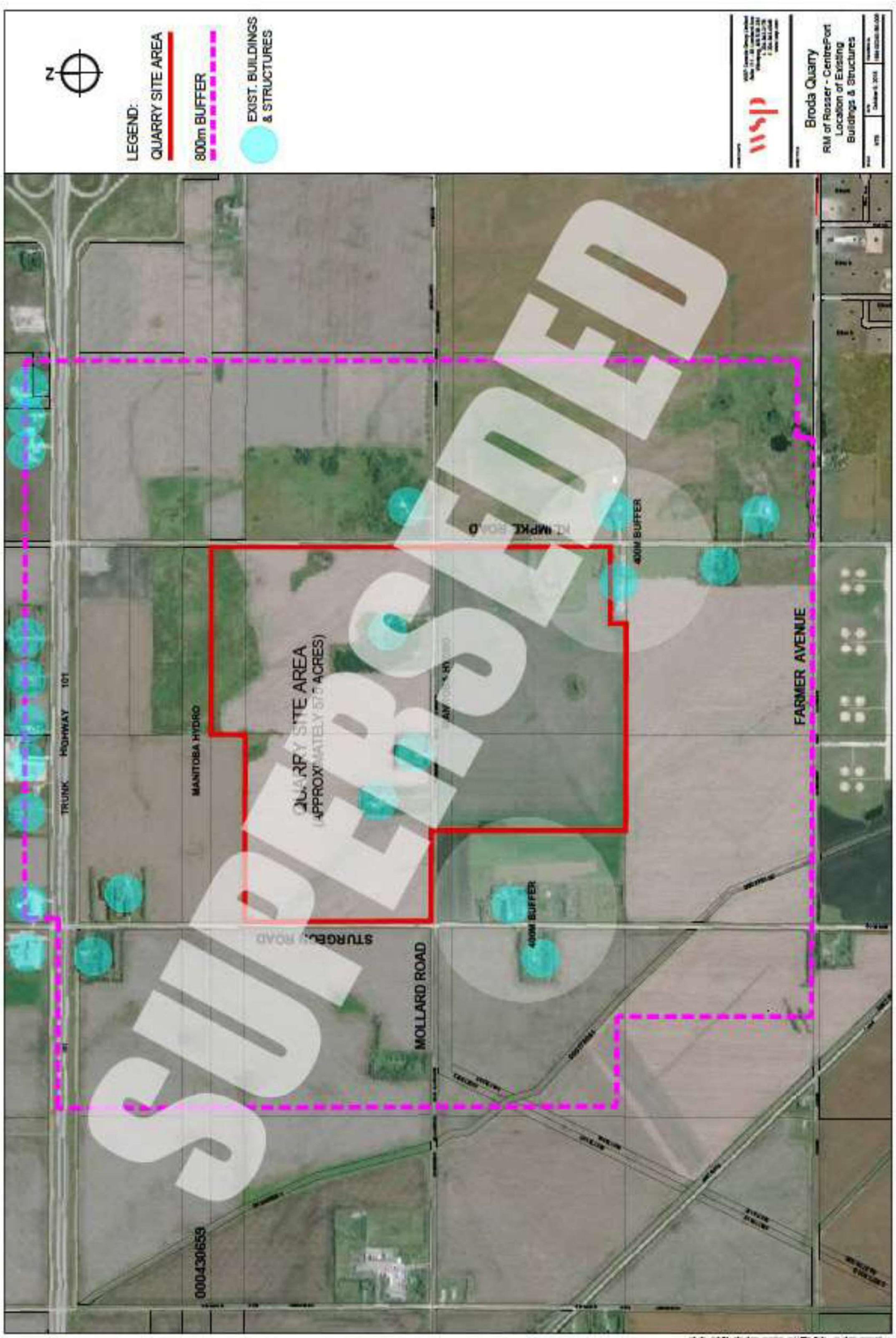
The most important elements of the current working draft of the Conceptual Operating Plan are preliminary site layout drawings which have been developed mindful of (i) the physical attributes of the site; (ii) the intended reliance on Surface Miner technology; (iii) the intention to minimize surface water ponds and groundwater accumulations on the site; and (iv) many corporate commitments to preclude, or minimize, visual and sound impacts being experienced at adjoining properties. The current draft drawings follow below; these draft drawings have recently been superseded and will continue to evolve before being finalized and submitted for review by the RM of Rosser.


LEGEND:
QUARRY SITE AREA
800m BUFFER
Broda Quarry
RM of Rosser - CentrePort
Quarry Boundary
SUPERSEDED
TRUNK HIGHWAY 101
MANITOBA HYDRO
QUARRY SITE AREA
400M BUFFER
FARMER AVENUE
MOLLARD ROAD
STURGEON ROAD
000430659

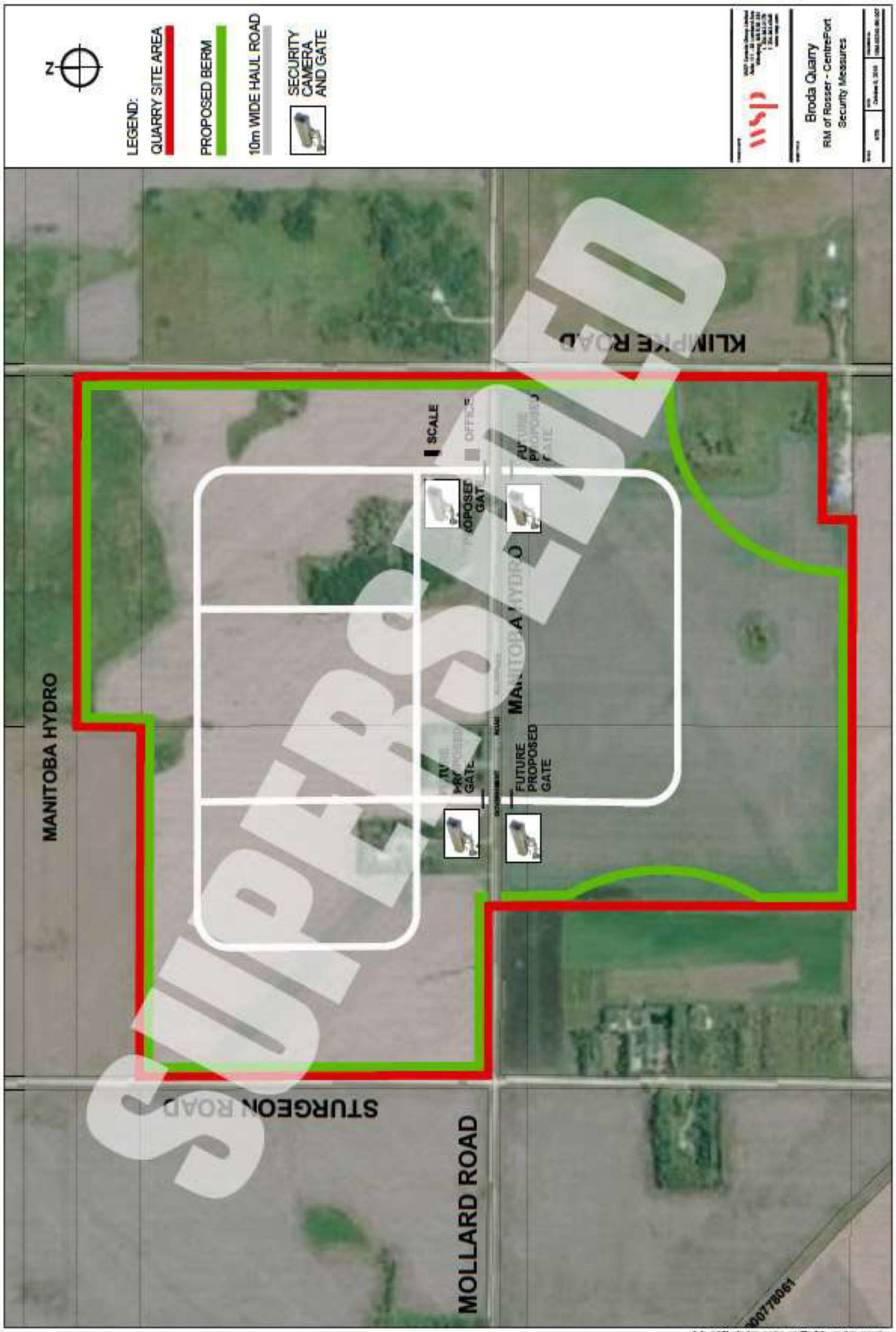

LEGEND:
QUARRY SITE AREA
Broda Quarry
RM of Rosser - CentrePort
Land Area and Excavation
KLIMPKE ROAD
MANITOBA HYDRO
STURGEON ROAD
MOLLARD ROAD
PROPOSED QUARRY AREA = 2,326,942 Sq.m
APPROXIMATE DEPTH OF EXCAVATION = ±10 m
SUPERSEDED


LEGEND:
QUARRY SITE AREA
Broda Quarry
RM of Rosser - CentrePort
Phasing
KLIMPKE ROAD
PHASE 1
PHASE 2
PHASE 3
PHASE 4
PHASE 5
MANITOBA HYDRO
STURGEON ROAD
MOLLARD ROAD
SUPERSEDED

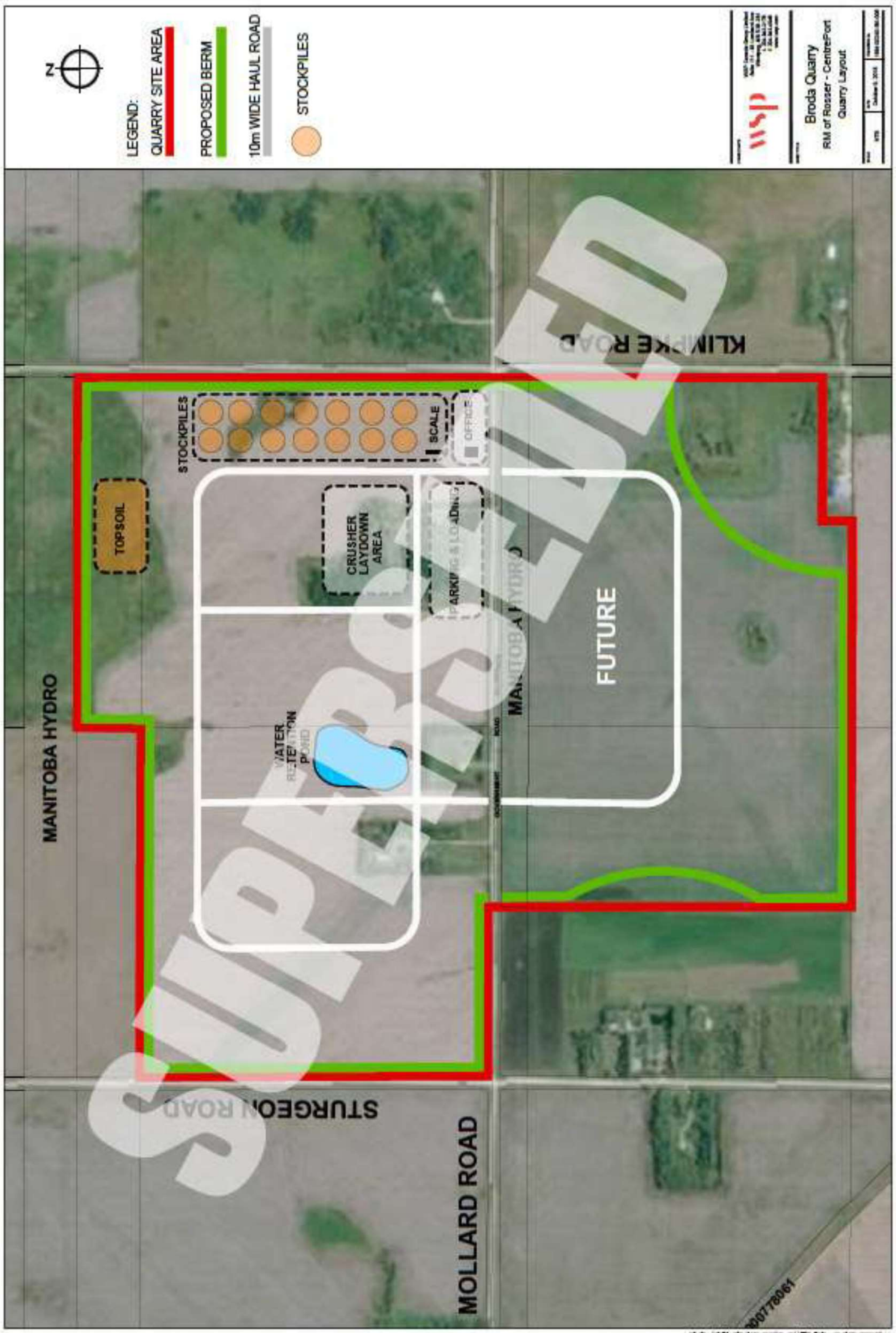

LEGEND:
QUARRY SITE AREA
REHABILITATION AREA
Broda Quarry
RM of Rosser - CentrePort
Site Rehabilitation
MANITOBA HYDRO
MOLLARD ROAD
STURGEON ROAD
SUPERSEDED


N
LEGEND:
QUARRY SITE AREA
800m BUFFER
EXIST. BUILDINGS & STRUCTURES
wsp
Broda Quarry
RM of Rosser - CentrePort
Location of Existing
Buildings & Structures
SUPERSEDED
QUARRY SITE AREA
TRUNK HIGHWAY 101
MANITOBA HYDRO
400M BUFFER
400M BUFFER
FARMER AVENUE
MOLLARD ROAD
000430659

MLi3


LEGEND:
QUARRY SITE AREA
PROPOSED BERM
10m WIDE HAUL ROAD
SECURITY CAMERA AND GATE
Broda Quarry
RM of Rosser - CentrePort
Security Measures
KLIMPKE ROAD
MANITOBA HYDRO
SCALE
FUTURE PROPOSED GATE
STURGEON ROAD
MOLLARD ROAD
SUPERSEDED

MLi3


LEGEND:
QUARRY SITE AREA
PROPOSED BERM
10m WIDE HAUL ROAD
STOCKPILES
Broda Quarry
RM of Rosser - CentrePort
Quarry Layout
STOCKPILES
SCALE
TOPSOIL
CRUSHER LAYDOWN AREA
FUTURE
MANITOBA HYDRO
STURGEON ROAD
MOLLARD ROAD
SUPERSEDED

APPENDIX B CONTINUOUS SURFACE MINER TECHNOLOGY

Wirtgen Technology and Models in Particular

See: https://www.wirtgen.de/en/technologies/application/surface-mining/surface_mining.php.

See also: https://media.wirtgen-group.com/media/02_wirtgen/media_1/media_1_06_surface_miners_2/media_1_06_surface_miners_2_00_general_information/W_brochure_Surface-Mining_0116_EN.pdf.

As the surface miner moves forward, a special cutting drum rotates against the direction of travel, cutting layers of material from the rock formations and crushing it in the process. The primary conveyor picks up the material in the drum housing and transports it towards the rear of the machine, where it is then accepted by the slewable and height-adjustable discharge conveyor. The discharge conveyor loads the material into trucks or dumpers or discharges it to the side of the miner. The discharge height can be adjusted to the height of the transport vehicles. The surface miner is driven via four steerable and height-adjustable track units. An automatic levelling system ensures precise adherence to the cutting depth, thus enabling even thin seams or layers to be mined selectively and with maximum accuracy.

Strict environmental standards in terms of noise and dust emissions make the vibration-free surface mining process attractive in comparison to drilling and blasting. The stable, precise and level surfaces produced in mining, earthworks and rock operations are suitable for immediate use as pavements, slopes or tunnel floors.

The economical exploitation of primary resources in opencast mining is becoming increasingly difficult as the mineral content of many deposits is dwindling due to difficult geological conditions. In rock construction, machines are required for precise levelling operations under restricted space conditions. Our patent remedy in both cases is mechanical exploitation by means of surface mining. Being the innovative leader in this technology, Wirtgen is passionately driving the development of this economical and environmentally gentle process, using its expertise to successfully master the even more demanding challenges lying ahead.

We not only develop innovative machines of the highest quality. With our machine technology, we also constantly endeavour to keep environmental pollution as low as possible. A WIRTGEN surface miner is a perfect example of this philosophy: it impresses with its environmentally friendly technology as it cuts, crushes and loads rock in a single operation. A tremendous advantage of selective mining is that the vibrationless mining operation without drilling and blasting is accompanied by low levels of dust and noise. The low environmental impact also permits maximum exploitation of the deposit right up to the edge of residential areas. The selective mining of high-quality materials requires considerably less space than conventional mining methods. Our fuel-efficient, intelligently controlled engines comply with the strictest exhaust emission standards.

Figure B-1. A Wirtgen 4200SM Surface Miner.

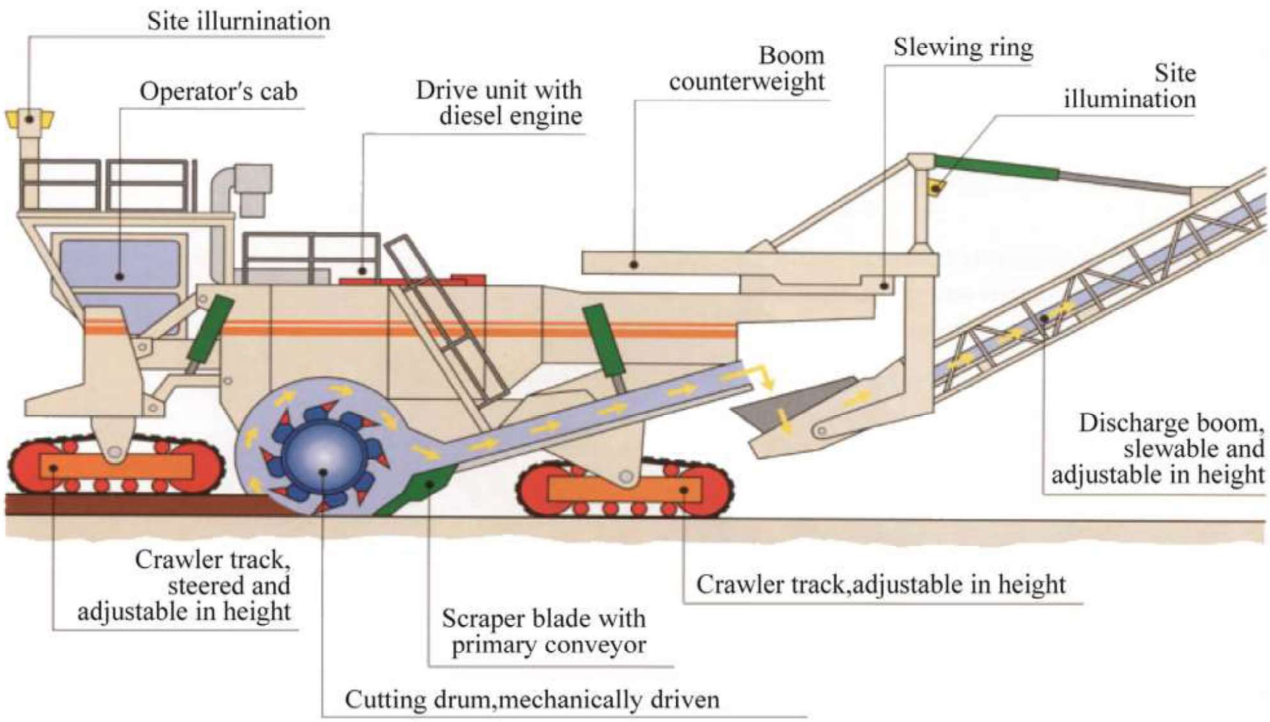


Figure B-2. A cross section of a Wirtgen surface miner in operation.

Figure B-3. A Wirtgen 4200SM Surface Miner.

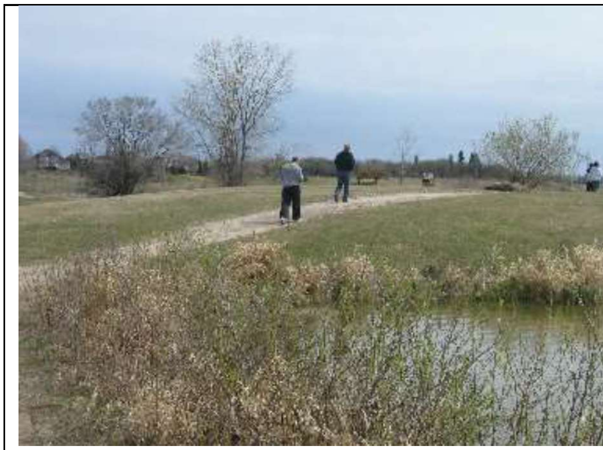
Figure B-4. A Wirtgen 4200SM Surface Miner.

Figure B-5. A Wirtgen 2500SM Surface Miner.

Figure B-6. A Wirtgen 2500SM Surface Miner.

APPENDIX C

Typical Rehabilitation of Former Quarry and other Industrial Use Lands



Typical mixed-used public park amenity created from former quarry

Storm-water retention pond created from rehabilitated quarry pit encouraging residential development

Typical mixed-use public amenity created around storm-water retention ponds developed from quarry rehabilitation

Typical hybrid poplar in “high-yield” commercial plantation developed on reclaimed quarry

Typical prairie restoration and mixed-wood tree plantation developed on rehabilitated sand and aggregate quarries

TRANSPORTATION AND HAUL ROUTE PLAN

07

NORTH PERIMETER
AGGREGATES QUARRY

BRODA PROPERTIES INC.

PROPOSED LIMESTONE QUARRY IN THE RM OF ROSSER

TRAFFIC IMPACT STUDY

SEPTEMBER 2018

CONFIDENTIAL

PROPOSED LIMESTONE QUARRY IN THE RM OF ROSSER

TRAFFIC IMPACT STUDY

BRODA PROPERTIES INC.

REPORT
CONFIDENTIAL

PROJECT NO.: 18M-00240-00
DATE: SEPTEMBER 2018

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1 INTRODUCTION

Broda Properties Inc. retained WSP Canada Group Limited (WSP) to conduct a Traffic Impact Study for a proposed aggregate development operation to be located in Section 33-11-2E and Section 4-12-2E in the Rural Municipality (RM) of Rosser in southern Manitoba. The operator of the quarry is North Perimeter Aggregates Inc., which is owned by Broda Properties Inc. The development is proposed for both north and south of Mollard Road between Klimpke Road and Sturgeon Road, as indicated in **Figure 1.1**. A Traffic Impact Study is one of the requirements for the Quarry Permit Application.

This Study outlines the proposed site plan and haul route for the proposed development and investigates the potential traffic impacts related to the proposed aggregate operation on the adjacent rural road and connecting provincial highway network. The review includes weekday a.m. and p.m. peak hour traffic analysis for opening day (2019) and opening day plus 10 years (2029), as well as gap analyses at two-way stop controlled intersections along the haul route where trucks are expected to complete a left-turn. Since the haul routes include provincial roads, this Traffic Impact study has followed the Manitoba Infrastructure *General Guidelines for the Preparation of Traffic Impact Studies* dated April 2010.

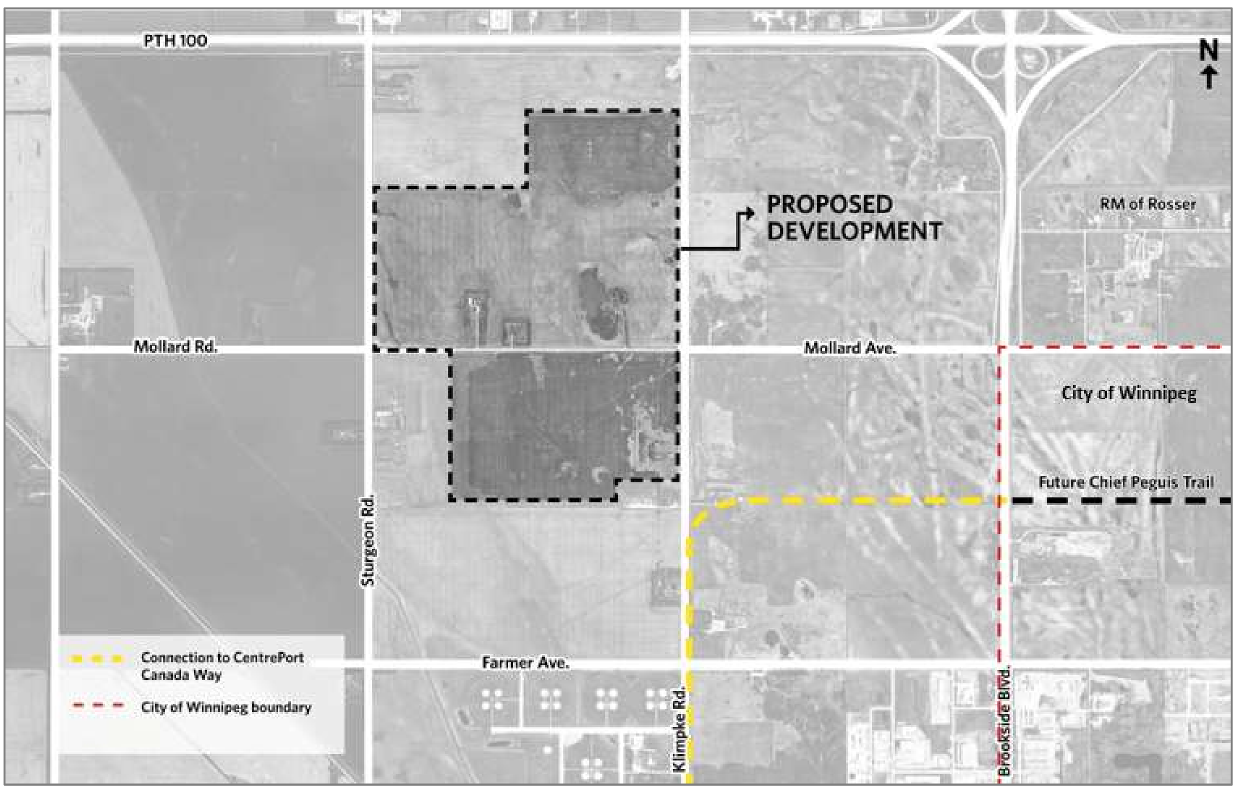

Figure 1.1: Proposed Development Location

2 PROPOSED DEVELOPMENT

2.1 AGGREGATE OPERATION

The proposed development site is located in Sections 33-11-2E and 4-12-2E in the RM of Rosser, approximately 1.6 kilometres northwest of Winnipeg, Manitoba. Land use in the vicinity of the development is rural with agricultural activities, scattered residential development and some nearby park land (Little Mountain Park) and industrial developments. The plan for the aggregate operation identifies access from Mollard Road. This access will serve as the entrance to and exit from the development for employee traffic as well as all heavy truck traffic. Mollard Road is an existing two-lane undivided gravel RM road. The anticipated site start-up date is summer 2019.

2.2 HAUL ROUTE

North Perimeter Aggregates Inc. (owned by Broda Properties Inc.) is proposing the haul route shown in **Figure 2.1** from the proposed development to Brookside Boulevard. The City of Winnipeg is the anticipated destination for the majority of material from the site.

The proposed haul route would require trucks to travel east on Mollard Road from the site access, pass through the intersection with Klimpke Road and continue to Brookside Boulevard, where they would perform either a left or right turn depending on their destination. Klimpke Road is a two-lane undivided roadway and Brookside Boulevard is a four-lane divided roadway. Mollard Road at Klimpke Road is a yield controlled intersection (i.e., yield sign controlled for southbound and westbound traffic), and Mollard Road at Brookside Boulevard is a two-way stop controlled intersection (i.e., stop sign controlled for eastbound and westbound traffic). The implications for the proposed haul route include:

- Fully loaded semi-trailers would be required to make a turning movement at a unsignalized intersection onto a high-speed divided roadway (Brookside Boulevard).
- Brookside Boulevard is the closest RTAC roadway to the development as access to PTH 101 from Sturgeon Road and Klimpke Road is planned to be closed by Manitoba Infrastructure in the near future.
- Trucks will pass by less than five existing residential homes on Mollard Road before turning onto Brookside Boulevard.
- Brookside Boulevard is classified as an RTAC Route and has been designed for heavy vehicles.
- Mollard Road is currently a gravel road. The roadway may need to be upgraded to accommodate heavy vehicles from the quarry.

2.3 STUDY AREA

The proposed haul route requires the review of the intersections of Mollard Road with Klimpke Road and Brookside Boulevard to determine traffic impacts. The traffic analysis area for this study is illustrated in **Figure 2.2**. The study area includes the following key transportation facilities:

- Mollard Road is a two-lane undivided gravel RM roadway with a speed limit of 90 kilometers per hour.
- Klimpke Road is a two-lane undivided gravel RM roadway with a speed limit of 90 kilometers per hour.
- Brookside Boulevard is a four-lane divided paved highway with paved shoulders and a speed limit of 100 kilometers per hour for northbound traffic and 90 kilometers per hour for southbound traffic at the intersection with Mollard Road.

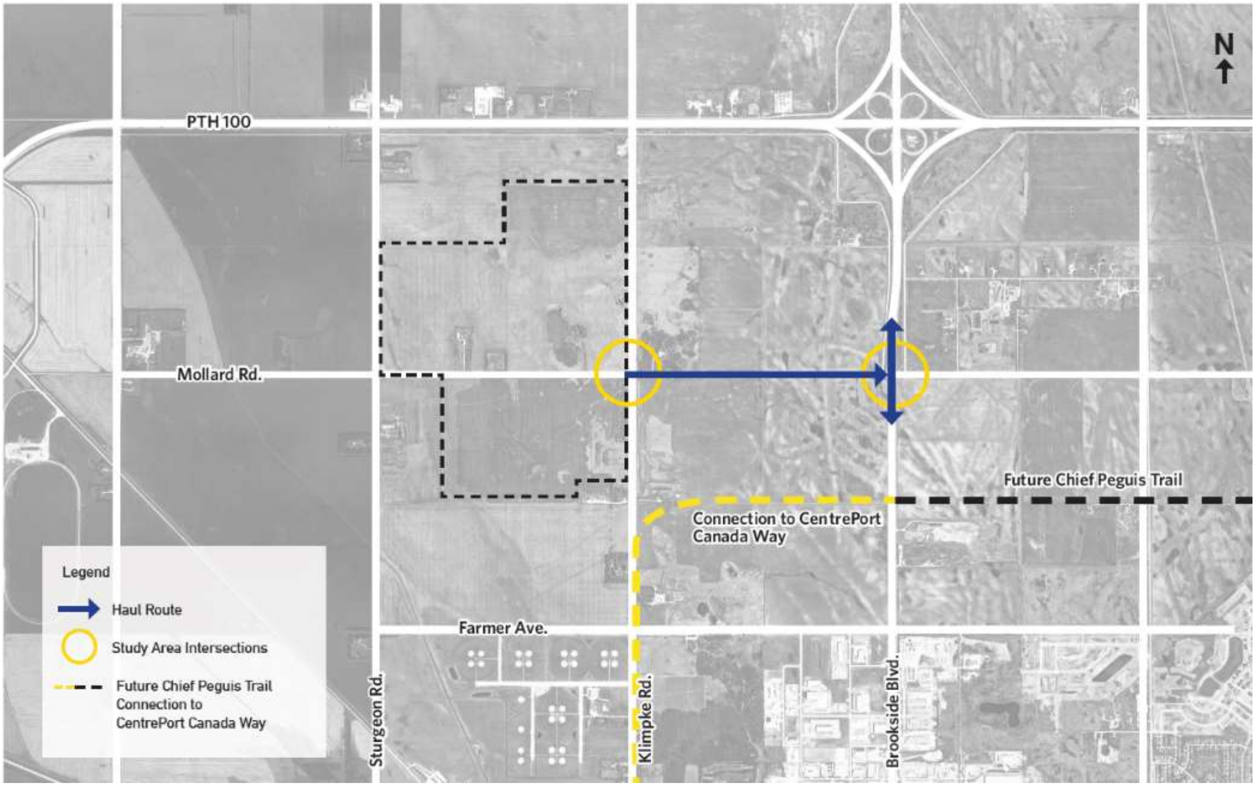

Figure 2.1: Proposed Haul Route

Figure 2.2 : Study Area

3 TRAFFIC VOLUMES

3.1 EXISTING TRAFFIC

The weekday a.m. and p.m. peak hours were selected for analysis in this study as they are generally the busiest time period for traffic on Brookside Boulevard, as it carries commuter traffic to and from Winnipeg during the week. Traffic associated with the aggregate operation varies throughout the day depending on demand, although there is usually a peak in the morning and often one in the afternoon. The morning and afternoon peak periods will therefore be the most critical in terms of traffic operations.

Current turning movement information for the two study area intersections was not available from the Manitoba Highway Traffic Information System (MHTIS) website (no counts were available for the intersections of Mollard Road with Klimpke Road and Brookside Boulevard). Traffic counts were therefore conducted by WSP at the intersection of Klimpke Road and Mollard Road and the intersection of Brookside Boulevard and Mollard Road on Thursday, April 26, 2018. Existing traffic volumes for the weekday a.m. and p.m. peak hours are illustrated in **Figure 3.1**. The numbers were rounded to the nearest five vehicles per hour. The detailed count results are included in **Appendix A**.

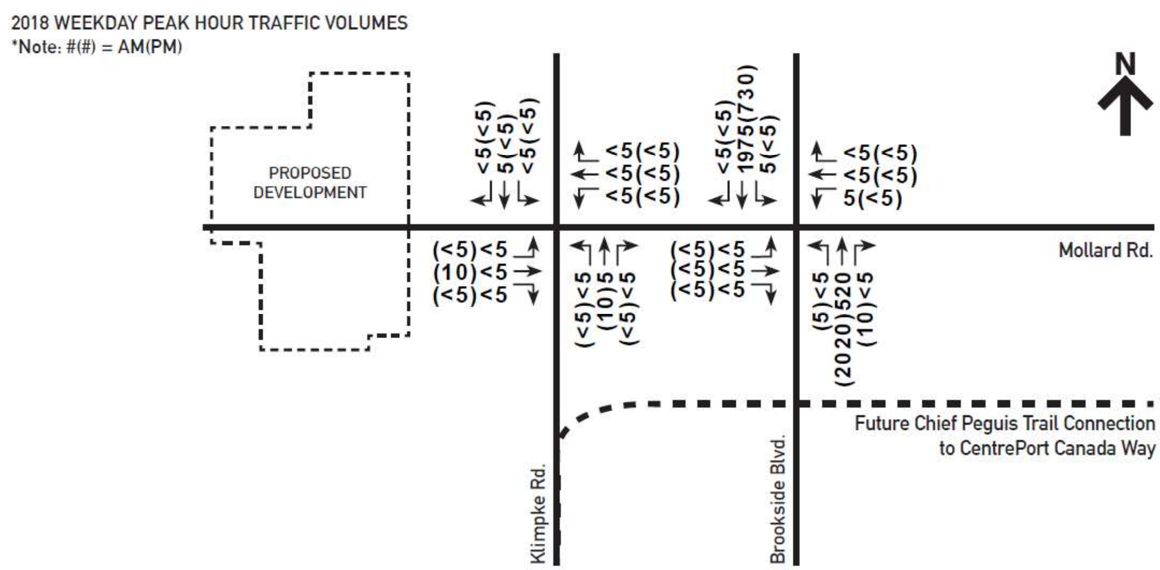

Figure 3.1: 2018 Weekday Peak Hour Traffic Volumes

3.2 BACKGROUND TRAFFIC

Background traffic refers to traffic volumes that exclude the impact of the proposed development. They are determined by projecting existing traffic volumes to the horizon years (opening day in 2019 and opening day plus ten years in 2029) and adding the impact of any other significant future infrastructure or developments in the area.

For this location, major future infrastructure includes the Chief Peguis Trail Extension from Main Street to Brookside Boulevard (CPT), and potentially its further extension to connect to Centreport Canada Way (CPT & CCW). The effects of CPT and CPT & CCW on Brookside Boulevard traffic volumes were extracted from *Chief Peguis Trail Extension West from Main Street to Brookside Boulevard Functional Design - Final Report* prepared by Morrison

Hershfield in 2016 and *Chief Peguis Trail Extension West from Main Street to Brookside Boulevard Functional Design Report* prepared by WSP in 2017. The projected 2029 Brookside Boulevard through movement volumes were adjusted based on the projected 2029 volumes of Brookside Boulevard at its intersection with CPT for each scenario independently (i.e., CPT and CPT & CCW).

3.2.1 GROWTH RATES

Based on historical traffic volumes and recent projects in the adjacent area, the annual traffic growth rate for Brookside Boulevard through movements was assumed to be two percent. Based on the potential development for the area a two percent growth rate was also assumed for all other turning movements at the intersection of Brookside Boulevard and Mollard Road and all turning movements at the intersections of Klimpke Road and Mollard Road.

3.2.2 DAILY TRAFFIC

In order to convert weekday p.m. peak hour traffic volumes into weekday daily traffic volumes a conversion factor was determined. The p.m. peak hour as a percentage of the Average Annual Daily Traffic (AADT) was calculated at a number of nearby Permanent Count Stations. The selected stations are highly influenced by commuter traffic volumes to/from Winnipeg and are therefore expected to have similar traffic variations to Brookside Boulevard. The selected routes and the associated weekday p.m. peak hour percentages are summarized in **Table 3.1**.

Table 3.1: Weekday PM Peak Hour to Daily Traffic Volumes Conversion Factors

STATION	LOCATION	PM PEAK HOUR / AADT
# 1	PTH 8, 4.1 kilometres north of PTH 101	9.3 %
# 3	PTH 9, 6.8 kilometres north of PTH 101	9.0 %
# 51	PTH 2, 1.4 kilometres south of PTH 100	8.8 %
# 20	PTH 101, 1.4 kilometres east of PTH 8	9.0 %
# 47	PTH 100, 0.8 kilometres south of PTH 1	9.9 %
# 99	PTH 190, 1.3 kilometres east of PTH 101	10.5 %
Average		**9.2 %**

Based on the data provided in **Table 3.1**, the weekday p.m. peak hour was conservatively assumed to be equal to 10 percent of the AADT. This value is typically used in urban centres for converting weekday p.m. peak hour volumes to daily volumes.

3.2.3 FORECAST BACKGROUND TRAFFIC VOLUMES

Background traffic volumes for the weekday a.m. peak hour and p.m. peak hour and weekday are illustrated in **Figures 3.2** to **3.5**.

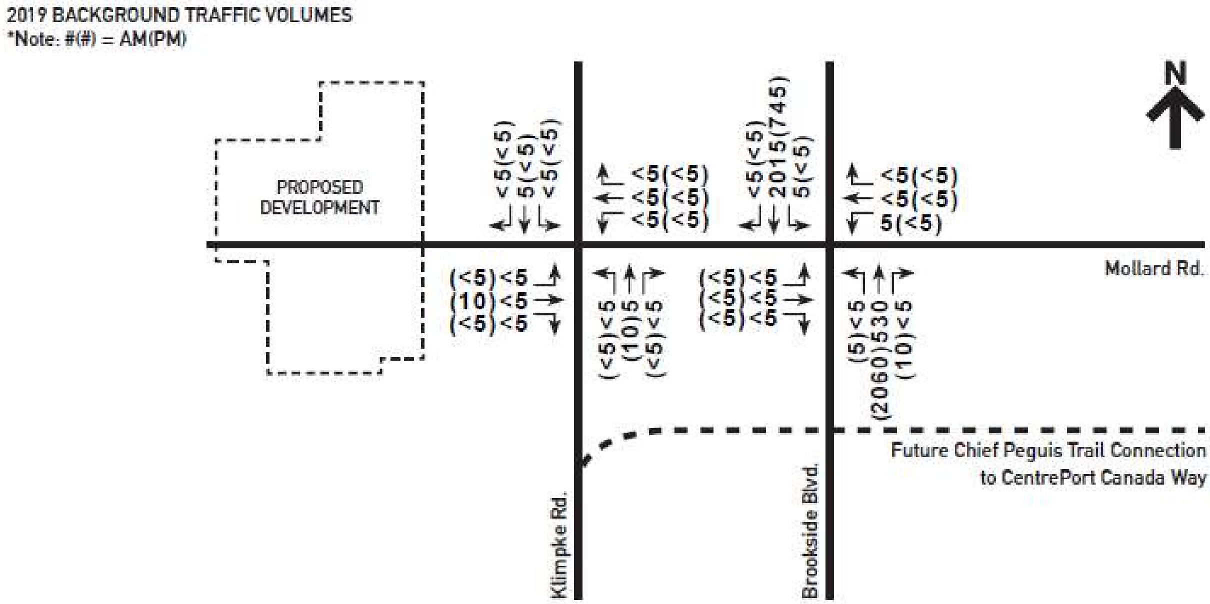

Figure 3.2: 2019 AM (PM) Peak Hour Background Traffic Volumes

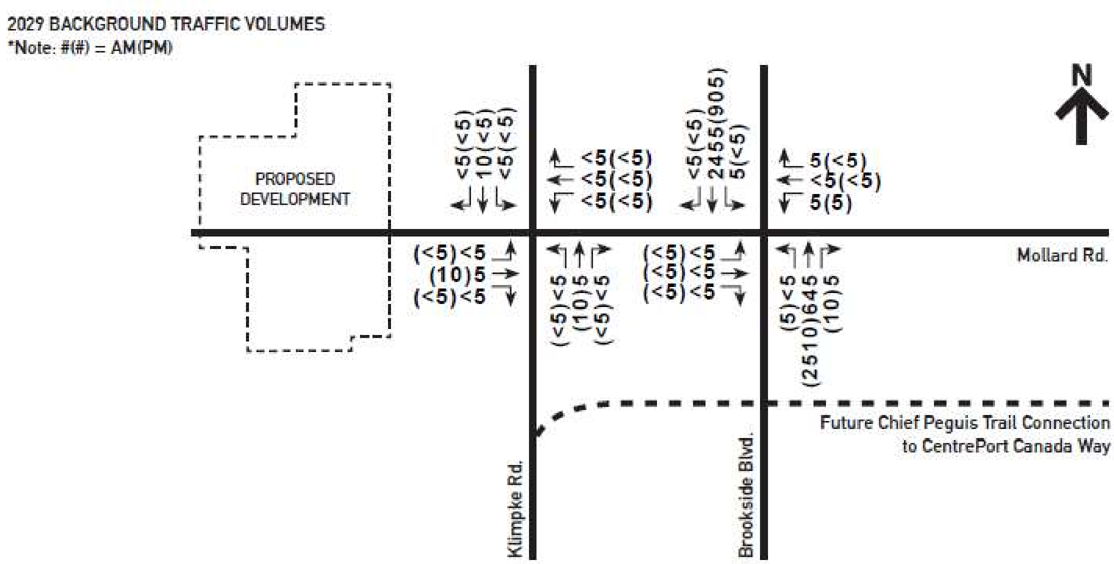

Figure 3.3: 2029 AM (PM) Peak Hour Background Traffic Volumes

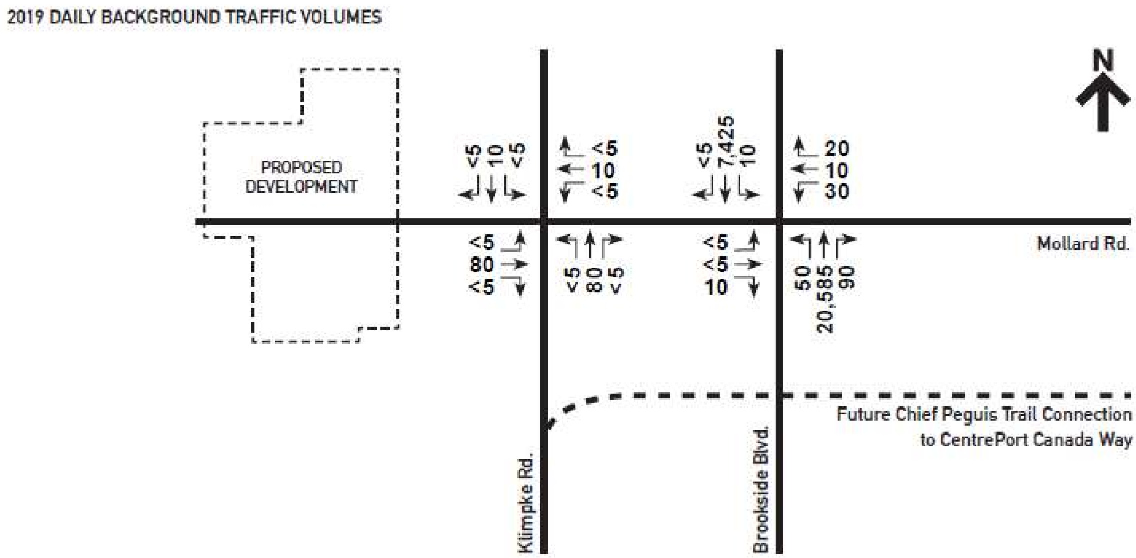

Figure 3.4: 2019 Daily Background Traffic Volumes

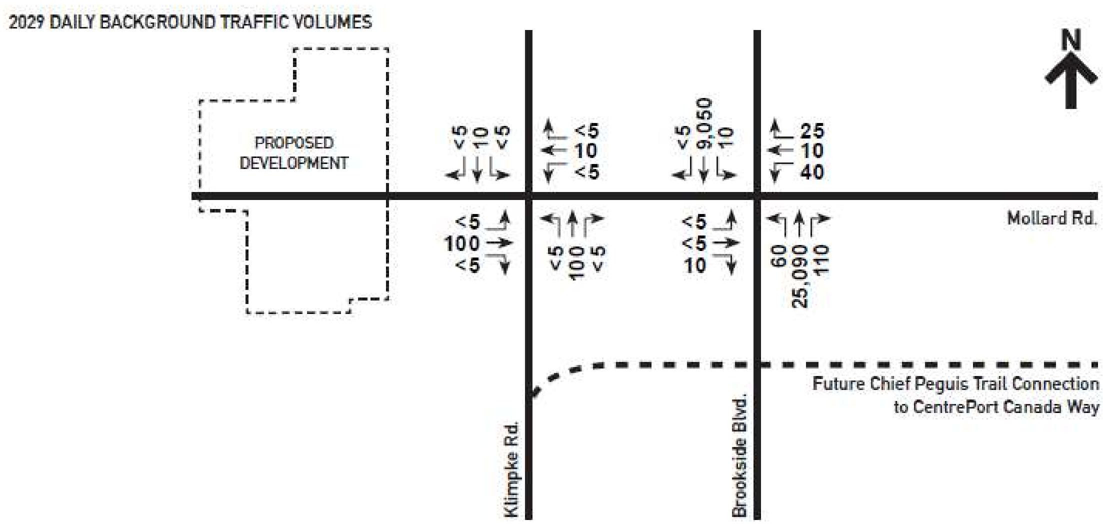

Figure 3.5: 2029 Daily Background Traffic Volumes

3.3 DEVELOPMENT TRAFFIC

3.3.1 TRIP GENERATION

North Perimeter Aggregates Inc. (owned by Broda Properties Inc.) provided WSP with an estimate of traffic activity for the proposed development based on activity at their existing sites and the projected operation of the proposed site. A summary of the forecast trip generation for the proposed development is provided in **Table 3.2.** The proposed aggregate development is forecast to generate 70 new trips (40 entering and 30 exiting) during the weekday a.m. peak hour and 70 new trips (30 entering and 40 exiting) during the weekday p.m. peak hour.

Table 3.2: Broda Quarry Development Trip Generations

TRIP GENERATION		WEEKDAY AM PEAK HOUR	WEEKDAY PM PEAK HOUR	WEEKDAY
Truck Trips	Inbound	25	25	200
	Outbound	25	25	200
	Total	50	50	400
Passenger Vehicle / Employee Trips	Inbound	15	5	30
	Outbound	5	15	30
	Total	20	20	60
Total Trips	Inbound	40	30	230
	Outbound	30	40	230
	Total	70	70	460

3.3.2 TRIP DISTRIBUTION & ASSIGNMENT

Trip distribution refers to the directional split of traffic entering and exiting the study area, and trip assignment refers to the assignment of distributed trips to the adjacent road network. Trip distribution for truck trips is based on the proposed haul route identified in **Section 2.2.** The haul route utilizes Mollard Road from the proposed development to Brookside Boulevard. Passenger vehicle trip distribution is based on a review of expected employee travel patterns and the Winnipeg Area Travel Survey (WATS). It is expected that all passenger vehicle trips will access the development via Mollard Road from Brookside Boulevard. The intersection of Brookside Boulevard and Mollard Road was assumed to have the following distribution:

— 28 percent to/from the north on Brookside Boulevard; and

— 72 percent to/from the south on Brookside Boulevard.

New trips generated by the proposed development were distributed and assigned to the road network based on the split noted above. Background traffic was combined with the additional development traffic generated, distributed and assigned to the road network to determine traffic projections for the post development scenarios. Post development traffic volumes for the weekday a.m. peak hour and p.m. peak hour with and without the CPT extension and the CPT & CCW extension are illustrated in **Figures 3.6** to **3.9**. Post development daily traffic volumes are illustrated in **Figures 3.10** and **3.11**.

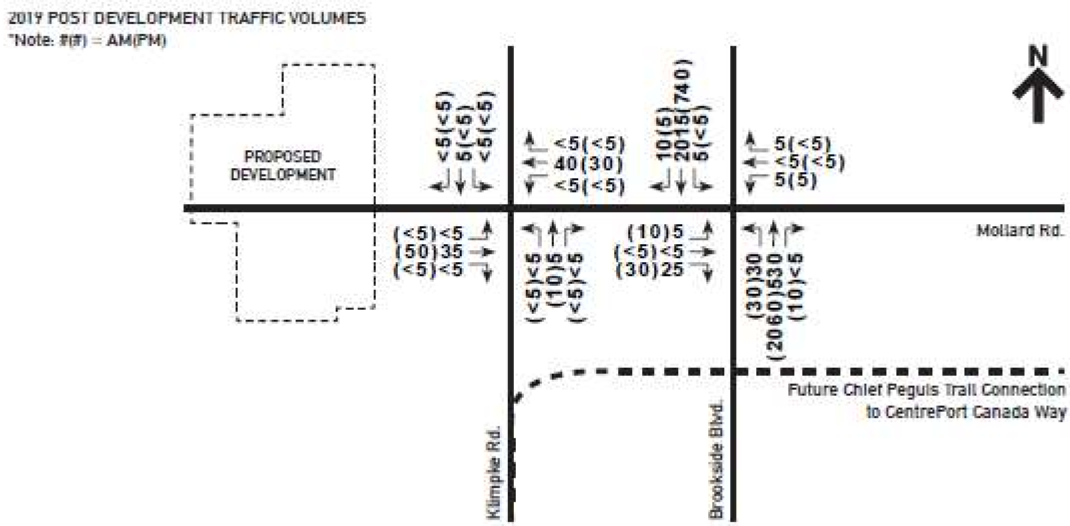

Figure 3.6: 2019 AM (PM) Peak Hour Post Development Traffic Volumes

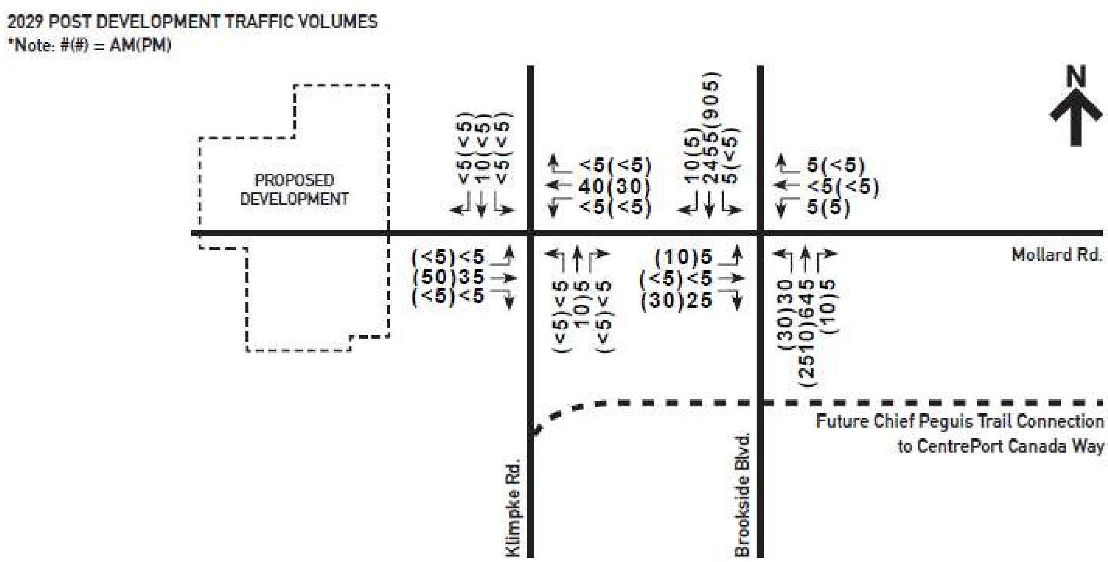

Figure 3.7: 2029 AM (PM) Peak Hour Post Development Traffic Volumes

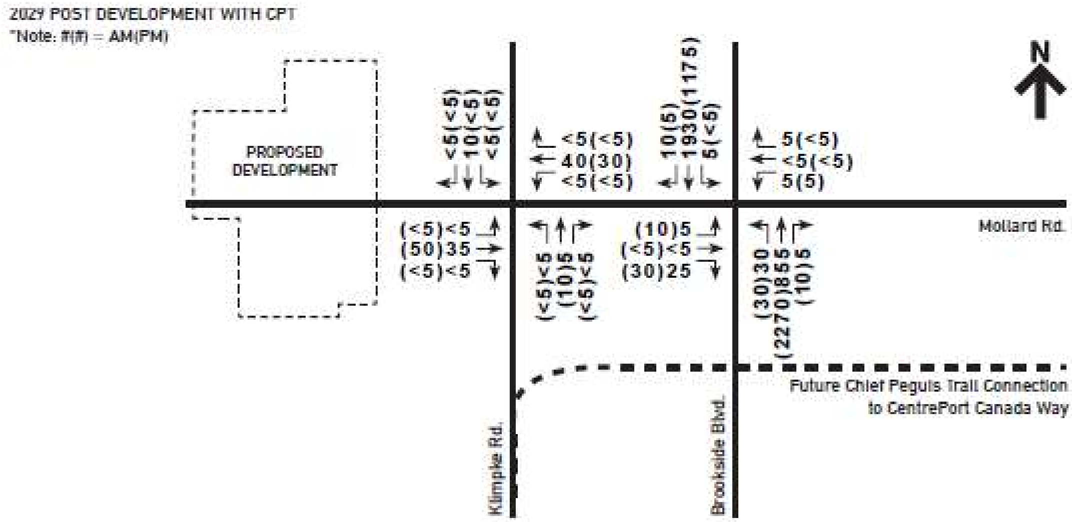

Figure 3.8: 2029 AM (PM) Peak Hour Post Development Traffic Volumes with Chief Peguis Trail (CPT)

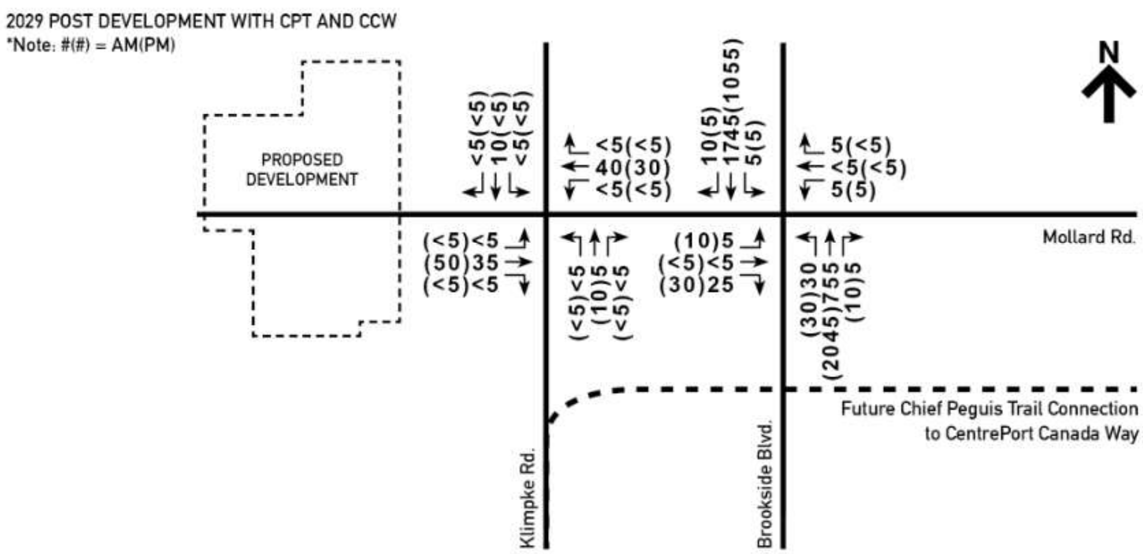

Figure 3.9: 2029 AM (PM) Peak Hour Post Development Traffic Volumes with Chief Peguis Trail Extension to the Centerport Canada Way (CPT & CCW)

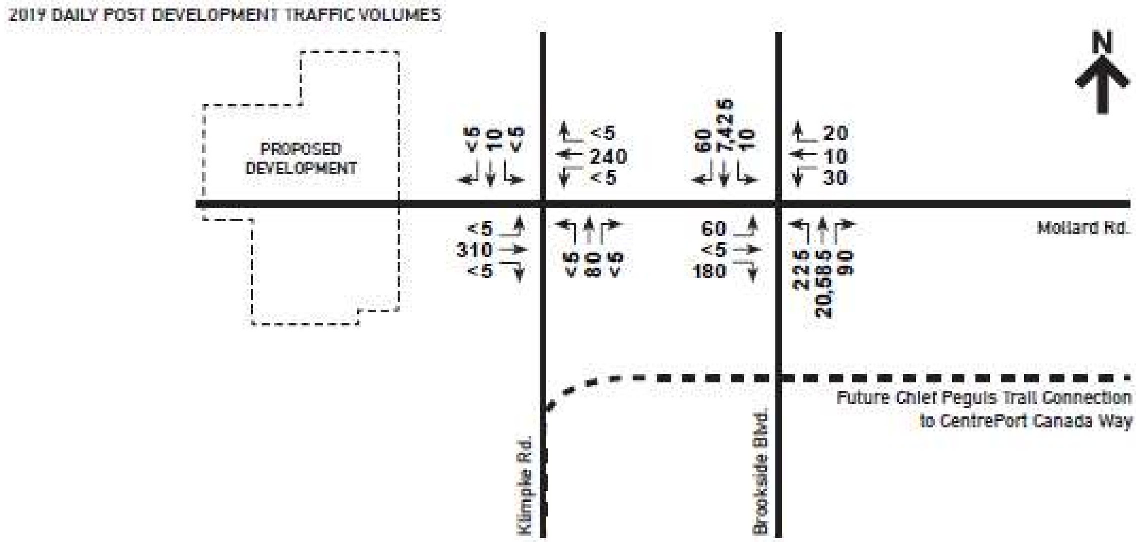

Figure 3.10: 2019 Daily Post Development Traffic Volumes

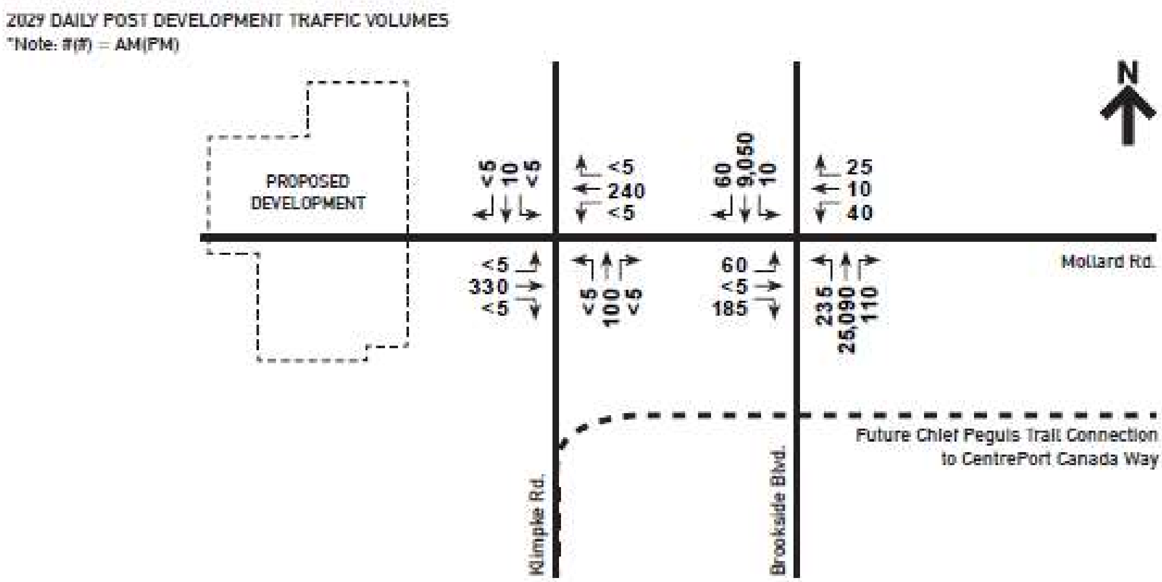

Figure 3.11: 2029 Daily Post Development Traffic Volumes

4 TRAFFIC ANALYSIS

4.1 INTERSECTION ANALYSIS

The traffic analysis for the proposed development was undertaken using Synchro Version 10 traffic analysis software. The relative performance of an intersection is measured in terms of level of service (LOS), ranging from A (excellent) to F (beyond capacity). In general, LOS E is considered to be at capacity. Level of service for signalized intersections is defined in terms of delay, which is a measure of driver discomfort and frustration, fuel consumption, and lost travel time. Delay is a complex measure and is dependent on a number of variables, including the quality of progression, cycle length, green ratio and ratio for the lane group in question.

Level of service for unsignalized intersections is also defined in terms of delay. Delay is the total elapsed time from when a vehicle stops at the end of the queue until the vehicle departs from the stop line. This includes the time required for the vehicle to travel from the last in queue position to the first.

LOS B or better for the overall intersection is widely considered desirable in a rural area during peak traffic periods. At unsignalized intersections, LOS C or better is generally considered acceptable for minor streets accessing major provincial roads and highways, with LOS B or better acceptable for through movements on the highway.

Intersection capacity utilization level of service (ICU LOS) provides additional insight into how a signalized intersection is functioning and how much extra capacity is available to handle traffic fluctuations and incidents. ICU LOS ranges from A (excellent) to H (beyond capacity), with ICU LOS E generally considered to be at practical capacity.

The volume to capacity (v/c) ratio is used to determine the level of congestion for each lane group. If the v/c ratio is greater than or equal to 1.00 that approach is operating above capacity. The detailed Synchro results are included in **Appendix B**.

4.1.1 MOLLARD ROAD AND KLIMPKE ROAD

The intersection of Mollard Road and Klimpke Road is an existing four-legged unsignalized intersection. The northbound (Klimpke Road) and eastbound (Mollard Road) approaches are free-flowing, while the westbound (Mollard Road) and southbound (Klimpke Road) approaches are yield controlled. All approaches at the intersection currently consist of a single shared left-turn/through/right-turn lane. After development there will be considerable truck traffic on Mollard Road, so it is recommended that the northbound and southbound approaches to the intersection be stop controlled. As a result, the post development analysis was performed assuming a two-way stop-controlled intersection.

Table 4.1 summarizes the results of the intersection analysis for Mollard Road and Klimpke Road.

The data provided in **Table 4.1** indicates the following:

— All post development scenarios feature minimal average delay per vehicle for the overall intersection (less than five seconds per vehicle).

— All post development scenarios feature acceptable overall intersection ICU levels of service (LOS A).

— All post development scenarios feature acceptable levels of service for the critical movement at the intersection (LOS A).

Table 4.1: Mollard Road and Klimpke Road Intersection Analysis

SCENARIO	OVERALL INTERSECTION			CRITICAL MOVEMENT	
	LOS (DELAY)	ICU LOS	MAX V/C	MOVEMENT	LOS (DELAY)
WEEKDAY AM PEAK HOUR					
2018 Existing	-	A (13%)	0.00 (N/A)	-	-
2019 Background	-	A (13%)	0.01 (N/A)	-	-
2019 Post Development (Two-Way Stop)	A (1.3 sec)	A (13%)	0.01 (NB)	NB	A (9.6 sec)
			0.01 (SB)	SB	A (9.6 sec)
2029 Background	-	A (13%)	0.01 (N/A)	-	-
2029 Post Development (Two-Way Stop)	A (1.6 sec)	A (13%)	0.01 (NB)	NB	A (9.6 sec)
			0.01 (SB)	SB	A (9.6 sec)
WEEKDAY PM PEAK HOUR					
2018 Existing	-	A (13%)	0.00 (N/A)	-	-
2019 Background	-	A (13%)	0.01 (N/A)	-	-
2019 Post Development (Two-Way Stop)	A (1 sec)	A (13%)	0.01 (NB)	NB	A (9.6 sec)
			0.01 (SB)	SB	A (9.6 sec)
2029 Background	-	A (13%)	0.01 (N/A)	-	-
2029 Post Development (Two-Way Stop)	A (1.2 sec)	A (13%)	0.01 (NB)	NB	A (9.6 sec)
			0.01 (SB)	SB	A (9.6 sec)

4.1.2 MOLLARD ROAD AND BROOKSIDE BOULEVARD

The intersection of Mollard Road and Brookside Boulevard is a four-legged unsignalized intersection. The northbound and southbound approaches on Brookside Boulevard are free-flowing while eastbound and westbound traffic on Mollard Road approach stop signs at the intersection with Brookside Boulevard. The eastbound and westbound approaches on Mollard Road consist of a single shared left-turn/through/right-turn lane, while the northbound and southbound approaches on Brookside Boulevard consist of a shared left-turn/through lane and a shared through/right-turn lane.

Table 4.2 summarizes the results of the intersection analysis for Mollard Road and Brookside Boulevard.

The data provided in **Table 4.2** indicates the following:

- All post development scenarios feature acceptable levels of service and average delay per vehicle for the overall intersection (six seconds or less per vehicle).
- In five of eight post development scenarios the intersection is forecast to operate at practical capacity ICU levels of service (ICU LOS E to F).
- The critical eastbound or westbound movement is forecast to operate at LOS E or F in all post development scenarios.

Table 4.2: Mollard Road and Brookside Boulevard Intersection Analysis

SCENARIO	OVERALL INTERSECTION			CRITICAL MOVEMENT	
	LOS (DELAY)	ICU LOS	MAX V/C	MOVEMENT	LOS (DELAY)
WEEKDAY AM PEAK HOUR					
2018 Existing	A (0.2 sec)	C (69%)	0.58 (SB)	**EB**	**E (38.8 sec)**
2019 Background	A (0.2 sec)	C (71%)	0.60 (SB)	**EB**	**E (40.6 sec)**
2019 Post Development	A (1.4 sec)	C (70%)	0.60 (SB)	**EB**	**F (50.9 sec)**
2029 Background	A (0.4 sec)	E (84%)	0.85 (SB)	**EB**	**F (103.9 sec)**
2029 Post Development	A (5.7 sec)	**E (83%)**	**0.93 (EB)**	**EB**	**F (> 200 sec)**
2029 Post Development with CPT	A (1.4 sec)	C (69%)	0.57 (SB)	EB	E (46.6 sec)
2029 Post Development with CPT +CCW	A (1.2 sec)	B (63%)	0.52 (SB)	EB	E (36.1 sec)
WEEKDAY PM PEAK HOUR					
2018 Existing	A (0.2 sec)	C (70%)	0.60 (NB)	**WB**	**F (57.3 sec)**
2019 Background	A (0.2 sec)	C (71%)	0.61 (SB)	**WB**	**F (60.4 sec)**
2019 Post Development	A (0.8 sec)	**E (87%)**	0.61 (NB)	**WB**	**F (66.3 sec)**
2029 Background	A (0.3 sec)	C (72%)	0.61 (NB)	**WB**	**F (67.0 sec)**
2029 Post Development	A (1.3 sec)	**G (100%)**	0.74 (NB)	**WB**	**F (146.3 sec)**
2029 Post Development with CPT	A (1.3 sec)	**F (94%)**	0.67 (NB)	**WB**	**F (104.8 sec)**
2029 Post Development with CPT +CCW	A (1.0 sec)	**E (87%)**	0.61 (NB)	**WB**	**F (74.7 sec)**

4.2 GAP STUDY

A gap study measures the number of gaps in a vehicle stream (seconds between vehicles) that are suitably long enough to allow left-turning vehicles to complete their manoeuvre. In order to determine the number of gaps that are suitably long enough, the critical headway and follow-up headway must be defined.

The critical headway is defined in the *Highway Capacity Manual 2010* as "the minimum time interval in the major-street traffic stream that allows intersection entry for one minor-street vehicle". A critical headway of 10 seconds was assumed as the minimum time required for a typical fully-loaded semi-trailer to accelerate from rest, complete a left-turn manoeuvre, and begin travelling in the traffic stream. The *Highway Capacity Manual 2010* defines follow-up headway as "the time between the departure of one vehicle from the minor-street and the departure of the next vehicle using the same major-street headway, under a condition of continuous queuing on the minor-street." A follow-up headway of 7.5 seconds was assumed for subsequent vehicles making the same turning manoeuvre in the same gap. These times were selected based on a review of gap acceptance studies and previous work completed by WSP (formerly MMM Group Limited and ND Lea)[1].

[1]SOURCES:
INLAND AGGREGATES PROPOSED LIMESTONE QUARRY IN THE RM OF ROSSER TRAFFIC IMPACT STUDY, MMM GROUP LIMITED, 2011

Gap studies were conducted on April 26, 2018 for the left-turn and right-turn manoeuvres from eastbound Mollard Road onto northbound and southbound Brookside Boulevard, respectively, and for the left-turn manoeuvre from northbound Brookside Boulevard onto westbound Mollard Road. Gaps in the traffic stream were recorded in 15-minute intervals and in 0.5 second bins during peak periods (7:00 a.m. to 9:00 a.m. and 4:00 p.m. to 5:00 p.m.). The complete set of data for the gap study can be found in **Appendix C**.

At the intersection of Brookside Boulevard and Mollard Road, the gap study results indicate that during the weekday a.m. peak hour (7:00 a.m. to 8:00 a.m.) the number of available gaps for truck turning manoeuvres are as follows:

- Left turns from eastbound Mollard Road onto northbound Brookside Boulevard: 6 trucks;
- Right turns from eastbound Mollard Road onto southbound Brookside Boulevard: 23 trucks; and
- Left turns from northbound Brookside Boulevard onto westbound Mollard Road: 23 trucks.

The estimated truck turning movements in the weekday a.m. peak hour in 2019 after development are as follows:

- Left turns from eastbound Mollard Road onto northbound Brookside Boulevard: 6 trucks;
- Right turns from eastbound Mollard Road onto southbound Brookside Boulevard: 19 trucks; and
- Left turns from northbound Brookside Boulevard onto westbound Mollard Road: 19 trucks.

There is sufficient capacity at the intersection to accommodate the forecast truck turning movements in 2019 with the aggregate development in operation.

During the weekday p.m. peak hour (4:00 p.m. to 5:00 p.m.), the number of available gaps for truck turning manoeuvres at the intersection of Brookside Boulevard and Mollard Road are as follows:

- Left turns from eastbound Mollard Road onto northbound Brookside Boulevard: 6 trucks;
- Right turns from eastbound Mollard Road onto southbound Brookside Boulevard: 141 trucks; and
- Left turns from northbound Brookside Boulevard onto westbound Mollard Road: 141 trucks.

The estimated truck turning movements in the weekday p.m. peak hour in 2019 after development are as follows:

- Left turns from eastbound Mollard Road onto northbound Brookside Boulevard: 6 trucks;
- Right turns from eastbound Mollard Road onto southbound Brookside Boulevard: 19 trucks; and
- Left turns from northbound Brookside Boulevard onto westbound Mollard Road: 20 trucks.

There is sufficient capacity at the intersection to accommodate the forecast truck turning movements in 2019 with the aggregate development in operation.

It should be noted that there are additional passenger car turning movements at the intersection which need a considerably shorter gap than a fully loaded semi-trailer truck to complete turning movements. Considering the existing extra gaps and the fact that Brookside Boulevard is a divided highway with a large median, it is expected that right turning passenger cars from Mollard Road onto southbound Brookside Boulevard and left turning passenger cars from northbound Brookside Boulevard onto westbound Mollard Road will have sufficient gaps to complete their turning movements. It is also anticipated that left turns from eastbound Mollard Road onto northbound Brookside Boulevard will face minor delays during the weekday p.m. peak hour, which is acceptable for turning vehicles from a minor road onto a major road. Additionally, these turning vehicles will be able to use the wide median on Brookside Boulevard to complete their turning movement in two stages.

SOURCES:
HIGHWAY CAPACITY MANUAL 2010, TRANSPORTATION RESEARCH BOARD, 2010
A FURTHER INVESTIGATION ON CRITICAL GAP AND FOLLOW-UP TIME, Z. TIAN, R. TROUTBECK, M. KYTE, W. BRILON, M VANDEHAY, W KITTELSON, B ROBINSON, 2000
POPLAR BLUFF INDUSTRIAL PARK TRAFFIC IMPACT STUDY, ND LEA, 2003

4.3 COLLISION ANALYSIS

Collision data analysis involves a review of the collision history of a facility through an assessment of multiple years of collision statistics to establish collision rates and to identify possible relationships between the collisions that have occurred and the geometric features and operational conditions of the facility.

Collision data was provided by the City of Winnipeg and Manitoba Public Insurance (MPI). The City of Winnipeg data includes a summary of the number and severity of reported collisions over four years between 2012 and 2016 for the intersection of Brookside Boulevard and Mollard Road. According to the data provided by the City of Winnipeg, there were only two collisions at this intersection during this period; one fatality and one property damage collision.

MPI provided data for a ten-year period between 2008 and 2017 for the intersections of Mollard Road with Brookside Boulevard and Klimpke Road; however, the data provided did not include any information regarding the severity of the collisions. According to the data provided by MPI, nine collisions were reported at the intersection of Brookside Boulevard and Mollard Road between 2008 and 2017. No collisions were reported for the intersection of Klimpke Road and Mollard Road and no collision data was provided for the segment of Mollard Road between Klimpke Road and Brookside Boulevard. The intersection collision analysis was performed using the MPI data as it includes more years of data.

As mentioned in **Section 3.1**, turning movement counts were conducted at the intersection of Klimpke Road and Mollard Road and the intersection of Brookside Boulevard and Mollard Road during the a.m. and p.m. peak periods in April 2018. The turning movement counts at Brookside Boulevard and Mollard Road were used to estimate the average daily traffic entering the intersection for the collision rate analysis.

4.3.1 LINK COLLISION ANALYSIS

Collision rates are a measure of risk faced by the road user and are measured as the number of collisions per million vehicle-kilometers of travel (MVKT) on a roadway section during the analysis period. The Province of Manitoba considers a road segment with a collision rate exceeding 1.5 collisions per MVKT as a location warranting further safety review. There is no record of collision data on the segment of Mollard Road between Klimpke Road and Brookside Boulevard to enable a link collision analysis.

4.3.2 INTERSECTION COLLISION REVIEW

Table 4.3 summarizes the number of collisions between 2008 and 2017 at the Brookside Boulevard and Mollard Road intersection. There were nine reported collisions at this intersection, which corresponds to an average of 0.9 collisions per year.

Table 4.3: Collision Summary

YEAR	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	TOTAL	AVERAGE DAILY ENTERING VEHICLES	COLLISION RATE
Collision Frequency	1	1	0	1	1	0	1	2	0	2	**9**	**27,680**	**0.1**

Intersection collision rates are measured as the number of collisions per million entering vehicles (MEV) at an intersection during the analysis period. To calculate the average daily entering vehicles at the intersection, p.m. peak hour volumes were conservatively assumed to be equal to 10 percent of the average daily traffic.

The Province of Manitoba considers an intersection with a collision rate exceeding 1.5 collisions per MEV as a location warranting further safety review. Based on the average daily entering vehicles and the collisions reported between 2008 and 2017, the intersection of Brookside Boulevard and Mollard Road had a collision rate of 0.1 collisions per MEV, well below the Provincial guideline.

4.4 TRAFFIC SIGNAL WARRANT ANALYSIS

Traffic signal warrants were completed for the Mollard Road and Brookside Boulevard intersection following the *Canadian Matrix Traffic Signal Warrant Analysis* developed by the Transportation Association of Canada. Traffic signal warrant analysis is not required for the intersection of Mollard Road and Klimpke Road due to the low traffic volumes. Forecast 2019 (opening day) and 2029 (full build-out plus ten years) traffic volumes with and without the proposed development were used for the signal warrant analysis. The warrant is based on a review of the top six peak hour turning movements, the distance to upstream traffic signals, median width, and other local characteristics.

The duration of the Miovison Camera count at the intersection of Brookside Boulevard and Mollard Road was from 7:00 to 9:00 a.m. and from 3:30 to 6:30 p.m. The top four peak hours during the count were 4:00 to 5:00 p.m., 7:00 to 8:00 a.m., 5:00 to 6:00 p.m., and 8:00 to 9:00 a.m.. The method described below was used to estimate the two remaining peak hours in order to complete the signal warrant analysis.

In November 2017, WSP conducted a Miovision Camera traffic count from 8:00 a.m. to 10:00 p.m. at the intersection of Brookside Boulevard and Farmer Road, which is located approximately 1.6 kilometres directly south of the intersection of Brookside Boulevard and Mollard Road. There are only a few minor approaches on Brookside Boulevard between Farmer Road and Mollard Road, and the hourly distribution of traffic at both intersections follows similar trends (**Figure 4.1**). It was therefore assumed that the remaining two peak hours at the Mollard Road and Brookside Boulevard intersection occurred from 2:00 to 3:00 p.m. and from 3:00 to 4:00 p.m., similar to the Farmer Road and Brookside Boulevard intersection. It was also assumed at both intersections that the ratio of the traffic volumes during these time periods to the p.m. peak hour traffic volume are equal (equation 4.1), which allowed the additional traffic volumes to be estimated.

$$\frac{V_{(2:00-\ 3:00\ \text{pm},\ \ \text{Mollard \& Brookside})}}{V_{(PM\ Peak,\ \ \text{Mollard \& Brookside})}} = \frac{V_{(2:00-\ 3:00\ \text{pm},\ \ \text{Farmer \& Brookside})}}{V_{(PM\ Peak,\ \ \text{Farmer \& Brookside})}}$$

Equation 4-1

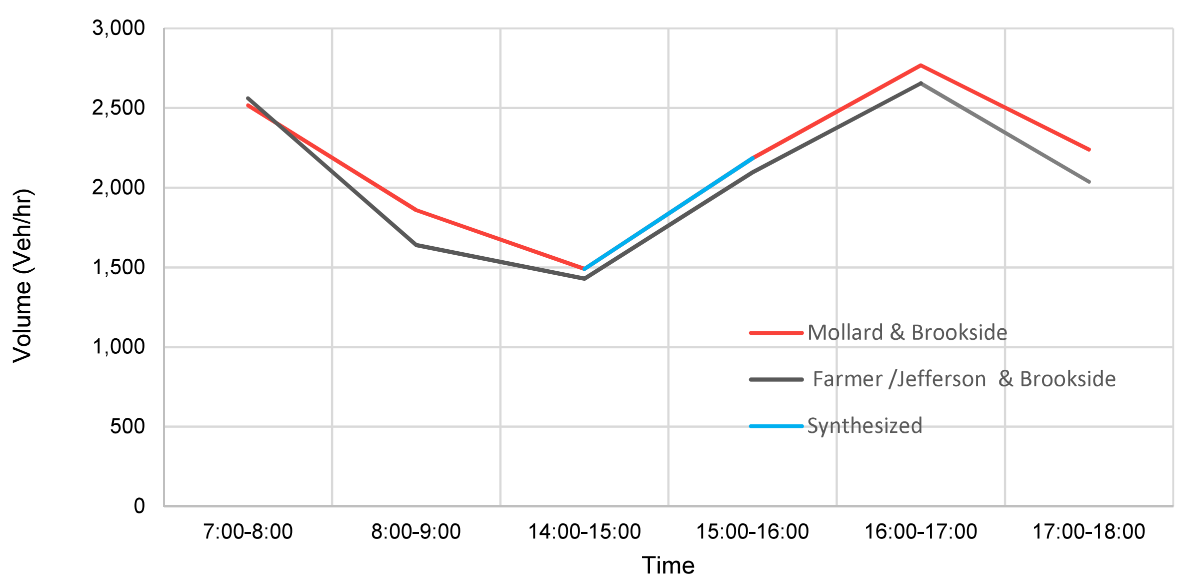

Figure 4.1. Peak Hourly Traffic at Brookside Boulevard Intersections with Farmer Road and Mollard Road

After estimating the top six peak hour volumes for the background traffic, these volumes were used to calculate the projected 2019 and 2029 background and post development volumes without CPT and CPT & CCW. The traffic signal warrant analysis is included in **Appendix D**.

MI's guideline for the consideration of traffic signals on provincial roadways is when an intersection exceeds 50 priority points and the average six-hour cross-street traffic volume is greater than 75 vehicles per hour. **Table 4.4** summarizes the traffic signal warrant results for the 2018 background and 2019 and 2029 background and post development scenarios.

The results of the analysis indicate that traffic signals are not warranted at the intersection of Brookside Boulevard and Mollard Road based on the forecast 2019 and 2029 post development traffic volumes.

Table 4.4: Traffic Signal Warrant Analysis

INTERSECTION	SCENARIO	WARRANT PRIORITY POINT	VS > 75?	SIGNAL WARRANTED
Brookside Blvd. & Mollard Rd.	2018 Background	6	No	No
	2019 Background	7	No	No
	2019 Post Development	35	No	No
	2029 Background	11	No	No
	2029 Post Development without CPT and CPT & CCW	48	No	No

** Vs – Average cross-street volume per hour during average six-hour peak period*

5 CONCLUSIONS AND RECOMMENDATIONS

The following conclusions and recommendations are made for the proposed aggregate extraction operation based on the results of the analysis:

1. North Perimeter Aggregates Inc. (owned by Broda Properties Inc.) propose to use Mollard Road and Brookside Boulevard as their haul route for their proposed development.
2. The proposed aggregate extraction operation is forecast to generate:
   - 70 new truck trips (40 entering and 30 exiting) and 20 new passenger vehicles trips (15 entering and five exiting) during the weekday a.m. peak hour;
   - 70 new truck trips (30 entering and 40 exiting) and 20 passenger vehicle trips (five entering and 15 exiting) during the weekday p.m. peak hour; and
   - 460 new truck trips (230 entering and 230 exiting) and 60 new passenger vehicle trips (30 entering and 30 exiting during a weekday).
3. An analysis of collision data and collision rates in the study area did not identify any significant concerns.
4. It is recommended that the intersection of Mollard Road and Klimpke Road be converted to a two-way stop-controlled intersection, with the northbound and southbound approaches to the intersection stop controlled. With the revised configuration, Synchro analysis indicates that the intersection is forecast to operate at an acceptable level of service with the proposed development.
5. Synchro analysis indicates that the intersection of Mollard Road and Brookside Boulevard is forecast to operate at an acceptable level of service with the proposed development. Signal warrant analysis does not show a need for traffic signal and the gap study confirmed that there are sufficient gaps to accommodate the forecast turning movements.

APPENDIX

A

TRAFFIC VOLUMES

Study Name Mollard and Klimpke
Start Date Thursday, April 26, 2018 7:00 AM
End Date Thursday, April 26, 2018 6:45 PM
Site Code

Report Summary

		Southbound						Westbound						Northbound						Eastbound						
Time Period	**Class.**	**R**	**T**	**L**	**U**	**I**	**O**	**R**	**T**	**L**	**U**	**I**	**O**	**R**	**T**	**L**	**U**	**I**	**O**	**R**	**T**	**L**	**U**	**I**	**O**	**Total**
Peak 1	Lights	0	7	0	0	7	3	0	2	1	0	3	3	0	3	0	0	3	8	0	3	0	0	3	2	16
Specified Period	%	0%	100%	0%	0%	100%	75%	0%	100%	100%	0%	100%	100%	0%	75%	0%	0%	75%	100%	0%	100%	0%	0%	100%	100%	94%
7:00 AM - 9:15 AM	Mediums	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1
One Hour Peak	%	0%	0%	0%	0%	0%	25%	0%	0%	0%	0%	0%	0%	0%	25%	0%	0%	25%	0%	0%	0%	0%	0%	0%	0%	6%
7:45 AM - 8:45 AM	ticulated Truc	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Total	**0**	**7**	**0**	**0**	**7**	**4**	**0**	**2**	**1**	**0**	**3**	**3**	**0**	**4**	**0**	**0**	**4**	**8**	**0**	**3**	**0**	**0**	**3**	**2**	**17**
	PHF	0	0.58	0	0	0.58	0.5	0	0.5	0.25	0	0.38	0.38	0	0.5	0	0	0.5	0.5	0	0.38	0	0	0.38	0.5	0.71
	Approach %					41%	24%					18%	18%					24%	47%					18%	12%	
Peak 2	Lights	0	3	0	0	3	9	2	4	0	0	6	1	0	7	0	0	7	3	0	1	0	0	1	4	17
Specified Period	%	0%	100%	0%	0%	100%	90%	100%	100%	0%	0%	100%	100%	0%	88%	0%	0%	88%	100%	0%	100%	0%	0%	100%	100%	94%
3:30 PM - 6:45 PM	Mediums	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1
One Hour Peak	%	0%	0%	0%	0%	0%	10%	0%	0%	0%	0%	0%	0%	0%	13%	0%	0%	13%	0%	0%	0%	0%	0%	0%	0%	6%
3:45 PM - 4:45 PM	ticulated Truc	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Total	**0**	**3**	**0**	**0**	**3**	**10**	**2**	**4**	**0**	**0**	**6**	**1**	**0**	**8**	**0**	**0**	**8**	**3**	**0**	**1**	**0**	**0**	**1**	**4**	**18**
	PHF	0	0.75	0	0	0.75	0.42	0.25	0.5	0	0	0.75	0.25	0	0.5	0	0	0.5	0.75	0	0.25	0	0	0.25	0.5	0.56
	Approach %					17%	56%					33%	6%					44%	17%					6%	22%	

Study Name Mollard and Brookside
Start Date Thursday, April 26, 2018 7:00 AM
End Date Thursday, April 26, 2018 6:30 PM
Site Code

Report Summary

		Southbound						Westbound						Northbound						Eastbound						
Time Period	Class.	R	T	L	U	I	O	R	T	L	U	I	O	R	T	L	U	I	O	R	T	L	U	I	O	Total
Peak 1	Lights	1	1891	4	1	1897	400	2	0	4	0	6	9	3	397	0	0	400	1896	1	2	0	0	3	1	2306
Specified Period	%	100%	96%	80%	100%	96%	76%	67%	0%	100%	0%	86%	90%	100%	76%	0%	0%	76%	96%	100%	100%	0%	0%	100%	100%	92%
7:00 AM - 9:15 AM	Mediums	0	48	1	0	49	60	1	0	0	0	1	1	0	59	0	0	59	48	0	0	0	0	0	0	109
One Hour Peak	%	0%	2%	20%	0%	2%	11%	33%	0%	0%	0%	14%	10%	0%	11%	0%	0%	11%	2%	0%	0%	0%	0%	0%	0%	4%
7:00 AM - 8:00 AM	ticulated Truc	0	37	0	0	37	64	0	0	0	0	0	0	0	64	0	0	64	37	0	0	0	0	0	0	101
	%	0%	2%	0%	0%	2%	12%	0%	0%	0%	0%	0%	0%	0%	12%	0%	0%	12%	2%	0%	0%	0%	0%	0%	0%	4%
	Total	**1**	**1976**	**5**	**1**	**1983**	**524**	**3**	**0**	**4**	**0**	**7**	**10**	**3**	**520**	**0**	**0**	**523**	**1981**	**1**	**2**	**0**	**0**	**3**	**1**	**2516**
	PHF	0.25	0.85	0.62	0.25	0.85	0.85	0.75	0	0.33	0	0.44	0.5	0.75	0.85	0	0	0.85	0.86	0.25	0.25	0	0	0.38	0.25	0.86
	Approach %					79%	21%					0%	0%					21%	79%					0%	0%	
Peak 2	Lights	0	625	1	0	626	1953	1	1	3	0	5	10	9	1952	4	1	1966	630	1	0	0	0	1	5	2598
Specified Period	%	0%	86%	100%	0%	86%	97%	50%	100%	100%	0%	83%	100%	100%	97%	100%	100%	97%	86%	100%	0%	0%	0%	100%	100%	94%
3:30 PM - 6:30 PM	Mediums	0	46	0	0	46	31	1	0	0	0	1	0	0	30	0	0	30	46	0	0	0	0	0	0	77
One Hour Peak	%	0%	6%	0%	0%	6%	2%	50%	0%	0%	0%	17%	0%	0%	1%	0%	0%	1%	6%	0%	0%	0%	0%	0%	0%	3%
4:00 PM - 5:00 PM	ticulated Truc	0	57	0	0	57	36	0	0	0	0	0	0	0	36	0	0	36	57	0	0	0	0	0	0	93
	%	0%	8%	0%	0%	8%	2%	0%	0%	0%	0%	0%	0%	0%	2%	0%	0%	2%	8%	0%	0%	0%	0%	0%	0%	3%
	Total	**0**	**728**	**1**	**0**	**729**	**2020**	**2**	**1**	**3**	**0**	**6**	**10**	**9**	**2018**	**4**	**1**	**2032**	**733**	**1**	**0**	**0**	**0**	**1**	**5**	**2768**
	PHF	0	0.92	0.25	0	0.92	0.97	0.5	0.25	0.75	0	0.75	0.62	0.75	0.96	0.5	0.25	0.97	0.92	0.25	0	0	0	0.25	0.62	0.96
	Approach %					26%	73%					0%	0%					73%	26%					0%	0%	

APPENDIX

B SYNCHRO RESULTS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	3	0	1	2	0	0	7	0	0	4	0
Future Volume (vph)	0	3	0	1	2	0	0	7	0	0	4	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (m)	3.6	3.5	3.6	3.6	3.5	3.6	3.6	3.5	3.6	3.6	3.5	3.6
Grade (%)		0%			0%			0%			0%	
Storage Length (m)	0.0		0.0	0.0		0.0	0.0		0.0	0.0		0.0
Storage Lanes	0		0	0		0	0		0	0		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Satd. Flow (prot)	0	1842	0	0	1813	0	0	1842	0	0	1842	0
Flt Permitted					0.984							
Satd. Flow (perm)	0	1842	0	0	1813	0	0	1842	0	0	1842	0
Link Speed (k/h)		90			90			90			90	
Link Distance (m)		673.1			1640.0			543.4			1044.7	
Travel Time (s)		26.9			65.6			21.7			41.8	
Lane Group Flow (vph)	0	3	0	0	3	0	0	7	0	0	4	0
Sign Control		Free			Yield			Free			Yield	

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 13.3%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	2	1	4	0	3	0	520	3	6	1976	1
Future Volume (vph)	0	2	1	4	0	3	0	520	3	6	1976	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (m)	3.6	3.5	3.6	3.6	3.5	3.6	3.6	3.5	3.6	3.6	3.5	3.6
Grade (%)		0%			0%			0%			0%	
Storage Length (m)	0.0		0.0	0.0		0.0	0.0		0.0	0.0		0.0
Storage Lanes	0		0	0		0	0		0	0		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Satd. Flow (prot)	0	1759	0	0	1687	0	0	3243	0	0	3500	0
Flt Permitted					0.972							
Satd. Flow (perm)	0	1759	0	0	1687	0	0	3243	0	0	3500	0
Link Speed (k/h)		90			90			100			90	
Link Distance (m)		1640.0			885.2			667.4			1223.1	
Travel Time (s)		65.6			35.4			24.0			48.9	
Lane Group Flow (vph)	0	3	0	0	7	0	0	523	0	0	1983	0
Sign Control		Stop			Stop			Free			Free	

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 69.5%	ICU Level of Service C
Analysis Period (min) 15	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	3	0	1	2	0	0	4	0	0	7	0
Future Volume (vph)	0	3	0	1	2	0	0	4	0	0	7	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (m)	3.6	3.5	3.6	3.6	3.5	3.6	3.6	3.5	3.6	3.6	3.5	3.6
Grade (%)		0%			0%			0%			0%	
Storage Length (m)	0.0		0.0	0.0		0.0	0.0		0.0	0.0		0.0
Storage Lanes	0		0	0		0	0		0	0		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Satd. Flow (prot)	0	1842	0	0	1813	0	0	1842	0	0	1842	0
Flt Permitted					0.984							
Satd. Flow (perm)	0	1842	0	0	1813	0	0	1842	0	0	1842	0
Link Speed (k/h)		90			90			90			90	
Link Distance (m)		673.1			1640.0			543.4			1044.7	
Travel Time (s)		26.9			65.6			21.7			41.8	
Lane Group Flow (vph)	0	3	0	0	3	0	0	4	0	0	7	0
Sign Control		Free			Yield			Free			Yield	

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 13.3%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	2	1	4	0	3	0	530	3	6	2016	11
Future Volume (vph)	0	2	1	4	0	3	0	530	3	6	2016	11
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (m)	3.6	3.5	3.6	3.6	3.5	3.6	3.6	3.5	3.6	3.6	3.5	3.6
Grade (%)		0%			0%			0%			0%	
Storage Length (m)	0.0		0.0	0.0		0.0	0.0		0.0	0.0		0.0
Storage Lanes	0		0	0		0	0		0	0		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Satd. Flow (prot)	0	1759	0	0	1687	0	0	3243	0	0	3496	0
Flt Permitted					0.972							
Satd. Flow (perm)	0	1759	0	0	1687	0	0	3243	0	0	3496	0
Link Speed (k/h)		90			90			100			90	
Link Distance (m)		1640.0			885.2			667.4			1223.1	
Travel Time (s)		65.6			35.4			24.0			48.9	
Lane Group Flow (vph)	0	3	0	0	7	0	0	533	0	0	2033	0
Sign Control		Stop			Stop			Free			Free	

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 70.9%	ICU Level of Service C
Analysis Period (min) 15	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣			✣			✣			✣	
Traffic Volume (vph)	0	33	0	1	42	0	0	4	0	0	7	0
Future Volume (vph)	0	33	0	1	42	0	0	4	0	0	7	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (m)	3.6	3.5	3.6	3.6	3.5	3.6	3.6	3.5	3.6	3.6	3.5	3.6
Grade (%)		0%			0%			0%			0%	
Storage Length (m)	0.0		0.0	0.0		0.0	0.0		0.0	0.0		0.0
Storage Lanes	0		0	0		0	0		0	0		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Satd. Flow (prot)	0	1634	0	0	1632	0	0	1634	0	0	1634	0
Flt Permitted					0.999							
Satd. Flow (perm)	0	1634	0	0	1632	0	0	1634	0	0	1634	0
Link Speed (k/h)		90			90			90			90	
Link Distance (m)		673.1			1640.0			543.4			1044.7	
Travel Time (s)		26.9			65.6			21.7			41.8	
Lane Group Flow (vph)	0	33	0	0	43	0	0	4	0	0	7	0
Sign Control		Free			Free			Stop			Stop	

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 13.3%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✥			✥			↰↑↱			↰↑↱	
Traffic Volume (vph)	7	2	24	4	0	3	30	530	3	6	2016	11
Future Volume (vph)	7	2	24	4	0	3	30	530	3	6	2016	11
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (m)	3.6	3.5	3.6	3.6	3.5	3.6	3.6	3.5	3.6	3.6	3.5	3.6
Grade (%)		0%			0%			0%			0%	
Storage Length (m)	0.0		0.0	0.0		0.0	0.0		0.0	0.0		0.0
Storage Lanes	0		0	0		0	0		0	0		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Satd. Flow (prot)	0	1469	0	0	1687	0	0	3226	0	0	3494	0
Flt Permitted		0.990			0.972			0.997				
Satd. Flow (perm)	0	1469	0	0	1687	0	0	3226	0	0	3494	0
Link Speed (k/h)		90			90			100			90	
Link Distance (m)		1640.0			885.2			667.4			1223.1	
Travel Time (s)		65.6			35.4			24.0			48.9	
Lane Group Flow (vph)	0	33	0	0	7	0	0	563	0	0	2033	0
Sign Control		Stop			Stop			Free			Free	

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 70.3%	ICU Level of Service C
Analysis Period (min) 15	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	4	0	1	2	0	0	5	0	0	9	0
Future Volume (vph)	0	4	0	1	2	0	0	5	0	0	9	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (m)	3.6	3.5	3.6	3.6	3.5	3.6	3.6	3.5	3.6	3.6	3.5	3.6
Grade (%)		0%			0%			0%			0%	
Storage Length (m)	0.0		0.0	0.0		0.0	0.0		0.0	0.0		0.0
Storage Lanes	0		0	0		0	0		0	0		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Satd. Flow (prot)	0	1842	0	0	1813	0	0	1842	0	0	1842	0
Flt Permitted					0.984							
Satd. Flow (perm)	0	1842	0	0	1813	0	0	1842	0	0	1842	0
Link Speed (k/h)		90			90			90			90	
Link Distance (m)		673.1			1640.0			543.4			1044.7	
Travel Time (s)		26.9			65.6			21.7			41.8	
Lane Group Flow (vph)	0	4	0	0	3	0	0	5	0	0	9	0
Sign Control		Free			Yield			Free			Yield	

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 13.3%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	2	1	5	0	4	0	647	4	7	2457	1
Future Volume (vph)	0	2	1	5	0	4	0	647	4	7	2457	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (m)	3.6	3.5	3.6	3.6	3.5	3.6	3.6	3.5	3.6	3.6	3.5	3.6
Grade (%)		0%			0%			0%			0%	
Storage Length (m)	0.0		0.0	0.0		0.0	0.0		0.0	0.0		0.0
Storage Lanes	0		0	0		0	0		0	0		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Satd. Flow (prot)	0	1759	0	0	1685	0	0	3243	0	0	3500	0
Flt Permitted					0.973							
Satd. Flow (perm)	0	1759	0	0	1685	0	0	3243	0	0	3500	0
Link Speed (k/h)		90			90			100			90	
Link Distance (m)		1640.0			885.2			667.4			1223.1	
Travel Time (s)		65.6			35.4			24.0			48.9	
Lane Group Flow (vph)	0	3	0	0	9	0	0	765	0	0	2899	0
Sign Control		Stop			Stop			Free			Free	

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 84.5%	ICU Level of Service E
Analysis Period (min) 15	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	34	0	1	42	0	0	5	0	0	9	0
Future Volume (vph)	0	34	0	1	42	0	0	5	0	0	9	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (m)	3.6	3.5	3.6	3.6	3.5	3.6	3.6	3.5	3.6	3.6	3.5	3.6
Grade (%)		0%			0%			0%			0%	
Storage Length (m)	0.0		0.0	0.0		0.0	0.0		0.0	0.0		0.0
Storage Lanes	0		0	0		0	0		0	0		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor												
Frt												
Flt Protected					0.999							
Satd. Flow (prot)	0	1634	0	0	1632	0	0	1634	0	0	1634	0
Flt Permitted					0.999							
Satd. Flow (perm)	0	1634	0	0	1632	0	0	1634	0	0	1634	0
Link Speed (k/h)		90			90			90			90	
Link Distance (m)		673.1			1640.0			543.4			1044.7	
Travel Time (s)		26.9			65.6			21.7			41.8	
Lane Group Flow (vph)	0	34	0	0	43	0	0	5	0	0	9	0
Sign Control		Free			Free			Stop			Stop	

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 13.3%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣			✣			⮜↑⮞			⮜↑⮞	
Traffic Volume (vph)	7	2	24	5	0	4	30	647	4	7	2457	11
Future Volume (vph)	7	2	24	5	0	4	30	647	4	7	2457	11
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (m)	3.6	3.5	3.6	3.6	3.5	3.6	3.6	3.5	3.6	3.6	3.5	3.6
Grade (%)		0%			0%			0%			0%	
Storage Length (m)	0.0		0.0	0.0		0.0	0.0		0.0	0.0		0.0
Storage Lanes	0		0	0		0	0		0	0		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	0.95	0.95	0.95	0.95
Ped Bike Factor												
Frt		0.902			0.940			0.999			0.999	
Flt Protected		0.990			0.973			0.998				
Satd. Flow (prot)	0	1469	0	0	1685	0	0	3231	0	0	3494	0
Flt Permitted		0.990			0.973			0.998				
Satd. Flow (perm)	0	1469	0	0	1685	0	0	3231	0	0	3494	0
Link Speed (k/h)		90			90			100			90	
Link Distance (m)		1640.0			885.2			667.4			1223.1	
Travel Time (s)		65.6			35.4			24.0			48.9	
Lane Group Flow (vph)	0	33	0	0	9	0	0	681	0	0	2475	0
Sign Control		Stop			Stop			Free			Free	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	
Intersection Capacity Utilization 83.1%	ICU Level of Service E
Analysis Period (min) 15	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	34	0	1	42	0	0	5	0	0	9	0
Future Volume (vph)	0	34	0	1	42	0	0	5	0	0	9	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (m)	3.6	3.5	3.6	3.6	3.5	3.6	3.6	3.5	3.6	3.6	3.5	3.6
Grade (%)		0%			0%			0%			0%	
Storage Length (m)	0.0		0.0	0.0		0.0	0.0		0.0	0.0		0.0
Storage Lanes	0		0	0		0	0		0	0		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor												
Frt												
Flt Protected					0.999							
Satd. Flow (prot)	0	1634	0	0	1632	0	0	1634	0	0	1634	0
Flt Permitted					0.999							
Satd. Flow (perm)	0	1634	0	0	1632	0	0	1634	0	0	1634	0
Link Speed (k/h)		90			90			90			90	
Link Distance (m)		673.1			1640.0			543.4			1044.7	
Travel Time (s)		26.9			65.6			21.7			41.8	
Lane Group Flow (vph)	0	34	0	0	43	0	0	5	0	0	9	0
Sign Control		Free			Free			Stop			Stop	

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 13.3%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	7	2	24	5	0	4	30	856	4	7	1933	11
Future Volume (vph)	7	2	24	5	0	4	30	856	4	7	1933	11
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (m)	3.6	3.5	3.6	3.6	3.5	3.6	3.6	3.5	3.6	3.6	3.5	3.6
Grade (%)		0%			0%			0%			0%	
Storage Length (m)	0.0		0.0	0.0		0.0	0.0		0.0	0.0		0.0
Storage Lanes	0		0	0		0	0		0	0		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	0.95	0.95	0.95	0.95
Ped Bike Factor												
Frt		0.902			0.940			0.999			0.999	
Flt Protected		0.990			0.973			0.998				
Satd. Flow (prot)	0	1469	0	0	1685	0	0	3232	0	0	3494	0
Flt Permitted		0.990			0.973			0.998				
Satd. Flow (perm)	0	1469	0	0	1685	0	0	3232	0	0	3494	0
Link Speed (k/h)		90			90			100			90	
Link Distance (m)		1640.0			885.2			667.4			1223.1	
Travel Time (s)		65.6			35.4			24.0			48.9	
Lane Group Flow (vph)	0	33	0	0	9	0	0	890	0	0	1951	0
Sign Control		Stop			Stop			Free			Free	

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization 68.7% ICU Level of Service C

Analysis Period (min) 15

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	34	0	1	42	0	0	5	0	0	9	0
Future Volume (vph)	0	34	0	1	42	0	0	5	0	0	9	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (m)	3.6	3.5	3.6	3.6	3.5	3.6	3.6	3.5	3.6	3.6	3.5	3.6
Grade (%)		0%			0%			0%			0%	
Storage Length (m)	0.0		0.0	0.0		0.0	0.0		0.0	0.0		0.0
Storage Lanes	0		0	0		0	0		0	0		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Satd. Flow (prot)	0	1634	0	0	1632	0	0	1634	0	0	1634	0
Flt Permitted					0.999							
Satd. Flow (perm)	0	1634	0	0	1632	0	0	1634	0	0	1634	0
Link Speed (k/h)		90			90			90			90	
Link Distance (m)		673.1			1640.0			543.4			1044.7	
Travel Time (s)		26.9			65.6			21.7			41.8	
Lane Group Flow (vph)	0	34	0	0	43	0	0	5	0	0	9	0
Sign Control		Free			Free			Stop			Stop	

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 13.3%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	7	2	24	5	0	4	30	754	4	7	1746	11
Future Volume (vph)	7	2	24	5	0	4	30	754	4	7	1746	11
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (m)	3.6	3.5	3.6	3.6	3.5	3.6	3.6	3.5	3.6	3.6	3.5	3.6
Grade (%)		0%			0%			0%			0%	
Storage Length (m)	0.0		0.0	0.0		0.0	0.0		0.0	0.0		0.0
Storage Lanes	0		0	0		0	0		0	0		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Satd. Flow (prot)	0	1469	0	0	1685	0	0	3231	0	0	3494	0
Flt Permitted		0.990			0.973			0.998				
Satd. Flow (perm)	0	1469	0	0	1685	0	0	3231	0	0	3494	0
Link Speed (k/h)		90			90			100			90	
Link Distance (m)		1640.0			885.2			667.4			1223.1	
Travel Time (s)		65.6			35.4			24.0			48.9	
Lane Group Flow (vph)	0	33	0	0	9	0	0	788	0	0	1764	0
Sign Control		Stop			Stop			Free			Free	

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 63.5%	ICU Level of Service B
Analysis Period (min) 15	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣			✣			✣			✣	
Traffic Volume (vph)	0	8	0	0	1	0	0	8	0	0	1	0
Future Volume (vph)	0	8	0	0	1	0	0	8	0	0	1	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (m)	3.6	3.5	3.6	3.6	3.5	3.6	3.6	3.5	3.6	3.6	3.5	3.6
Grade (%)		0%			0%			0%			0%	
Storage Length (m)	0.0		0.0	0.0		0.0	0.0		0.0	0.0		0.0
Storage Lanes	0		0	0		0	0		0	0		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor												
Frt												
Flt Protected												
Satd. Flow (prot)	0	1842	0	0	1842	0	0	1842	0	0	1842	0
Flt Permitted												
Satd. Flow (perm)	0	1842	0	0	1842	0	0	1842	0	0	1842	0
Link Speed (k/h)		90			90			90			90	
Link Distance (m)		673.1			1640.0			543.4			1044.7	
Travel Time (s)		26.9			65.6			21.7			41.8	
Lane Group Flow (vph)	0	8	0	0	1	0	0	8	0	0	1	0
Sign Control		Free			Yield			Free			Yield	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	
Intersection Capacity Utilization 13.3%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	1	3	1	2	5	2018	9	1	728	0
Future Volume (vph)	0	0	1	3	1	2	5	2018	9	1	728	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (m)	3.6	3.5	3.6	3.6	3.5	3.6	3.6	3.5	3.6	3.6	3.5	3.6
Grade (%)		0%			0%			0%			0%	
Storage Length (m)	0.0		0.0	0.0		0.0	0.0		0.0	0.0		0.0
Storage Lanes	0		0	0		0	0		0	0		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	0.95	0.95	0.95	0.95
Ped Bike Factor												
Frt		0.865			0.955			0.999				
Flt Protected					0.976							
Satd. Flow (prot)	0	1593	0	0	1717	0	0	3496	0	0	3246	0
Flt Permitted					0.976							
Satd. Flow (perm)	0	1593	0	0	1717	0	0	3496	0	0	3246	0
Link Speed (k/h)		90			90			100			90	
Link Distance (m)		1640.0			885.2			667.4			1223.1	
Travel Time (s)		65.6			35.4			24.0			48.9	
Lane Group Flow (vph)	0	1	0	0	6	0	0	2032	0	0	729	0
Sign Control		Stop			Stop			Free			Free	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	
Intersection Capacity Utilization 69.5%	ICU Level of Service C
Analysis Period (min) 15	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	8	0	0	1	0	0	8	0	0	1	0
Future Volume (vph)	0	8	0	0	1	0	0	8	0	0	1	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (m)	3.6	3.5	3.6	3.6	3.5	3.6	3.6	3.5	3.6	3.6	3.5	3.6
Grade (%)		0%			0%			0%			0%	
Storage Length (m)	0.0		0.0	0.0		0.0	0.0		0.0	0.0		0.0
Storage Lanes	0		0	0		0	0		0	0		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor												
Frt												
Flt Protected												
Satd. Flow (prot)	0	1842	0	0	1842	0	0	1842	0	0	1842	0
Flt Permitted												
Satd. Flow (perm)	0	1842	0	0	1842	0	0	1842	0	0	1842	0
Link Speed (k/h)		90			90			90			90	
Link Distance (m)		673.1			1640.0			543.4			1044.7	
Travel Time (s)		26.9			65.6			21.7			41.8	
Lane Group Flow (vph)	0	8	0	0	1	0	0	8	0	0	1	0
Sign Control		Free			Yield			Free			Yield	

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 13.3%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	1	3	1	2	5	2058	9	1	743	0
Future Volume (vph)	0	0	1	3	1	2	5	2058	9	1	743	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (m)	3.6	3.5	3.6	3.6	3.5	3.6	3.6	3.5	3.6	3.6	3.5	3.6
Grade (%)		0%			0%			0%			0%	
Storage Length (m)	0.0		0.0	0.0		0.0	0.0		0.0	0.0		0.0
Storage Lanes	0		0	0		0	0		0	0		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	0.95	0.95	0.95	0.95
Ped Bike Factor												
Frt		0.865			0.955			0.999				
Flt Protected					0.976							
Satd. Flow (prot)	0	1593	0	0	1717	0	0	3496	0	0	3246	0
Flt Permitted					0.976							
Satd. Flow (perm)	0	1593	0	0	1717	0	0	3496	0	0	3246	0
Link Speed (k/h)		90			90			100			90	
Link Distance (m)		1640.0			885.2			667.4			1223.1	
Travel Time (s)		65.6			35.4			24.0			48.9	
Lane Group Flow (vph)	0	1	0	0	6	0	0	2072	0	0	744	0
Sign Control		Stop			Stop			Free			Free	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	
Intersection Capacity Utilization 70.7%	ICU Level of Service C
Analysis Period (min) 15	