NUCLEAR WASTE MANAGEMENT ORGANIZATION
SOCIÉTÉ DE GESTION DES DÉCHETS NUCLÉAIRES

Road Conditions Study Report - Southwestern Ontario Community Study

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This report has been prepared under contract to the NWMO. The report has been reviewed by the NWMO, but the views and conclusions are those of the authors and do not necessarily represent those of the NWMO.

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MORRISON HERSHFIELD

Road Conditions Study Report
Southwestern Ontario Community Study

For Nuclear Waste Management Organization
NWMO P.O. No.: 2001020

MH Project No.: 2035249.00

July 6, 2022

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Revision History

REV.	ISSUE DATE	DESCRIPTION	PREPARED BY	REVIEWED BY	APPROVED BY
0	April 7, 2022	Draft Road Conditions Study Report	Deven Bhatla, Morrison Hershfield	James Kennedy, Morrison Hershfield	Vicki McCulloch, DPRA
1	June 14, 2022	Revised Draft Road Conditions Study Report	Deven Bhatla, Morrison Hershfield	James Kennedy, Morrison Hershfield	Vicki McCulloch, DPRA
2	July 6, 2022	Final Road Conditions Study Report	Deven Bhatla, Morrison Hershfield	James Kennedy, Morrison Hershfield Brad Hewton, Morrison Hershfield	Vicki McCulloch, DPRA

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APPENDICES

1 INTRODUCTION

1.1 Background and Context

Since 2012, the Municipality of South Bruce (MSB) has been involved in a process of learning about the Nuclear Waste Management Organization's (NWMO) Adaptive Phased Management Project ('the Project') for the long-term management of Canada's used nuclear fuel. The two remaining siting areas in the process are the South Bruce Area and the Ignace Area. The NWMO plans to complete all preliminary assessment work and to select one community/area to host the Project by 2023. Preliminary studies suggest that the Project can be implemented safely in the South Bruce Area for a repository that will contain, and isolate used nuclear fuel from people and the environment for the long timeframes required.

Further detailed studies are required to fully assess the potential impacts of the Project in the community and regionally. Building on previous work, engagement completed to-date, and the MSB's 36 Guiding Principles, the NWMO and the MSB are working together to prepare a suite of community studies which will be shared broadly with the community. The list of socio-economic community studies is included in **Appendix A**. These studies were undertaken by the NWMO or MSB, with some being joint efforts. The MSB has retained consultants (the GHD team) to develop a number of studies and to peer review others developed by the NWMO and their consultants (the DPRA Canada Inc. (DPRA) team). The information acquired through these studies is expected to help South Bruce leadership and residents make informed decisions about whether the Project is a good fit for their community, and if they are willing to consider hosting it and under what circumstances and terms.

This *Road Conditions Study* is one of the community studies being prepared. This study is organized as follows:

- Purpose and Scope (**Section 1.3**)
- Methodology (**Section 2**)
- Existing Conditions (**Section 3**)
- Relevant Adaptive Phased Management Project Characteristics (**Section 4**)
- Preliminary Analysis/Effects Assessment (**Section 5**)
- Options Assessment (**Section 6**)
- Summary (**Section 7**)
- References (**Section 8**)

Note to Reader:

This and other community studies are preliminary and strategic in nature, all intended to identify possible consequences (e.g., to roadway conditions) in the South Bruce Area based on our current level of understanding of the Project. Using information known at this point in time, these community studies will describe a range of possible consequences that are the subject of specific and separate studies. For each possible consequence, potential options are offered to leverage opportunities and/or mitigate possible negative consequences/effects.

It is important to note that these community studies (developed collaboratively by the NWMO and the MSB) being investigated at this time are not the formal or final baseline or effects studies that will be part of the Impact Assessment (IA). Those studies will be completed at a later date if the Project is located in the area. However, these current studies will inform the effects studies that will be initiated at a later date.

These community studies are intended to support current dialogue between the MSB and the NWMO regarding a potential hosting agreement by:

a) Exploring in more detail the questions, aspirations and topics of interest expressed by the community through the Guiding Principles approved by the MSB following the project visioning process completed in the community;
b) Assisting the NWMO and the MSB in developing a deeper understanding of the community aspirations/values and to work with the MSB in identifying possible programs and commitments which ensure that the Project will be implemented in a manner that fosters the well-being of the community and area;
c) Advancing learning and understanding on topics of interest to the neighboring areas; and
d) Providing the community with information it has requested to help them make an informed decision in 2023.

The NWMO is committed to collaboratively working with the communities to ensure questions, concerns and aspirations are captured and addressed through continuous engagement and dialogue.

The NWMO will independently engage with the Saugeen Ojibway Nation to understand how they wish to evaluate the potential negative effects and benefits that the Project may bring to their communities.

1.2 Land Acknowledgement

It is acknowledged that the lands and communities discussed in this report are situated on the Traditional Territory of the Anishinabek Nation: The People of the Three Fires known as Ojibwe, Odawa and Pottawatomie Nations. The Chippewas of Saugeen and the Chippewas of Neyaashiinigmiing (Nawash), now known as the Saugeen Ojibway Nation, are the traditional keepers of this land and water. It is also recognized that the ancestors of the Historic Saugeen Métis and Georgian Bay Métis communities shared this land and these waters.

1.3 Purpose and Scope

Objectives for this study are described in the *Southwestern Ontario Road Conditions Study Work Plan* (DPRA, October 2021). The overall objective of the *Road Conditions Study* is to assess the existing municipal, county, and provincial road conditions and provide options for any improvements and/or monitoring associated with the Project.

The specific objectives of the *Road Conditions Study* are to:

1. Describe the existing road conditions for roads potentially used for the transportation of workers, equipment and materials to be used during construction and operations, including the eventual transportation of used nuclear fuel.
2. Identify potential road improvements (including culverts & bridges).
3. Identify options for measures that may be implemented to maintain the roads such as routine monitoring and cleaning during construction.

The *Road Conditions Study* is relevant to MSB Guiding Principles (2020) #2, #3, #7, #30, #31 and #36:

- #2: “The NWMO must demonstrate to the satisfaction of the Municipality that sufficient measures will be in place to ensure the natural environment will be protected, including the community’s precious waters, land and air, throughout the Project’s lifespan of construction, operation and into the distant future.”
- #3: “The NWMO must demonstrate to the satisfaction of the Municipality that used nuclear fuel can be safely and securely transported to the repository site.”
- #7: “The NWMO must commit to preparing construction management and operation plans that detail the measures the NWMO will implement to mitigate the impacts of construction and operation of the Project.”
- #30: “The NWMO will prepare a review of the existing and projected capacity of South Bruce’s road network and will commit to providing appropriate funding for any required upgrades to the road network.”
- #31: “The NWMO will enter into a road use agreement with the Municipality that identifies approved transportation routes during construction and operation of the Project and ensures proper funding for maintenance and repair of municipal roads and bridges used for the Project.”
- #36: “The NWMO must demonstrate to the satisfaction of the Municipality that the Project will benefit the broader region outside of the community of South Bruce, including local Indigenous communities.”

The *Road Conditions Study* provides information directly relevant to Principles #30 and #31 and contributes more generally to Principles #2, #3, #7 and #36.

The *Road Conditions Study* provides information that the NWMO and MSB can use to inform agreements and funding arrangements (as described by Principles #30 and #31) in the future as part of negotiations of a draft hosting agreement and/ or subsequent studies/ discussions if the South Bruce Area is ultimately selected as the Project location. For clarity, development of these types of agreements/arrangements is not part of the objectives / work plan for this study.

The NWMO will be responsible for the completion of the *Road Conditions Study*. This study was undertaken as described in the work plan (DPRA, 2021) by Morrison Hershfield Limited, a sub-consultant to DPRA, the prime consultant to the NWMO.

1.3.1 Peer Review Approach

An earlier draft of the *Road Conditions Study Report* was reviewed by MSB consultants according to their Peer Review Protocol. The Peer Review Protocol provides for a collaborative approach to conducting the peer review, with peer review activity occurring throughout the execution of the study. The *Road Conditions Study* is an NWMO-led study, and the NWMO determined the spatial Study Area, the data and inputs used to establish baseline conditions, and the assessment of the forecasted effects resulting from the Project.

The peer review has been carried out on the scope and framing of the study, data inputs, baseline conditions and the effects assessment. Options developed by the NWMO to address potential effects were presented to the NWMO and MSB in the draft study report.

This final *Road Conditions Study Report* reflects the comments provided by the MSB peer review consultants on the earlier draft report, and subsequent discussions.

For the *Road Conditions Study*, the peer review was led by RJ Burnside & Associates Ltd, as part of the GHD team.

1.3.2 Spatial Boundaries

The spatial boundaries for the *Road Conditions Study* include:

- Roads identified as key potential routes for commuters travelling between population centres and the potential Project Site;
- Roads identified as key potential haul routes or material supply routes connecting to the potential Project Site; and
- Roads in proximity to the potential Project Site that may be used by used nuclear fuel transport vehicles during the operations phase.

Based on the above-noted criteria, the roads selected in collaboration with the NWMO and the MSB for review as part of this study make up the Study Area and are depicted in **Figure 1-1**.

This road network includes roads within the following municipalities:

- Bruce County
    - The MSB
    - Township of Huron-Kinloss
    - Municipality of Brockton
    - Municipality of Kincardine
    - Town of Saugeen Shores
- Huron County
    - Municipality of Morris-Turnberry
    - Township of North Huron
    - Township of Howick

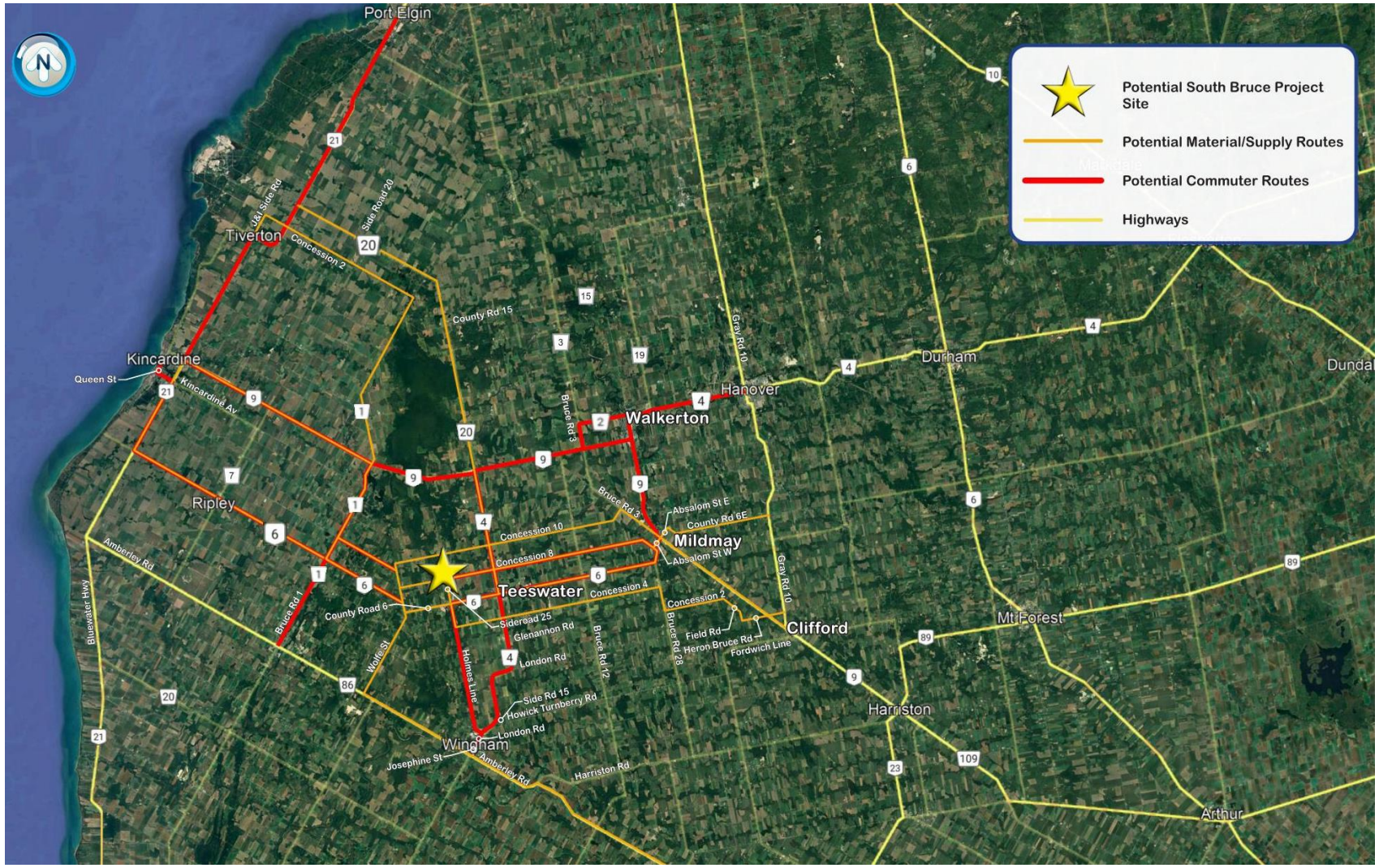

Figure 1-1: Road Conditions Study Network (Imagery: Google Earth, 2022)

The primary focus of this study is the roads that are most likely to be used to connect provincial highways to the potential Project Site, referred to as the “Last Mile” route. The “Last Mile” area of focus is bound by Ministry of Transportation Ontario (MTO) Highway 9, Bruce County Road 4, Bruce County Road 6, and Bruce County Road 1, as illustrated in **Figure 1-2**: "Last Mile" Study Area.

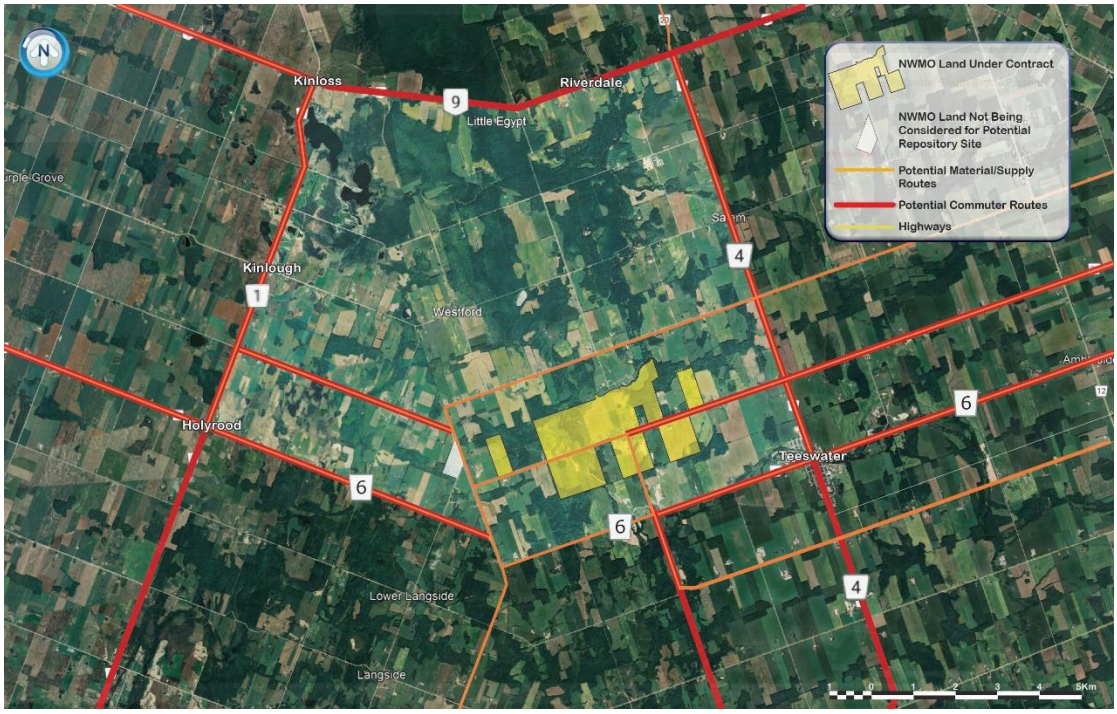

Figure 1-2: "Last Mile" Study Area (Imagery: Google Earth, 2022)

1.3.3 Temporal Boundaries

The temporal boundaries for the *Road Conditions Study* are as follows:

- Near-term (2023 to 2032) – Pre-Construction
  - Aligns with end of site preparation phase in 2032 and design and construction start 2033
- Mid-term (2033 to 2042) – Construction
  - Aligns with construction phase ending in 2042 and operations start 2043
- Long-term (2043 and beyond)
  - Aligns with operations phase (approximately 40 years; does not include monitoring and decommissioning)

2 METHODOLOGY

2.1 General Approach

The NWMO and the MSB drafted Statements of Work for each community study in response to the MSB's 36 Guiding Principles. As previously mentioned, the community studies are being undertaken by the NWMO or the MSB, with some being joint efforts.

The socio-economic community studies were categorized into three themes: Economics, Social Cultural, and Infrastructure and Aggregate. The list of socio-economic studies is provided in **Appendix A**.

The following methodology pertains to the 13 community studies solely or jointly led by the NWMO.

Based on the Statements of Work, work plans for each community study were developed. The work plans:

- Outlined the peer review approach with the MSB
- Identified linkages to other studies
- Identified the spatial and temporal boundaries
- Identified key assumptions that will dictate the completion of the study
- Described the tasks associated with the study and schedule for each task
- Identified key information sources and data collection methods

Draft work plans were reviewed by the MSB and its peer review team. Formal peer review team comments on the draft community study work plans were received in September 2021. The peer review of the draft *Road Conditions Study* work plan was undertaken by RJ Burnside & Associates Ltd, as part of the GHD team.

DPRA provided Comment Disposition Tables and revised work plans to respond to the peer review comments in October 2021. In a memo dated November 3, 2021, the GHD team provided acknowledgement of comments that were addressed in the revised community study work plans or flagged to be addressed in future work such as the community study reports.

Several consultant consortium meetings and "check-in" meetings with the MSB and its peer review team were held during the development of each study.

In addition, meetings with neighbouring municipalities (i.e., the Township of Huron-Kinloss, Municipality of Brockton, Township of North Huron and Municipality of Morris-Turnberry[1]) were held to discuss the progress and scope of the community studies. Morrison Hershfield attended a meeting with the neighbouring municipalities on November 18, 2021 to provide an overview of the *Road Conditions* and *Local Traffic* studies, including field work, the preliminary road network and information sources.

[1] Morris-Turnberry began attending these meetings in February 2022.

2.2 Data Collection/Information Sources

Data and key information for this study was collected from primary sources such as knowledge holder interviews and field work, and secondary sources such as Project information from the NWMO and data/documents from local and regional organizations. The sections below describe how data and information was collected from these sources.

In addition to data and information collected specifically for this study, some of the input was obtained from the results of the *Local Traffic Study* (Morrison Hershfield, 2022*), Aggregate Resources Study* (Keir Corp., 2022a)*, and Housing Needs and Demand Analysis Study* (Keir Corp., 2022b). Data and information were collected for these studies using the methodology described in those study reports. The findings of the *Local Traffic Study* (Morrison Hershfield, 2022) relating to traffic growth were used as a criterion for the identification of potential road improvements that could be considered in support of the Project, as discussed in **Section 6** of this report.

As noted above in Section 2.1, Morrison Hershfield attended a meeting with the neighbouring municipalities on November 18, 2021 to provide an overview of the *Road Conditions* and *Local Traffic* studies, including field work, the preliminary road network and information sources.

Key data sought in development of this study, as well as the source types are outlined in **Table 2-1**. Wherever possible, secondary sources were cross-checked against findings from the field review performed in order to validate the data or information obtained.

Table 2-1: Data Collection Methods and Sources

DATA	COLLECTION METHODS	PRIMARY	SECONDARY
Existing Road Conditions & Uses	• Field work • Desktop	• Field review • Knowledge holder interviews	• Infrastructure condition reports & asset inventories (multiple jurisdictions) • Thematic maps
Planned Road Construction	• Desktop		• Infrastructure capital works plans (multiple jurisdictions) • Knowledge Holder Interviews (multiple jurisdictions)
Future Road Requirements	• Desktop		• NWMO reports & assumptions
Forecasted Traffic Volumes	• Desktop		• *Local Traffic Study* (Morrison Hershfield, 2022*)*

2.2.1 Knowledge Holder Interviews

The selection of knowledge holders was undertaken through an iterative review process between the NWMO and the MSB and its peer review team. Interviews were scheduled by the NWMO and a representative from the NWMO, the NWMO's consultants and the MSB peer review team were present. The knowledge holders were provided with an Interview Guide prior to the interview to provide background information on the Project and a general framework for the interview. During the interview, the NWMO's consultants and MSB's peer review team also

asked specific questions relevant to applicable community studies. The NWMO representative took notes during the interviews and distributed the notes and any documents received from the knowledge holder to the consultants/peer review team members. Information received from these interviews has been used in the development of the study report.

Knowledge holder interviews were undertaken with the following organizations:

- The Municipality of South Bruce
- The Township of Huron-Kinloss
- Bruce County
- Huron County

The MTO was also identified as a knowledge holder and opted to participate in the interview process in written form. The initial set of knowledge holders were identified by the NWMO and MSB. Additional knowledge holders were identified based on input from the NWMO's consultants and the peer review team based on the jurisdiction of the roads subject to review as part of this study.

Further details on the knowledge holder interviews are provided in **Appendix B**.

2.2.2 Field Work

A field visit was performed in October 2021 to review the condition of roads within the Study Area. The purpose of this review was to gather information on the existing condition of roads identified as part of the road study network described in **Section 1.3.2**. The review entailed a cursory visual observation of pavement characteristics, including type, distresses, and applied maintenance treatments, in order to assign a Pavement Condition Rating (PCR), as described in the *Pavement Design and Rehabilitation Manual* (MTO, 2013). A PCR is estimated on a scale of 0 to 100, with 0 representing pavements in poor to very poor condition, and 100 representing pavements in excellent condition. While pavement conditions generally varied along the assessed road segments, each was assigned a representative PCR based on overall impressions (not necessarily the best or worst performing sections of pavement within the segment). It is noted that measurements of distress severity and density, roughness, profile and structure were not performed as part of the review. The estimated PCRs were established based on a qualitative assessment. Representative measurements of road and shoulder widths were taken.

2.2.3 Other Key Information and Data Sources

Other key information and data sources for this study included:

- The NWMO's updated Project information:
    - *APM 2021 DGR Lifecycle Cost Estimate Update Cost Summary Report* (Heimlich, 2021)
    - *Community Studies Planning Assumptions* (Confidential) (NWMO, October 2021)
    - *Deep Geological Repository Conceptual Design Report Crystalline/Sedimentary Rock* (Naserifard et al., 2021)
    - *Deep Geological Repository Transportation System Conceptual Design Report Crystalline/Sedimentary Rock* (AECOM, 2021)

- Data/documents from organizations within the Study Area (various levels of government, agencies, etc.).

2.3 Assessment

Roadway improvements that may be warranted as result of the proposed Project have been identified in this report based on two overarching factors: the existing condition of a road, and the potential impact of the Project on that road.

Upon initiation of this *Road Conditions Study*, a road study network was established, as described in **Section 1.3.2**. The roads contained therein were identified as key routes that could be impacted by traffic associated with the Project, such as commuter, construction, truck, and/or used nuclear fuel transport traffic. Through field and desktop reviews, the existing conditions of these roads were determined. Required or desired conditions for roads potentially carrying additional traffic associated with the Project, heavy construction vehicles, and/or used nuclear fuel were also compiled.

Finally, based on the outputs of the *Local Traffic Study* (Morrison Hershfield, 2022), those roads within the Study Area road network that are projected to see an incremental increase in traffic, above background levels, as a result of the Project were identified. Roads meeting these criteria, in addition to those that could be suitable candidates for use as construction, or used nuclear fuel haul routes, were identified for consideration of potential road improvements. For these roads, improvements recommended under this study consider their existing conditions (including load restrictions) and their required characteristics as noted above. The process for determining road improvement recommendations is outlined in further detail in **Section 6.2**.

2.4 Limitations

This study was undertaken in accordance with the work plan developed in October 2021 (DPRA, October, 2021). The contents of this report are based upon information and data obtained through the means and methods identified above. However, it is noted that not all relevant data and information contemplated in the work plan to be reviewed and considered as part of this study was available from knowledge holders and other sources. Below is a summary of some key information that could not be obtained:

- Identification of specific haul routes and access routes to be used to access the potential Project Site
- Drawings or data detailing existing pavement structures

The data gaps were mitigated by broadening the Study Area road network, and by relying on field reviews or other secondary data (e.g., Google Earth).

As noted in **Section 2.2.2**, field work completed in support of this study entailed a cursory visual observation of pavement dimensions, characteristics, including type, distresses, and applied maintenance treatments. The findings are representative of the roads reviewed, but do not reflect detailed assessment methodologies as described in the MTO *Pavement Design and Rehabilitation Manual* (MTO, 2013).

The high-level preliminary cost estimates presented in this report were established by applying generic per kilometer rates for the various road improvement options. They do not necessarily reflect site-specific conditions. More refined cost estimates can be developed in future studies

once more information is known about the structure of existing roads, and required road improvements, if the Project is located in the South Bruce Area.

3 EXISTING CONDITIONS

The existing conditions of roads and structures within the Study Area are summarized below, based on the findings of a field visit (as described in **Section 2.2.2**), Google Earth imagery reviews, as well as other sources noted in the subsections below. Conditions generally varied along the length of each road segment, and the descriptions below reflect the overall impressions of the roads, as well as the most predominant or significant findings (e.g., observed distresses, dimensions, etc.). These descriptions are not intended as a comprehensive conditions summary.

Additional data about each road, subdivided by segments, is located in **Appendix C**. The location of these roads is shown in **Appendix D**. A figure identifying load restricted roads within the road study network is located in **Appendix E**.

3.1 Municipal Roads – Municipality of South Bruce

All existing roads owned by the Municipality of South Bruce (MSB) are subject to half-load restrictions during the spring season (MSB, 2021). Agricultural machinery was observed on various municipal roads and shoulders during the field visit conducted in October 2021, near the end of the season's harvest.

3.1.1 Concession Road 2 W

A 4.0 kilometer (km) length of Concession Road 2 W was reviewed between County Road 28 and Tack Road. Within these limits, the road is approximately 7 m wide, with no shoulder. The pavement is in fairly good condition but includes frequent areas of slight distortion, and intermittent edge break.

3.1.2 Concession Road 4

A 17.3 km length of Concession Road 4 was reviewed between Side Road 25 N and County Road 28. The road is a low-volume collector serving primarily farm properties, and within these limits, measures approximately 6.5 m to 7 m wide, with a narrow or discontinuous gravel shoulder. The pavement is in fair condition, though features intermittent areas of moderate wheel track rutting and frequent cracking, including edge break. Patching has been applied intermittently. This segment of Concession Road 4 also traverses two structures noted below in **Section 3.5**.

3.1.3 Concession Road 8

A 21.7 km length of Concession Road 8 was reviewed between Kinloss-Culross Road and County Road 28 near Mildmay. The road is a low-volume collector serving primarily farm properties, and within these limits, measures approximately 6.5 m to 7 m wide, with either no shoulder, or a narrow intermittent 0.5 m gravel shoulder.

The 8 km segment of Concession Road 8 between Kinloss-Culross Road and County Road 4 traverses the general area of the potential Project Site. This segment features pavement in fair condition, with frequent instances of moderate pavement edge break, and intermittent instances of wheel track rutting and distortion along the road edge. Patching has been applied to some areas of distress. The most significant distresses are located just west of County Road 4. This segment of Concession Road 8 also traverses two structures noted below in **Section 3.5**.

Between County Road 4 and County Road 12, the road is in fairly good condition. Between County Road 12 and County Road 28, the road is in fair condition, though with frequent instances of rutting and alligator cracking extending from the wheel tracks to the outer pavement edge.

3.1.4 Concession Road 10

An 18.5 km length of Concession Road 10 was reviewed between Kinloss-Culross Road and Side Road 15. The road is a low-volume collector serving primarily farm properties, and within these limits, measures approximately 6.5 m to 7 m wide, with generally no shoulder. The 8 km segment of Concession Road 10 between Kinloss-Culross Road and County Road 4 runs immediately north of the general area of the potential Project Site. This segment also traverses four structures noted below in **Section 3.5**.

The pavement on Concession Road 10 is in poor to fair condition throughout. Frequent instances of slight wheel track rutting and moderate distortion along the road edge, resulting in edge break exist. A loss of cover aggregate is noted at intermittent locations.

3.1.5 Field Road

A 3.4 km length of Field Road was reviewed between Tack Road and Huron Bruce Road. The road is gravel-surfaced and measures approximately 7.5 m wide. The condition and rideability are poor to fair, with intermittent potholes, and intermittent locations where longitudinal breaks in pavement elevation along the centreline exist (i.e., left and right sides of the road at different elevations).

3.1.6 Huron Bruce Road

A 3.6 km length of Huron Bruce Road was reviewed between Field Road and Grey Road 10. Within these limits, the road is approximately 6.5 m wide, with 0.5 m gravel shoulders on each side. The pavement is in good condition, with only slight signs of distress.

3.1.7 Kinloss-Culross Road

A 3.3 km length of Kinloss-Culross Road was reviewed between County Road 6 and County Road 10. The road is a low-volume collector serving primarily farm properties, and within these limits, measures approximately 7 m wide, with an intermittent 0.5 m gravel shoulder. The pavement is in fair condition throughout most of the road's length, with periodic areas featuring rutting, distortion, and longitudinal cracking. The pavement at the intersection with County Road 6 is in poor condition, with numerous moderate potholes, some of which have been filled.

Kinloss-Culross Road runs directly west of the general area of the potential Project Site.

3.1.8 Side Road 15

A 1.2 km length of Side Road 15 was reviewed between Concession Road 10 and County Road 3. Within these limits, the road is approximately 6.5 m to 7 m wide, with an intermittent gravel shoulder. The pavement is in fair condition, with moderate longitudinal and pavement edge cracking observed on an intermittent basis.

3.1.9 Side Road 25 N

A 4.0 km length of Side Road 25 N was reviewed between Concession Road 8 and Concession Road 4. The 2.1 km segment of the road between Concession Road 8 and County Road 6 traverses the general area of the potential Project Site. This gravel-surfaced road has an undulating profile and has a variable width, measuring 5 m to 6 m through most of its length. There is insufficient room for opposing vehicles to comfortably pass in some locations, including on the bridge discussed in **Section 3.5.4**. The segment is in poor condition and has poor rideability due to frequent areas of rutting and distortion, as well as intermittent potholes. Aggregate has been lost from the road surface in discrete sections. The road is not maintained in winter months.

Between County Road 6 and Concession Road 4, Side Road 25 N is gravel surfaced, with a width of approximately 7 m.

3.1.10 Side Road 25 S / Holmes Line Road

An 8.8 km length of Side Road 25 S / Holmes Line Road was reviewed between Concession Road 4 and North Street. The road is paved and approximately 7 m wide with narrow gravel shoulders of approx. 0.5 m in width.

The segment north of Turnberry Culross Road is under the jurisdiction of the MSB, while the segment south is under the jurisdiction of the Municipality of Morris-Turnberry.

3.2 Municipal Roads – Huron-Kinloss

All existing roads owned by the Township of Huron-Kinloss are subject to half-load restrictions during the spring season (Township of Huron-Kinloss, 2020). Agricultural machinery was observed on various municipal roads and shoulders during the field visit conducted in October 2021, near the end of the season's harvest.

3.2.1 Statters Lake Avenue

A 5.6 km length of Statters Lake Avenue was reviewed between County Road 1 and Kinloss-Culross Road. The road is a low-volume collector with numerous farm and residential properties. A notable volume of horse & buggy traffic was observed on this road during the field review in October 2021. Statters Lake Avenue has a width of 7 m with no shoulders. Its' pavement is in fairly good condition. There are intermittent instances of distortion and wheel track rutting, primarily concentrated in the eastern half of the road alignment. There is intermittent slight pavement cracking of varying types throughout the segment, many of which have been sealed.

3.2.2 Wolfe Street

A 7.6 km length of Wolfe Street was reviewed between County Road 86 and County Road 6. The road features a paved width of 6.75 m to 7 m, and intermittent 0.5 m gravel shoulders. The pavement is in fairly good condition, with intermittent transverse cracking and somewhat frequent pavement edge cracking being the most notable distresses.

3.3 County Roads

Agricultural machinery was observed on various county roads and shoulders during the field visit conducted in October 2021, near the end of the season's harvest.

3.3.1 Bruce County Road 1

A 17.1 km length of County Road 1 was reviewed between MTO Highway 9 at Kinloss and County Road 86 at Lucknow. County Road 1 features one 3.75 m wide lane with 3 m gravel shoulders per direction. The road is predominantly in good to excellent condition within these limits. There exists moderate cracking, distortion and/or curb separation at discrete locations in proximity to Kinloss, Kinlough and Lucknow. Horse and buggy traffic was observed on the shoulders.

Bruce County has identified County Road 1 as an existing preferred route to the Bruce Power site between County Road 20 and Highway 9 (County of Bruce, 2020).

3.3.2 Bruce County Road 2

A 4.4 km length of County Road 2 was reviewed between County Road 4 at Walkerton and County Road 3. The road has one 3.75 m lane per direction and 2 m wide gravel shoulders. This segment of road is in fair condition and appears to have been recently subject to a spray seal treatment.

3.3.3 Bruce County Road 3

Two separate segments of County Road 3 were reviewed.

Between Side Road 15 / Schaefer Road and MTO Highway 9 just northwest of Mildmay (3.7 km), the road is in fair condition overall, though does intermittently feature moderate distresses including cracking, rutting and other distortions. There is one 3.75 m lane and 2.5 m gravel shoulder in each direction.

Between County Road 2 and MTO Highway 9 west of Walkerton (2.1 km), the road is in fair condition, with frequent cracking and some rutting and surface aggregate loss in the wheel tracks. Spray patching has been applied primarily to the wheel tracks. There is one 3.75 m lane and 3 m gravel shoulder in each direction.

3.3.4 Bruce / Huron County Road 4

Two separate segments of County Road 4 were reviewed.

Between County Road 2 in central Walkerton and the boundary of Bruce County just west of Hanover, the pavement outside the urban limits is in good condition, with the exception of an approximately 1 km segment east of County Road 22, which is in poor condition, with significant cracking and patching. The condition deteriorates somewhat west of Side Road 15 as well. This segment predominantly features one 3.75 m lane plus a 2.75 m partially paved shoulder per direction.

Between MTO Highway 9 and North Street W in Wingham (23.9 km), the pavement is overall in fair condition. There are locations of moderate to severe potholing, wheel track rutting &

cracking, and pavement edge cracking/breaking, particularly in the vicinity of the Huron-Bruce Road intersection. The northbound lanes are in poorer condition than the southbound lanes. The road cross-section varies in this stretch, and generally includes two 3.5 m lanes with partially paved shoulders measuring greater than 2.5 m.

3.3.5 Bruce County Road 6

A 47.7 km length of County Road 6 & 6E was reviewed between MTO Highway 21 and Bruce County Road 28 near Mildmay. Within these limits, County Road 6 is a two-lane arterial with predominantly gravel shoulders. Lane widths generally measure 3.5 m east of County Road 1 (Holyrood) and 3.75 m to the west. Pavement conditions and ride comfort vary significantly along the length of the road. The road is in good to excellent condition east of County Road 4 (Teeswater), and generally in good condition west of Side Road 25 N. The 4.1 km segment between County Road 4 and Side Road 25 N is in poor condition with severe rutting and cracking within the outer wheel paths and road edge, and inconsistent shoulder widths, among other noted defects.

County Road 6 is identified as a load restricted road between County Road 4 and County Road 1. County Road 6 E is identified as a load restricted road between Highway 9 and Grey Road 10 (County of Bruce, 2019).

A 9.6 km length of County Road 6E (Absalom Street) was reviewed between Highway 9 in Mildmay and Grey Road 10. East of Mildmay, this road is in poor condition, and is signed as a “rough road.” There exists frequent to extensive locations of ravelling (dislodgement of aggregates from the road surface), distortion, wheel track and pavement edge cracking, manifesting in severe depressions and edge loss along the outside of the road in some areas. There have been minimal repairs. The road width is approximately 7 m.

3.3.6 Bruce County Road 20

A 29.2 km length of County Road 20 was reviewed between MTO Highway 21 and MTO Highway 9. Within these limits, County Road 20 is a two-lane arterial with gravel shoulders. Lane widths vary between 3.6 m and 3.75 m, and shoulder widths generally measure between 1.75 m and 2.25 m. Pavement conditions are excellent between MTO Highway 21 and Side Road 20, fair between Side Road 20 and County Road 15, and poor between County Road 15 and MTO Highway 9. The most significant distresses on this segment include moderate cracking throughout the paved surface (with a varying density of occurrence) and frequent distortion resulting in a notably inconsistent cross-fall in some locations.

Bruce County has identified County Road 20 as an existing preferred route to the Bruce Power site west of County Road 1 (County of Bruce, 2020).

3.3.7 Bruce County Road 28

Two separate segments of County Road 28 were reviewed.

Between County Road 6E and Concession Road 8W in Mildmay, the pavement is in fair condition, with intermittent wheel track rutting, cracking, and some pavement edge break being the most notable distresses. This segment features one 3.5 m lane plus a 2.5 m gravel shoulder per direction.

Between Concession Road 2 and Concession Road 4, the pavement is overall in good condition. There are some locations with distortion and cracking along the pavement edge, and locations where the shoulder is significantly depressed relative to the road edge and in need of re-grading. The road cross-section varies in this stretch, and generally includes two 3.25 m lanes with gravel shoulders measuring 3 m.

3.3.8 Bruce / Huron County Road 86

A 37.2 km length of County Road 86 was reviewed between Road 172 (at the boundary of Huron & Perth Counties) and Wolfe Street (within Bruce County). Within these limits, County Road 86 is primarily a two-lane arterial with partially paved shoulders. Lane widths are 3.5 m, and shoulder widths generally measure between 3 m and 3.25 m. Within the limits of Huron County, pavement conditions are generally good to excellent, with the exception of the road through Bluevale (significant cracking and distortion, with some areas having been patched). The road is in fair condition within the limits of Bruce County.

3.4 Provincial Roads

3.4.1 Highway 9

A 61.7 km length of MTO Highway 9 was reviewed between Highway 21 in Kincardine and Grey County Road 10 in Clifford. Within these limits, Highway 9 is a two-lane arterial. Lane widths range between 3.5 m and 3.75 m, and partially paved shoulders generally measure 3 m in width.

Along the segments between Highway 21 and Bruce County Road 7, and between Bruce County Road 4 (Walkerton) and Grey County Road 10, the roadway is generally in good to excellent condition. Highway 9 between Mildmay and Clifford is scheduled to be resurfaced by MTO in 2023-2024 (MTO, 2022).

Between County Road 7 and County Road 4 (Walkerton), the pavement is in fair condition. A spray seal treatment has been applied east of County Road 20, though this treatment has degraded in some locations. This segment features intermittent sections moderate shoulder edge break, and unsealed centreline and other pavement cracking. MTO plans to resurface this segment of highway between 2022 and 2024 (MTO, 2022). The section west of County Road 20 also features intermittent edge break and extensive centreline cracking. Maintenance treatments have been applied to distresses within this segment.

Bruce County has identified Highway 9 as an existing preferred route to the Bruce Power site east of the intersection with County Road 1 (County of Bruce, 2020).

3.4.2 Highway 21

A 42.8 km length of MTO Highway 21 was reviewed between County Road 6 and Concession Road 6 in Port Elgin. Within these limits, Highway 21 is a two-lane arterial. Lane widths range between 3.5 m and 3.6 m, and partially paved shoulders measure 3 m to 3.25 m in width. The road is predominantly in excellent condition between County Road 6 and County Road 15 in Tiverton. The highway is in good condition north of Tiverton, but there are sections with moderate longitudinal cracking at pavement joints, among other slight cracking. Intermittent sections of shoulder are slightly uneven. This segment of Highway 21 is scheduled to be resurfaced by MTO in 2022 (MTO, 2022).

3.5 Bridges & Culverts

The location of the various MSB structures described below is included in **Appendix D**. Further discussion on potential improvements to these structures is located in **Section 6.5**. The findings of this section are informed significantly by the MSB 2020 Municipal Bridge Inspection Report (R.J. Burnside & Associates Limited, 2020).

3.5.1 MSB Structure No. 0003 (Lorenz Bridge)

Lorenz Bridge crosses twin-cell CSP arch culverts, each with a diameter of 5.5 m. The structure carries Concession Road 4. The culverts appear to be in fair condition with bolt hole cracking within both barrels. Minor rehabilitation and installation of a guide barrier system over the culverts is recommended in the MSB 2020 Municipal Bridge Inspection Report (R.J. Burnside & Associates Limited, 2020).

3.5.2 MSB Structure No. 0004 (Kennedy Bridge)

Kennedy Bridge is an existing CSP arch culvert with a diameter of 6 m. It was constructed in 1982 and carries Concession Road 4. There is no roadside safety hardware present across the structure. Installation of guiderail is the only recommended work estimated within the next 10 years per the MSB 2020 Municipal Bridge Inspection Report (R.J. Burnside & Associates Limited, 2020), as the culvert appears to be in good condition.

3.5.3 MSB Structure No. 0007 (Green Bridge)

Green Bridge is an existing single-lane concrete through girder bridge that carries Side Road 25N over the Teeswater River approximately 180 m north of Bruce County Road 6. The bridge appears in poor condition with notable cracking and chipping on the face of the girders. Concrete from the wing walls has broken off of the structure in places. There is no roadside safety hardware present at the structure approaches. The bridge is recommended for replacement in the MSB 2020 Municipal Bridge Inspection Report (R.J. Burnside & Associates Limited, 2020).

3.5.4 MSB Structure No. 0008 (McPherson Bridge)

McPherson Bridge is an existing steel truss bridge that carries Concession Road 8 over the Teeswater River approximately 865 m west of Side Road 25N. The bridge is recommended for major rehabilitation within two years, or otherwise a replacement within twelve years in the MSB 2020 Municipal Bridge Inspection Report (R.J. Burnside & Associates Limited, 2020).

3.5.5 MSB Structure No. 0009 (Leahy Bridge)

The Leahy Bridge carried Side Road 25 N over the Teeswater River and was located between Concession Roads 8 and 10. Its' superstructure was removed in 2013, making this stretch of Side Road 25 N discontinuous. The abutments are still in place (R.J. Burnside & Associates Limited, 2020). Construction of a new superstructure would be required if the road were to be re-opened to through traffic.

3.5.6 MSB Structure No. 0010 (Culross Concession 10 Bridge)

The Culross Concession 10 Bridge is an existing precast concrete I-girder bridge that carries Concession Road 10 over the Teeswater River approximately 3.0 km west of County Road 4. The bridge was constructed in 2009 and remains in excellent condition. Some minor rehabilitation scope is recommended to address settlement issues at the approach slabs. The road width across the bridge is 8.6 m, sufficiently wide to accommodate bi-directional traffic.

3.5.7 MSB Structure No. 0011 (Donaldson Bridge)

Donaldson Bridge is an existing steel I-girder bridge that carries Concession Road 10 west of Side Road 10b. The bridge was constructed in 2018, and it remains in excellent condition. The road width across the bridge is 8.5 m, sufficiently wide to accommodate bi-directional traffic. No repairs are expected to be required for the next 10 years as per the MSB 2020 Municipal Bridge Inspection Report (R.J. Burnside & Associates Limited, 2020).

3.5.8 MSB Structure No. 0012 (Fischer Bridge)

Fischer Bridge is an existing CSP arch culvert, with a diameter of 5.4 m that carries Concession Road 10. Replacement of the current guide rail system for a steel beam guide rail system is recommended, though no further works are expected to be required for the next 10 years as per the MSB 2020 Municipal Bridge Inspection Report (R.J. Burnside & Associates Limited, 2020). (R.J. Burnside & Associates Limited, 2020).

3.5.9 MSB Structure No. 0024

MSB Structure No. 0024 is an existing concrete rigid-frame bridge overlain with granular and earth fill that carries Concession Road 8 over a waterbody approximately 960 m west of Side Road 25N. There is no roadside safety hardware present across the structure. The bridge is recommended for replacement or rehabilitation within nine years in the MSB 2020 Municipal Bridge Inspection Report (R.J. Burnside & Associates Limited, 2020). The report recommends that the need for this culvert to convey flow be reviewed.

3.5.10 MSB Structure No. 0025

MSB Structure No. 0025 is an existing corrugated steel pipe (CSP) culvert, with a diameter of 3 m. It was constructed in 2020 and carries Concession Road 10 over a watercourse, approximately 580 m west of County Road 4. There is no roadside safety hardware present across the structure. Installation of guiderail and ongoing routine maintenance is recommended for this culvert per the MSB 2020 Municipal Bridge Inspection Report (R.J. Burnside & Associates Limited, 2020).

3.5.11 MSB Structure No. 1020

MSB Structure No. 1020 is an existing CSP arch culvert, with a diameter of 2.7 m that carries Field Road (Sideroad 25S). The culvert is in good condition and remaining service life is estimated at approx. 10 years. There is no roadside safety hardware present across the structure. Installation of guiderail is also recommended for this culvert per the MSB 2020 Municipal Bridge Inspection Report (R.J. Burnside & Associates Limited, 2020).

4 PROJECT CHARACTERISTICS RELEVANT TO THE STUDY

4.1 Required Roadway Characteristics

The Project is expected to generate additional traffic volumes in proximity to the site. Across the Project phases, such traffic will include personal staff vehicles, construction vehicles, and Used Fuel Transport System (UFTS) vehicles, all of which need to be considered and accommodated by the road network. For the purposes of this study, it is assumed that a tractor trailer, namely a Designated Tractor-Trailer Combination 3 – Tractor Self-Steer Quad Semi-Trailer, from the *Ontario Regulation 413/05, Schedule 3*, as depicted in **Figure 4-1** and **Table 4-1** will be used as the UFTS (NWMO, 2021). This will serve as the governing design vehicle for any geometric intersection improvements recommended within the study area. It has been determined that the dimensions of this vehicle are sufficient to carry Used Fuel Transportation Packages (UFTP) (NWMO, 2021). This vehicle arrangement has a maximum allowable gross vehicle weight of 60.8 tonnes (Government of Ontario, 2021).

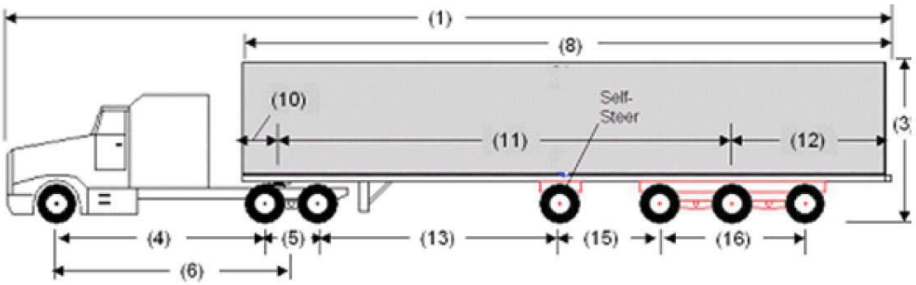

Figure 4-1: Assumed Used Fuel Transport System Vehicle (Government of Ontario, 2021)

Table 4-1: Assumed Used Fuel Transport System Vehicle Dimensions (Government of Ontario, 2021)

VEHICLE	REF.	FEATURE	DIMENSION LIMIT
Overall	(1)	Overall Length	Max. 23.0m
Overall	(2)	Width	Max. 2.6m
Overall	(3)	Height	Max. 4.15m
Tractor	(4)	Inter-axle Spacing	Min. 3.0m
Tractor	(5)	Tandem Axle Spread	1.2 to 1.85m
Tractor	(6)	Wheelbase	Max. 6.8
Semi-Trailer	(8)	Length	Max. 16.2m
Semi-Trailer	(9)	End-Dump Semi-Trailer Bed Length	Max. 14.65m
Semi-Trailer	(10)	Swing Radius	Max. 2.0m
Semi-Trailer	(11)	Wheelbase — if tractor wheel base is 6.2 m or less	6.25 to 12.50m
Semi-Trailer	(11)	Wheel base — if tractor wheel base is > 6.2 m to 6.3 m	6.25 to 12.47m
Semi-Trailer	(11)	Wheel base — if tractor wheel base is > 6.3 m to 6.4 m	6.25 to 12.40m
Semi-Trailer	(11)	Wheel base — if tractor wheel base is > 6.4 m to 6.5 m	6.25 to 12.33m
Semi-Trailer	(11)	Wheel base — if tractor wheel base is > 6.5 m to 6.6 m	6.25 to 12.27m
Semi-Trailer	(11)	Wheel base — if tractor wheel base is > 6.6 m to 6.7 m	6.25 to 12.20m
Semi-Trailer	(11)	Wheel base — if tractor wheel base is > 6.7 m to 6.8 m	6.25 to 12.13m
Semi-Trailer	(12)	Effective Rear Overhang	Max. 35% of wheelbase
Semi-Trailer	(13)	Inter-vehicle-unit Distance — if tridem spread is 3.0 < 3.6m	Min. 6.0m

VEHICLE	REF.	FEATURE	DIMENSION LIMIT
Semi-Trailer	(13)	Inter-vehicle-unit Distance — if tridem spread is 3.6 to 3.7m	Min. 5.5m
Semi-Trailer	(15)	Inter-axle Spacing	> 2.5 to 3.0m
Semi-Trailer	(16)	Tridem Spread	3.0 to 3.7m
Semi-Trailer	(19)	Track Width — tridem — trailer with single tires built before 2010	2.3 to 2.6m
Semi-Trailer	(19)	Track Width — tridem — trailer with single tires built after 2009	2.45 to 2.6m
Semi-Trailer	(19)	Track Width — tridem — all other trailers	2.5 to 2.6m

Precise routes to be used by UFTS vehicles to access the potential Project Site have not been established. It is expected that these vehicles will travel primarily on high quality roads with large cross-sections, such as provincial highways (NWMO, 2021). Such roads would not be subject to seasonal load restrictions, and thus are not anticipated to require significant improvements for the purposes of the Project. The “Last Mile” routes include county and concession roads that are most likely to be used to connect these primary transportation routes to the potential Project Site. These roads are the primary focus of this Study. As detailed in **Section 6,** such roads may warrant improvements to accommodate the Project. Potential improvements should consider and address the following:

- The adequacy of the road structure to carry increased traffic volumes, including UFTS and other heavy vehicles in all seasons
- The road and shoulder widths, cross-fall and drainage
- Intersection widths and sightlines, to accommodate the turning movements of the design vehicle
- The condition, dimensions, and capacity of bridges and culverts, to ensure compatibility with roadway characteristics

New or reconstructed roads within the “Last Mile” have a desirable cross-section with a 4.0 m wide lane and 2.5 m wide paved shoulder in each direction, with roadside ditching. This typical desirable cross-section is depicted in **Figure 4-2**, and considers operational requirements for the potential Project Site, as well as the provision of sufficient width to accommodate future maintenance and rehabilitation needs (NWMO, 2021). This cross-section is notably wider than many existing roads within the “Last Mile,” hence road right-of-way widening may be required for may be required to accommodate it.

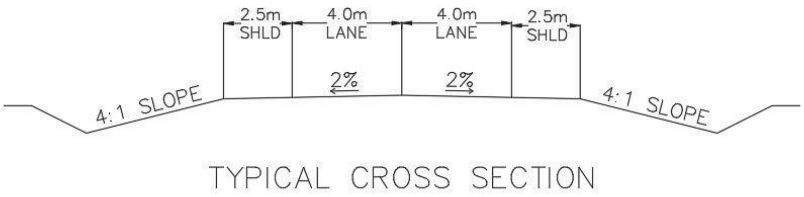

Figure 4-2: Desirable Typical Cross-Section for "Last Mile" (NWMO, 2021)

4.2 Anticipated Traffic Volumes

As described in the *Local Traffic Study* (Morrison Hershfield, 2022), forecasted traffic volumes within the study area are projected to increase during the lifespan of the Project. Much of this increase can be attributed to background population growth, whereas some can be directly or indirectly attributed to the Project. The potential Project Site will be a significant trip generator through all phases of the Project, most notably during the construction and operations phases. Considerations regarding the distribution of housing for the workforce are discussed in the *Housing Needs and Demand Analysis Study* (Keir Corp., 2022b), while the corresponding traffic forecasts are incorporated within the *Local Traffic Study* (Morrison Hershfield, 2022). The incremental percent traffic volume increases generated by the Project (beyond background traffic growth levels) are generally found to be highest on roads within the "Last Mile" in proximity to the potential Project Site, including Bruce County Road 4, Bruce County Road 6, and Concession Road 8.

Through the operations phase of the Project, the potential Project Site is expected to receive approximately 30,000 shipments of used nuclear fuel, or an average of approximately two shipments per day across forty-six years (AECOM, 2021).

4.3 Aggregate Supply

A supply of aggregates will be required to undertake the road improvements identified in **Section 6**. The *Aggregate Resources Study* (Keir Corp., 2022a) concludes that there is more than sufficient licensed extraction capacity for the construction of the Project, which represents a percentage of both the licensed extraction capacity, and the forecast baseline aggregate demand on a regional level. The peak years for aggregate demand associated with site preparation and construction of the Project are in 2033 and 2034, when the demand is projected to be 700,000 tonnes per year. Road improvements identified in support of the Project would likely be undertaken during the pre-construction phase, prior to site preparation activities, and are likewise not expected to make up a significant proportion of the annual aggregate demand within the Local Study Area[2] of the *Aggregate Resources Study*. It is noted that not all potential road improvements identified in this study are expected to be required and/or implemented in support of the Project; that is, they would be implemented with or without the Project.

[2] The Local Study Area for the *Aggregate Resources Study* includes the following municipalities: the MSB, Huron-Kinloss, Brockton, North Huron, Morris-Turnberry, Kincardine, West Grey, Minto, Howick, and Ashfield-Colborne-Wawanosh).

5 PRELIMINARY ANALYSIS/EFFECTS ASSESSMENT

5.1 Effect of Project on Roads & Road Uses

Additional traffic volumes and heavy vehicles associated with the Project will incrementally reduce the typical lifespan of some roadways included in this study. Many of the roadways in the Study Area, and particularly within the "Last Mile" have been identified as warranting either full reconstructions or rehabilitations based on various factors detailed below. However, based on the projections from the *Local Traffic Study* (Morrison Hershfield, 2022), traffic on many of the roadways will not significantly exceed the background annual traffic growth rate as a result of the Project. Potentially warranted road improvements have been identified for roadways where the seasonal average daily traffic (SADT) is projected to be higher due to the Project as compared to the base case (i.e., the "Impact-Minus-Base" case presented in Section 5.1 of the *Local Traffic Study* (Morrison Hershfield, 2022).

It is important to note that given the long timeframe of this Project, construction starting in 2033, and operations lasting until at least 2088, all the roads within the Study Area would need rehabilitation(s) or reconstruction as per typical life cycle asset management schedules and activities implemented by their owner. However, this *Road Conditions Study* focuses on the "Last Mile" roads and those within the Study Area that may be strictly impacted by the added traffic of the Project, and focuses on improvements that could be considered in advance of the operations phase. Additionally, roads identified as construction haul routes may warrant improvements prior to on-site construction, in order to accommodate increased traffic, including heavy vehicles.

Currently, all of the roads owned by the MSB have seasonal load restrictions from approximately March 1st to April 30th each year. During this time, a maximum weight of 5 tonnes per axle is allowed on any vehicle travelling on these roads (MSB, 2021). Since the load per axle on both the UFTS and other trucks is greater than this, we have identified potential reconstructions on any of these roads that have been identified as a potential construction or used nuclear fuel hauling route, such that operations can proceed year-round. It is anticipated that the reconstructed roads would be of sufficient quality and capacity to eliminate the need for seasonal load restrictions. Detailed reconstruction parameters are discussed in **Section 6** below.

Changes in the total volume and type of traffic in the area would increase interactions with existing road users and uses, including agricultural vehicles, pedestrians and cyclists. Another consideration was made for roads which currently carry notable volumes of Mennonite horse & buggy traffic to the west of the potential Project Site in the Township of Huron-Kinloss. In the Study Area, County Road 1 between County Road 86 (Lucknow) and Highway 9 (Kinloss), County Road 6 between County Road 7 (Ripley) and County Road 1 (Holyrood), and Statters Lake Avenue between County Road 1 and Kinloss-Culross Road contain numerous Mennonite residences, farms, schools and churches, and are frequently used by horse and buggy traffic and pedestrians (Municipality of South Bruce, 2017). Shoulder widening options have been considered for these sections of road if avoidance of these routes by trucks is not possible (though there exist numerous possible routes to the potential Project Site in the vicinity, which can be further evaluated as part of future studies). Widening or maintaining roadway shoulders may be considered in these sections with Mennonite horse & buggy traffic to achieve a 3 m width per side in order to accommodate all modes of transportation. Other considerations regarding roadway improvements in support of vulnerable road users are discussed further in the *Local Traffic Study* (Morrison Hershfield, 2022).

As with any large-scale project, there will be disruption to any locals living in close proximity to the potential Project Site, especially during the construction phase. However, with routing decisions, recommended road upgrades and proper maintenance, these disruptions should be minimized. The intent of these identified potential improvements is to provide roadways that can accommodate all current and potential future users.

5.2 Potential Road Improvements

Potential road improvements were identified for roads on which the Project may have some effect based on a set of criteria including:

- Whether the road is a potential used nuclear fuel transport route or construction haul route
- Load restrictions
- Other road uses
- SADT growth rate
- Current road conditions

Based on these criteria, roads were then ranked by priority for improvements based on distance from the potential Project Site. The criteria will be further discussed in detail in **Section 6**.

Based on these criteria, a total of 25 sections of road were identified for consideration of some form of improvement as shown in **Table 5-1** and **Figure 5-1** below. It is noted that used nuclear fuel and other material/supply haul and access routes will likely be established in advance of construction, meaning not all the candidate routes examined under this *Road Conditions Study* would be used for these purposes. It is important to note that the list of required road improvements should be reduced accordingly once those routes have been finalized. Roads works identified as required due to, or to accommodate construction traffic would likely be implemented in the near-term (pre-construction).

Table 5-1: Potential Road Improvements

STUDY ROAD	SECTION	FROM	TO	POTENTIAL ACTION
Concession Road 10	3.1.4	Kinloss-Culross	Side Road 25 N	Reconstruction
Concession Road 10	3.1.4	Side Road 25 N	County Road 4	Reconstruction
Concession Road 10	3.1.4	County Road 4	County Road 12	Reconstruction
Concession Road 10	3.1.4	County Road 12	Side Road 15	Reconstruction
Concession Road 4	3.1.2	County Road 4	County Road 12	Mill & Overlay
Concession Road 4	3.1.2	County Road 12	County Road 28	Mill & Overlay
Concession Road 4	3.1.2	Side Road 25 N	County Road 4	Mill & Overlay
Concession Road 8	3.1.3	County Road 4	County Road 12	Reconstruction
Concession Road 8	3.1.3	County Road 12	County Road 28 (Mildmay)	Reconstruction
Concession Road 8	3.1.3	Kinloss-Culross	Side Road 25 N	Reconstruction
Concession Road 8	3.1.3	Side Road 25 N	County Road 4	Reconstruction
County Road 4	3.3.4	Highway 9	County Road 6 (Teeswater)	Rehabilitation
County Road 6	3.3.5	County Road 7 (Ripley)	County Road 1 (Holyrood)	Mill & Overlay, Widen Shoulders

STUDY ROAD	SECTION	FROM	TO	POTENTIAL ACTION
County Road 6	3.3.5	County Road 1 (Holyrood)	1242 Bruce County Road 6	Reconstruction
County Road 6	3.3.5	Side Road 25 N	County Road 4 (Teeswater)	Reconstruction
County Road 20	3.3.6	Highway 21	Side Road 20	Mill & Overlay
County Road 20	3.3.6	County Road 15	Highway 9	Rehabilitation
Highway 9	3.4.1	County Road 4	Yonge Street (Walkerton)	Mill & Overlay
Huron Bruce Road	3.1.6	Field Road	Grey Road 10	Reconstruction
Kinloss-Culross Road	3.1.7	Concession Road 10	County Road 6	Reconstruction
Side Road 15	3.1.8	Concession Road 10	County Road 3	Reconstruction
Side Road 25 N	3.1.9	Concession Road 8	County Road 6	Reconstruction
Side Road 25 N	3.1.9	County Road 6	Concession Road 4	Reconstruction
Statters Lake Avenue	3.2.1	County Road 1	Kinloss-Culross Road	Mill & Overlay, Widen Shoulders
Wolfe Street	3.2.2	County Road 6	County Road 86	Reconstruction

Independent of the specific road improvements contemplated above, ongoing monitoring of road conditions, as discussed in **Section 6.1.5**, would enable proactive identification of deteriorations that may warrant intervention.

The following structures, as identified in the MSB 2020 Municipal Bridge Inspection Report (R.J. Burnside & Associates Limited, 2020) are situated on roads contemplated for potential improvements as per **Table 5-1**:

- MSB Structure No. 0003 (Lorenz Bridge)
- MSB Structure No. 0004 (Kennedey Bridge)
- MSB Structure No. 0007 (Green Bridge)
- MSB Structure No. 0008 (McPherson Bridge)
- MSB Structure No. 0009 (Leahy Bridge)
- MSB Structure No. 0010 (Culross Concession 10 Bridge)
- MSB Structure No. 0011 (Donaldson Bridge)
- MSB Structure No. 0012 (Fischer Bridge)
- MSB Structure No. 0024
- MSB Structure No. 0025
- MSB Structure No. 1020

Work potentially required on these structures is discussed further in **Section 6.5**. It is noted that any improvements to these structures should be scoped in accordance with intended roadway use and planned improvements.

Potential intersection improvements were also identified based on Autoturn movements using the design vehicle identified in **Section 4.1**. Widening locations were identified based on truck turning movements.

Potential intersection improvements are listed in

Table 5-2 and depicted in **Figure 5-1**.

Table 5-2: Potential Intersection Improvements

INTERSECTION	ACTION	LOCATION	GRAPHIC
County Road 1 at County Road 6	Widening	NE Corner	Appendix G-1
Highway 9 at County Road 1	Widening	NE and SW Corners	Appendix G-2
Highway 9 at County Road 4	Widening	NW Corner	Appendix G-3
County Road 4 at Concession Road 10	Widening	NW Corner	Appendix G-4
County Road 4 at County Road 6	Widening Traffic Signal Implementation	NW Corner	Appendix G-6
Concession Road 6 at Side Road 25 N	Widening	NW, NE, and SW Corner	Appendix G-7
County Road 6 at Wolfe St	Widening	SE Corner	Appendix G-8
Concession Road 8 at Side Road 25 N	Widening	SE and SW Corners	Appendix G-12
Highway 21 at County Road 6	Traffic Signal Implementation		
Highway 21 at Highway 9	Signal Timing Optimization Add Turning Lanes (TBD)		
Highway 21 at County Road 20	Signal Timing Optimization Add Turning Lanes (TBD		

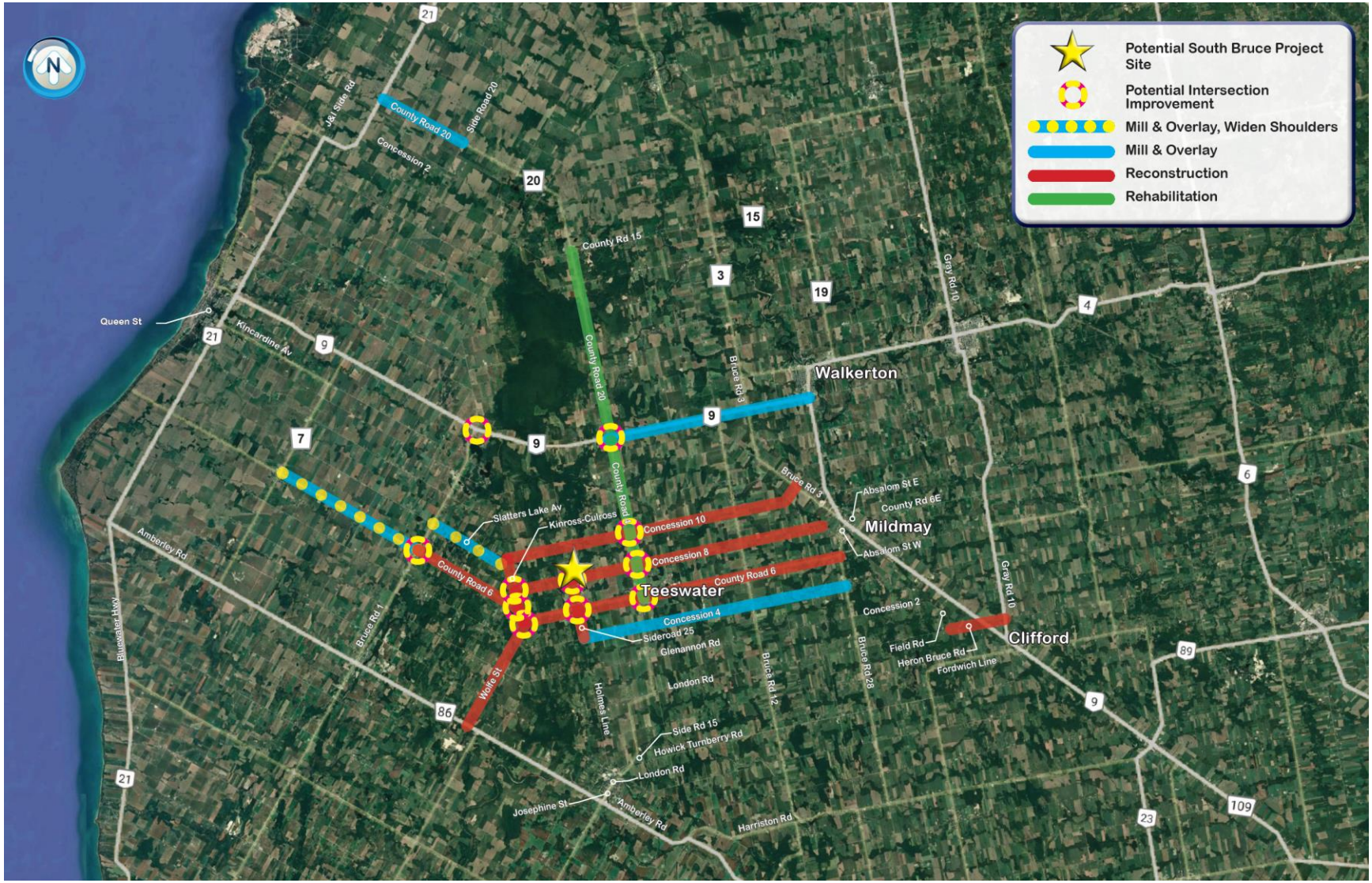

Figure 5-1: Potential Road and Intersection Improvements (Imagery: Google Earth, 2022)

6 OPTIONS ASSESSMENT

Note to Reader

This section provides an overview of possible options to mitigate negative consequences or to enhance positive outcomes. They are presented by the authors to foster discussion only. They do not represent commitments or actions for the NWMO, the Municipality of South Bruce, or other parties. The final decisions on actions and commitments will be made at a future date.

Options for the types of road improvements and monitoring that may be implemented within the Study Area are discussed in this section, as are the individual road segments to which these may potentially be applied. Opportunities for intersection and bridge improvements are also discussed herein. A more detailed ultimate scope of work for these roads can be determined in the future, based on the Project's needs, and/or its impact on the road network. This would require an in-depth understanding of factors including (but not limited to) final Project characteristics, traffic patterns, and infrastructure life-cycles, and their relations to the roadways over time.

The *Road Conditions Study* provides information that the NWMO and MSB can use to inform agreements and funding arrangements (as described by Principles #30 and #31) in the future as part of negotiations of a draft hosting agreement and/ or subsequent studies/ discussions if the South Bruce Area is ultimately selected as the Project location. For clarity, development of these types of agreements/arrangements is not part of the objectives / work plan for this study.

6.1 Roadway Improvement Strategies/Types

Below are descriptions of the work scope involved with each of the road improvement strategies that may be considered on various roadways within the Study Area.

6.1.1 Reconstruction

Reconstruction of a roadway involves rebuilding the entire road structure. It includes removal of existing pavement and excavation to subgrade, subgrade compaction, replacement of pavement structure including subbase, base course, asphalt pavement surface, as well as drainage improvements and ditching. For the purposes of this Project, reconstruction would be to a standard that removes seasonal load restrictions, and also includes widening existing roadways to the recommended width of 13 m, including 2-4 m lanes with 2.5 m paved shoulders as discussed in **Section 4.1** (NWMO, 2021). Due to potential road widenings using the new cross-section, it should be noted that the right-of-way for the roadways will need to be widened to accommodate this new cross-section and property acquisition may be required.

Strengths of a reconstruction include:

- Ability to follow optimal pavement and cross-section design for safety and increased traffic volume
- Achieves the longest lifespan

Weaknesses of a reconstruction include:

- Highest cost option (considering capital road improvement costs only)
- Property acquisition may be required in order to achieve recommended right-of-way widths
- Results in longest construction duration and impact

Detours will likely be required while roads are being reconstructed. A reconstructed pavement should typically last approximately 30 years with proper maintenance. The cost of a reconstruction is approximately $1,000,000 /km based on the typical cross-section and prices defined in the MTO Parametric Estimating Guide (MTO, 2016).

6.1.2 Rehabilitation

Rehabilitation of a roadway involves improving the pavement beyond the surface layer. Existing asphalt is removed, and existing areas may be excavated where required (e.g., due to frost heave or poor subgrade conditions) along with new base and subbase placed in these excavated areas. New asphalt is then placed over top of the entire roadway. Roadway cross-section and pavement widths are not changed during a rehabilitation.

Strengths of a rehabilitation include:

- Lower cost than reconstruction
- Ability to correct issues related to pavement base/subbase and subgrade
- Less construction impact and duration

Weaknesses of a rehabilitation include:

- No improvement to roadway cross-section or lane widths

A rehabilitated pavement should typically last approximately 20 years with proper maintenance. The cost of a rehabilitation is approximately $534,000 /km based on assumed 3.7 m lanes and prices defined in the MTO Parametric Estimating Guide (MTO, 2016).

6.1.3 Mill & Overlay

Mill & overlay of a roadway involves milling the existing asphalt pavement and overlaying with a new asphalt surface. No base work is performed. Roadway cross-section and pavement widths are not changed during a mill & overlay.

Strengths of a mill & overlay include:

- Lowest cost option (considering capital road improvement costs only)
- Least construction impact and duration

Weaknesses of a mill & overlay include:

- No improvement to roadway cross-section or lane widths
- Shortest lifespan

A pavement mill & overlay should typically last approximately 10 years with proper maintenance. The cost of a mill & overlay is approximately $346,000 /km based on assumed 3.7 m lanes and prices defined in the MTO Parametric Estimating Guide (MTO, 2016).

6.1.4 Shoulder Widening

Shoulder widening involves widening existing shoulders or creating roadway shoulders where there currently are none, without doing any work on the road itself unless noted. For the purposes of this *Road Conditions Study*, shoulder widening is intended to provide shoulders measuring 3 m in width. The shoulder widening is not anticipated to be paved and will be gravel only. Only shoulders constructed in reconstruction sections of road (using the new cross-section) will be paved. Shoulder widening is recommended to allow other road users (e.g., horse & buggy, farm vehicles, cyclists, pedestrians) to safely travel on the shoulder of the road away from truck or other vehicular traffic.

Shoulder widening is a cost-effective option to allow the roads to be safer for different uses without reconstructing the road or changing the entire cross-section. The cost for shoulder widening is approximately $45,000 /km (per meter of shoulder widening) based on calculated areas per meter of widening and construction costs found in Appendix C of the *Municipality of South Bruce Road Condition Assessment* report (Cobide Engineering Inc., 2020).

6.1.5 Road Maintenance and Monitoring

A routine maintenance and monitoring program should be put in place to monitor all roads being used as used nuclear fuel truck routes, or as construction haul routes and access roads for the Project. It is important to keep up with routine and as-needed maintenance to ensure pavement life until deterioration has reached a minimum acceptable level of serviceability. Yearly monitoring should be completed and addressed from high to low priority roads, as determined by traffic patterns of the time. Some routine maintenance that should be considered includes crack routing and sealing on all asphalt roads after 5 years and every 10 years thereafter, small patching and pothole filling where required, and typically a 100 mm mill and overlay after approximately 12 years.

Roads should also be kept clean and free of debris and snow during winter months. Additional maintenance such as shoulder grading, grass cutting, and drainage maintenance should be performed routinely (MTO, 2013).

6.1.6 Evaluation of Roadway Improvement Strategies

The road improvement strategies outlined above are summarized in **Table 6-1**. These options can be applied as improvements to roads used or impacted by the Project, as warranted. Selection and application of these options is discussed further in the sections below.

Table 6-1: Road Improvement Strategy Options

STRATEGY	EASE OF IMPLEMENTATION	EFFECTIVENESS	COST
Reconstruction	Requires design and tendering for construction by the road owner. Long-term traffic staging required (e.g., lane reduction).	Considered for roads in poor condition requiring subgrade repair, roads that have been previously rehabilitated, or requiring structural upgrades. Results in long pavement lifespan.	Highest
Rehabilitation	Requires design and tendering for construction by the road owner. Long-term traffic staging required (e.g., lane reduction).	Considered for roads in poor to fair condition, roads with localized distresses, or roads that have been previously rehabilitated. Results in moderate pavement lifespan.	High
Mill & Overlay	Requires design and tendering for construction by the road owner. Short-term traffic staging required (e.g., lane reduction).	Considered for roads in fair to good conditions with surface distresses. Results in short lifespan.	Moderate
Shoulder Widening	Requires design and tendering for construction by the road owner.	Consider for roads with no/ narrow shoulders with high traffic volumes and/or that are used by other vehicles/modes.	Low
Maintenance & Monitoring	Ongoing, routine operation by road owner or other party impacting the road.	Routine work recommended to prolong pavement life and identify other required improvements.	Lowest

6.2 Identification of Potential Road Improvements

Road improvement strategies that could be applied to roads within the Study Area in support of the Project were determined using a flow chart based on a set of criteria as shown in **Figure 6-1** below.

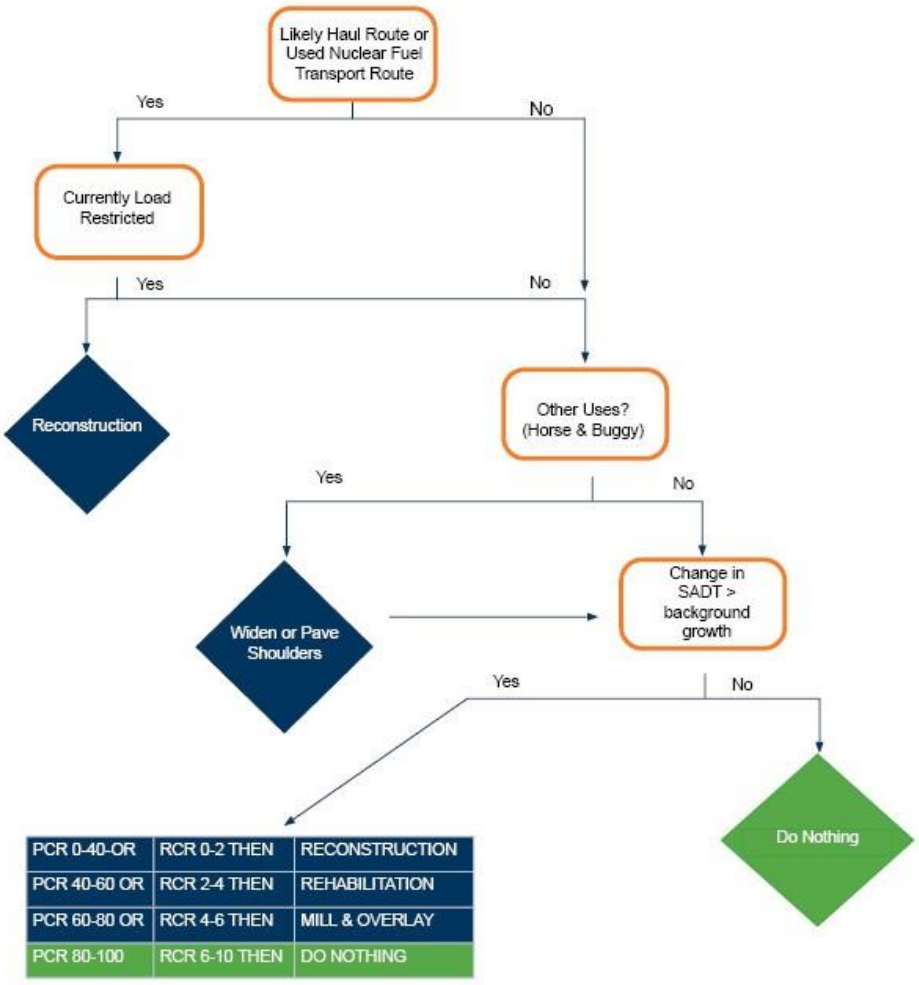

Figure 6-1: Road Improvement Needs Flow Chart

The main criteria considered was whether the road is identified as a “potential” or “likely” used nuclear fuel transport route or construction haul route based on a preliminary review of its location and characteristics, and if so, whether it is currently load restricted. If the road met both of these criteria, then a reconstruction is recommended to remove such restrictions, as under current load restrictions only 5 tonnes per axle is allowed during March and April of each year (MSB, 2021). The next criteria was whether there would be other uses on the road. If the route is commonly used by Mennonite horse & buggy traffic, it is recommended that a shoulder widening would be necessary on roads where the shoulder is currently less than 3 m wide on each side. A widening is recommended in order to accommodate all road users safely, and comfortably.

The next criteria looked at was the SADT growth rate from 2022 until the start of operations in 2043, considering background growth, as well as growth associated with the Project. If this growth rate was greater in the "Impact Case" (i.e., with the Project) per the *Local Traffic Study (Morrison Hershfield, 2022)*, the current road conditions were reviewed to determine if any immediate work could be considered to accommodate an increase in traffic. Any road that has a change in SADT greater than background growth is experiencing an increase in traffic due to the project. For the purposes of this study, based on the current PCR and ride condition rating (RCR), as described in the MTO *Pavement Design and Rehabilitation Manual* (2013), it was decided whether a reconstruction, rehabilitation, mill & overlay, or no action may be warranted. It is noted that these improvements may be warranted based on existing conditions and background traffic levels, and not solely due to the Project. Road improvements were then ranked by high, medium, or low priority based on the distance from site, assuming those closer to the potential Project Site are more likely to be subject to an increase in heavy vehicle traffic as a result of the Project.

It is noted that the current PCR and load restrictions established for any road do not provide wholistic information about its' pavement structure or subsurface conditions. It is therefore recommended that future geotechnical studies be performed on roads contemplated for improvements. Such studies could be used to determine the existing capacity of roads, and determine the improvements necessary to achieve the capacity necessary to carry increased heavy traffic, based on the existing pavement structure and soil conditions. They may also provide insight regarding poor-performing existing pavements, and would enable the refinement of scoping of these improvements based on actual conditions.

6.3 Potential Road Improvements

Potential road improvements and the preliminary estimated cost per segment if the Project is to be located in South Bruce are summarized in **Table 5-1** and **Table 6-2** and discussed in the sections below. The costs presented are based on parametric estimates only. Further design effort would be required to refine costs prior to being used for budgetary purposes. A detailed spreadsheet including each segment, length of road, potential action, and priority can be found in **Appendix F**. High priority roads that may be ultimately identified as used nuclear fuel or other construction vehicle haul routes should be addressed before the planned start of construction, while medium to low priority roads may be addressed during the construction phase to the beginning of the operational phase. All roads which are reconstructed or rehabilitated prior to the start of construction must be monitored routinely throughout construction and operations phases to determine any additional rehabilitation needs throughout the entire project duration.

As discussed in **Section 5.2**, used nuclear fuel and other material/supply haul and access routes will likely be established in advance of construction, meaning not all the candidate routes examined under this Road Conditions Study would be used for these purposes. The list of required road improvements should be reduced accordingly once those routes have been finalized. For clarity, only some of the potential improvements identified in **Table 6-2** are expected to be required in support of the Project.

Table 6-2: Cost of Potential Road Improvements (2022 dollars)

STUDY ROAD	FROM	TO	ESTIMATED COST (2022 Dollars)
Concession Road 10	Kinloss-Culross	Side Road 25 N	$3,900,000.00
Concession Road 10	Side Road 25 N	County Road 4	$4,100,000.00
Concession Road 10	County Road 4	County Road 12	$7,100,000.00
Concession Road 10	County Road 12	Side Road 15	$3,400,000.00
Concession Road 4	County Road 4	County Road 12	$2,196,000.00
Concession Road 4	County Road 12	County Road 28	$1,860,500.00
Concession Road 4	Side Road 25 N	County Road 4	$1,384,000.00
Concession Road 8	County Road 4	County Road 12	$7,100,000.00
Concession Road 8	County Road 12	County Road 28 (Mildmay)	$6,600,000.00
Concession Road 8	Kinloss-Culross	Side Road 25 N	$3,900,000.00
Concession Road 8	Side Road 25 N	County Road 4	$4,100,000.00
County Road 4	Highway 9	County Road 6 (Teeswater)	$5,106,400.00
County Road 6	County Road 7 (Ripley)	County Road 1 (Holyrood)	$4,447,200.00
County Road 6	County Road 1 (Holyrood)	1242 Bruce County Road 6	$10,900,000.00
County Road 6	Side Road 25 N	County Road 4 (Teeswater)	$4,100,000.00
County Road 20	Highway 21	Side Road 20	$2,110,600.00
County Road 20	County Road 15	Highway 9	$6,039,300.00
Highway 9	County Road 4	Yonge Street (Walkerton)	$4,601,800.00
Huron Bruce Road	Field Road	Grey Road 10	$3,600,000.00
Kinloss-Culross	Concession Road 10	County Road 6	$3,300,000.00
Side Road 15	Concession Road 10	County Road 3	$1,200,000.00
Side Road 25 N	Concession Road 8	County Road 6	$2,100,000.00
Side Road 25 N	County Road 6	Concession Road 4	$1,900,000.00
Statters Lake Avenue	County Road 1	Kinloss-Culross	$1,512,000.00
Wolfe Street	County Road 6	County Road 86	$7,600,000.00

6.3.1 Concession Road 10

Concession Road 10 in the MSB was identified for a potential reconstruction from Kinloss-Culross Road to Side Road 15 if selected as a haul route or access road. The section from Kinloss-Culross Road to County Road 4 are considered high priority, while from County Road 4 to Side Road 15 are medium priority. The estimated price per segment is listed in **Table 6-2** above.

Multiple segments of Concession Road 10 within these limits have been recommended for reconstruction or resurfacing in the next five years per the *Municipality of South Bruce Road Condition Assessment* report (Cobide Engineering Inc., 2020).

6.3.2 Concession Road 4

Concession Road 4 in the MSB was identified for a potential Mill & Overlay from Side Road 25 N to County Road 28 if selected as a haul route. All segments are considered medium priority. The estimated price per segment is listed in **Table 6-2** above.

Multiple segments of Concession Road 4 within these limits have been recommended for reconstruction or resurfacing in the next five years per the *Municipality of South Bruce Road Condition Assessment* report (Cobide Engineering Inc., 2020). One section of Concession Road 4, from County Road 12 to Side Road 5A has been identified in that report as needing a reconstruction immediately. As the sections of road identified in this project are larger than the sections used in the *Municipality of South Bruce Road Condition Assessment* report (Cobide Engineering Inc., 2020) our recommendations vary slightly and anything identified as urgent in that report should be treated as so.

6.3.3 Concession Road 8

Concession Road 8 in the MSB was identified for a potential reconstruction from Kinloss-Culross Road to County Road 28 if selected as a haul or access road. All segments are considered high priority. The estimated price per segment is listed in **Table 6-2** above.

Multiple segments of Concession Road 8 within these limits have been recommended for reconstruction or resurfacing in the next five years per the *Municipality of South Bruce Road Condition Assessment* report (Cobide Engineering Inc., 2020). Due to the needs of this project our roadway reconstruction design likely exceeds the scope of the proposed reconstruction design based on the *Municipality of South Bruce Road Condition Assessment* report. Our reconstruction design is based on the typical cross-section for “last mile” roads and includes widening based on the potential increased truck traffic due to construction and hauling.

6.3.4 Bruce County Road 4

Bruce County Road 4 was identified for a potential rehabilitation from Highway 9 to County Road 6. This segment is considered medium priority. The estimated price per segment is listed in **Table 6-2** above.

6.3.5 Bruce County Road 6

Bruce County Road 6 was identified for a potential reconstruction from County Road 1 to County Road 4 and a mill and overlay and shoulder widening from County Road 7 to County Road 1. The reconstruction segments are considered high priority and the other segment is low priority. The estimated price per segment is listed in **Table 6-2** above.

6.3.6 Bruce County Road 20

Bruce County Road 20 was identified for a potential mill and overlay from Highway 21 to Side Road 20, and a rehabilitation from County Road 15 to Highway 9. These segments are considered low priority. The estimated price per segment is listed in **Table 6-2** above.

Bruce County has identified County Road 20 to undergo a rehabilitation treatment in 2030 (County of Bruce, 2021).

6.3.7 Highway 9

Highway 9 was identified for a potential mill and overlay from County Road 4/20 to Yonge Street (Walkerton). This segment is considered low priority. MTO is scheduled to undertake this work by 2024 (Ontario Ministry of Transportation, 2022). The estimated price per segment is listed in **Table 6-2** above.

6.3.8 Huron Bruce Road

Huron Bruce Road in South Bruce was identified for a potential reconstruction from Field Road to Grey Road 10 if selected as a haul route. This segment is considered low priority. The estimated price per segment is listed in **Table 6-2** above.

Between Grey Road 10 and Highway 9, this road has been recommended for resurfacing in the next five years per the *Municipality of South Bruce Road Condition Assessment* report (Cobide Engineering Inc., 2020).

6.3.9 Kinloss-Culross Road

Kinloss-Culross Road in South Bruce was identified for a potential reconstruction from Concession Road 10 to County Road 6. This segment is considered high priority. The estimated price per segment is listed in **Table 6-2** above.

Between Concession Road 8 and County Road 6, this road has been recommended for resurfacing in the next five years per the *Municipality of South Bruce Road Condition Assessment* report (Cobide Engineering Inc., 2020).

6.3.10 Side Road 15

Side Road 15 in South Bruce was identified for a potential reconstruction from Concession Road 10 to County Road 3 if selected as a haul route. This segment is considered medium priority. The estimated price per segment is listed in **Table 6-2** above.

6.3.11 Side Road 25 N

Side Road 25 N in South Bruce was identified for a potential reconstruction from Concession Road 8 to Concession Road 4 if identified as a haul or access road. All segments are considered high priority. The estimated price per segment is listed in **Table 6-2** above.

6.3.12 Statters Lake Avenue

Statters Lake Avenue in Huron-Kinloss was identified for a potential mill and overlay, and shoulder widening from County Road 1 to Kinloss-Culross Road if selected as a haul or access route. Due to notable horse & buggy traffic on this road, it is expected that Statters Lake Avenue will likely not be selected for this purpose. This segment is considered medium priority. The estimated price per segment is listed in **Table 6-2** above.

6.3.13 Wolfe Street

Wolfe Street in Huron-Kinloss was identified for a potential reconstruction from County Road 6 to County Road 86 if selected as a haul route. This segment is considered high priority. The estimated price per segment is listed in **Table 6-2** above.

6.4 Potential Intersection Improvements

Intersection improvements should be considered at various locations in the “Last Mile” to accommodate increased frequency of large truck turning movements. This list should be refined once haul routes are established for the Project. Other factors that should be considered in

future determinations of warranted intersection improvements due to road geometrics include the frequency of turning movements by large vehicles and anticipated use by UFTS, among others. Turning templates for truck movements at intersections within the “Last Mile” are located in **Appendix G**, and corners that may warrant widening are identified therein.

Other intersection capacity and operational improvements that could be considered based on projected traffic volumes are identified in the *Local Traffic Study* (Morrison Hershfield, 2022), and summarized below for completeness.

A consolidated list of potential intersection improvements is shown in **Table 6-2** above, and would be considered high priority if located on a haul route. Each intersection widening would cost approximately $50,000 (2022 dollars) per location. This figure does not include the addition of turning lanes, nor traffic signals.

6.5 Potential Bridge & Culvert Improvements

The following existing structures are located within the “Last Mile” area or along routes identified as potential material/supply routes as per the study network, and may require replacement, rehabilitations and/or repairs, based on the future intended use of the roadway that each of them carries. The structure locations are included in **Appendix D**. It is noted that some of the work scope identified below is recommended based on the existing condition of the structures and would be required independent of the Project. It is recommended that design requirements of the Project (e.g., widths and load capacity), if any, be considered in any structure works undertaken during the pre-construction planning or site preparation phases of the Project. Consideration should be given to upgrading structures to match the capacity and width of roadways which may be upgraded. Future studies could establish improvement scopes for any structures impacted by the potential Project, including those listed below, as well as others (e.g., non-structural drainage culverts).

6.5.1 MSB Structure No. 0003 (Lorenz Bridge)

Lorenz Bridge crosses twin-cell corrugated steel pipe (CSP) arch culverts, each with a diameter of 5.5 m. The structure carries Concession Road 4. The bridge was assessed as documented in the MSB 2020 Municipal Bridge Inspection Report (R.J. Burnside & Associates Limited, 2020). In the report bolt hole cracking is noted within both barrels. Minor rehabilitation is recommended within 1 year resulting in an estimated cost of $234,000 (2020 dollars). The installation of a roadside safety system alone would be an estimated cost of $54,000 (2020 dollars).

Adjustments, including extension to the culvert may be required if Concession Road 4 is identified as a primary access point to the potential Project Site, due to the recommended reconstruction and widening of the roadway.

6.5.2 MSB Structure No. 0004 (Kennedy Bridge)

Kennedy Bridge is an existing corrugated steel pipe (CSP) arch culvert with a diameter of 6 m. It was constructed in 1982 and carries Concession Road 4. The bridge was assessed as documented in the MSB 2020 Municipal Bridge Inspection Report (R.J. Burnside & Associates Limited, 2020). The structure appears to be in good condition showing no major signs of deterioration. Installation of a roadside safety system is recommended at an estimated cost of $54,000 (2020 dollars).

Adjustments, including extension to the culvert may be required if Concession Road 4 is identified as a primary access point to the potential Project Site, due to the recommended reconstruction and widening of the roadway.

6.5.3 MSB Structure No. 0007 (Green Bridge)

Green Bridge is an existing single-lane concrete through girder bridge that carries Side Road 25N over the Teeswater River approximately 180 m north of Bruce County Road 6. The bridge was assessed as documented in the MSB 2020 Municipal Bridge Inspection Report (R.J. Burnside & Associates Limited, 2020). It was noted in the report that rehabilitation of the existing bridge would not be feasible, and that replacement of the structure is recommended, at an estimated cost of $2,127,000 (2020 dollars).

The current load limit of the bridge is 11 tonnes (R.J. Burnside & Associates Limited, 2020). Replacement of the bridge is therefore required if Side Road 25N is identified as a primary access point for the Project. It is further recommended that the new bridge provide one lane in each direction for traffic.

6.5.4 MSB Structure No. 0008 (McPherson Bridge)

McPherson Bridge is an existing steel truss bridge that carries Concession Road 8 over the Teeswater River approximately 865 m west of Side Road 25N. The bridge was assessed and documented in the MSB 2020 Municipal Bridge Inspection Report (R.J. Burnside & Associates Limited, 2020). The report recommends that a load limit evaluation be performed on this bridge due to its type and condition. Per the report, recommended work on this bridge includes rehabilitation within two years (at an estimated cost of $754,000 in 2020 dollars), or replacement within twelve years (at an estimated cost of $2,357,000 in 2020 dollars).

If Concession Road 8 is identified as a primary access point to the potential Project Site, it is recommended that rehabilitation and/or replacement of this bridge be performed during the site preparation phase of the Project. It is recommended that the bridge be designed to convey two-way traffic, including heavy vehicles. While rehabilitation and replacement options for this bridge are presented, the adequacy of the bridge rehabilitation option to fulfill this purpose would need to be verified.

6.5.5 MSB Structure No. 0009 (Leahy Bridge)

The Leahy Bridge carried Side Road 25 N over the Teeswater River and was located between Concession Roads 8 and 10. Its' superstructure was removed in 2013, making this stretch of Side Road 25 N discontinuous. The structure was assessed and documented in the MSB 2020 Municipal Bridge Inspection Report (R.J. Burnside & Associates Limited, 2020). The abutments are still in place. If re-opening of Side Road 25 N be planned, further review of the condition of the abutments would be required, in addition to construction of a new superstructure. The report estimates the cost of like-for-like replacement at $1,849,500 (2020 dollars).

If this segment of Side Road 25 N is re-opened and intended for use as an access route to the potential Project Site, it is recommended that the new bridge be designed to convey two-way traffic, including heavy vehicles.

6.5.6 MSB Structure No. 0010 (Culross Concession 10 Bridge)

The Culross Concession 10 Bridge is an existing precast concrete I-girder bridge that carries Concession Road 10 over the Teeswater River. The bridge was assessed and documented in the MSB 2020 Municipal Bridge Inspection Report (R.J. Burnside & Associates Limited, 2020). The bridge was constructed in 2009 and remains in excellent condition. It is noted in the report that some minor rehabilitation scope is recommended to primarily address settlement issues at the approach slabs, at an estimated cost of $56,400 in 2020 dollars.

Given the age, condition and width of the bridge, it is not anticipated that further (non-routine) rehabilitation would be required if Concession Road 10 is identified as a primary access point to the potential Project Site.

6.5.7 MSB Structure No. 0011 (Donaldson Bridge)

Donaldson Bridge is an existing steel I-girder bridge that carries Concession Road 10 west of Side Road 10b. The bridge was assessed as documented in the MSB 2020 Municipal Bridge Inspection Report (R.J. Burnside & Associates Limited, 2020). The bridge was constructed in 2018, and it remains in excellent condition. No repairs are expected to be required for the next 10 years.

Given the age, condition and width of the bridge, it is not anticipated that further (non-routine) rehabilitation would be required if Concession Road 10 is identified as a primary access point to the potential Project Site.

6.5.8 MSB Structure No. 0012 (Fischer Bridge)

Fischer Bridge is an existing corrugated steel pipe (CSP) arch culvert, with a diameter of 5.4 m that carries Concession Road 10. The bridge was assessed as documented in the MSB 2020 Municipal Bridge Inspection Report (R.J. Burnside & Associates Limited, 2020). The structure appears to be in good condition. Installation of a roadside safety system is recommended at an estimated cost of $54,000 (2020 dollars).

Adjustments, including extension to the culvert may be required if Concession Road 10 is identified as a primary access point to the potential Project Site, due to the recommended reconstruction and widening of the roadway.

6.5.9 MSB Structure No. 0024

MSB Structure No. 0024 is an existing concrete rigid-frame bridge overlain with granular and earth fill that carries Concession Road 8 over a waterbody approximately 960 m west of Side Road 25N. The bridge was assessed as documented in the MSB 2020 Municipal Bridge Inspection Report (R.J. Burnside & Associates Limited, 2020). In the report, it is suggested that replacement or removal of the structure would be most economical, instead of rehabilitation. Removal could be an option subject to a review of the necessity of this structure to convey flow, in which case it could be replaced with a road embankment. The report indicates that replacement of the structure would cost an estimated $555,500, and installation of roadside safety hardware would cost an estimated $54,000 (2020 dollars).

If Concession Road 8 is identified as a primary access point to the potential Project Site, it is recommended that replacement or removal of this bridge be performed during the site

preparation phase of the Project. It is recommended that the bridge be designed to convey two-way traffic, including heavy vehicles, and that appropriate roadside safety treatments be applied.

6.5.10 MSB Structure No. 0025

MSB Structure No. 0025 is an existing corrugated steel pipe (CSP) culvert constructed in 2020, and carries Concession Road 10 over a watercourse, approximately 580 m west of County Road 4. The bridge was assessed as documented in the MSB 2020 Municipal Bridge Inspection Report (R.J. Burnside & Associates Limited, 2020). Beyond routine maintenance, installation of a roadside safety system, at an estimated cost of $54,000 (2020 dollars), is the only short-term work required at this culvert, as recommended by the Burnside report.

Adjustments, including extension to the culvert may be required if Concession Road 10 is identified as a primary access point to the potential Project Site, due to the recommended reconstruction and widening of the roadway.

6.5.11 MSB Structure No. 1020

MSB Structure No. 1020 is an existing corrugated steel pipe (CSP) arch culvert, with a diameter of 2.7 m that carries Field Road (Sideroad 25S). The bridge was assessed as documented in the MSB 2020 Municipal Bridge Inspection Report (R.J. Burnside & Associates Limited, 2020). The overall condition of the culvert is good with no significant surface corrosion. Installation of a roadside safety system is recommended at an estimated cost of $54,000 (2020 dollars).

Adjustments, including extension to the culvert may be required if Concession Road 4 is identified as a primary access point to the potential Project Site, due to the recommended reconstruction and widening of the roadway.

7 SUMMARY

7.1 Key Findings

The following are the key findings & conclusions of this *Road Conditions Study*:

1. All roads within the Study Area are expected to require rehabilitation(s) and or reconstruction during the lifespan of the Project, given its long duration. The traffic increases within the road network that are generated by the Project may result in an incrementally shorter lifespan of some roads. Life cycle impacts may be quantified in future studies based on incremental equivalent single axle loads (ESAL) and using typical roadway deterioration curves. This cannot be quantified at this time as a geotechnical investigation has not been performed and the existing pavement structures are generally unknown. Additionally, exact access and hauling routes being used for the project have not yet been determined. Regular monitoring and maintenance of roads in proximity to the potential Project Site is recommended to maximize the lifespan of pavements.

2. Numerous roads within the “Last Mile” may warrant improvements (mostly reconstructions) if selected for use as haul routes or access roads to the potential Project Site. These improvements would primarily be required to provide the required roadway width and cross-section to accommodate Project operations, to accommodate increased traffic, and to eliminate seasonal load restrictions that existing municipal roads are subject to.

3. Widenings may be considered at some intersections within the “Last Mile” to accommodate a potentially higher volume of heavy vehicles.

4. Existing bridges & culverts within the “Last Mile” are identified for rehabilitation and/or replacements based on their existing conditions, independent of the Project. If the roads that these structures support are identified as haul routes or access roads to the potential Project Site, it is recommended that Project requirements be considered in the pending rehabilitation/replacement work scopes.

5. The potential road improvements identified in this report should be revisited once haul routes for construction vehicles and used nuclear fuel transport, and access routes for the Project have been established. At that point, improvements to the roads expected to be subject to the greatest effects from the Project could be advanced; others identified as not having little or no effect as a result of the Project may not need to be undertaken. For clarity, not all potential road improvements identified in this report are expected to be required in support of the Project.

6. The *Road Conditions Study* provides information that the NWMO and MSB can use to inform agreements and funding arrangements (as described by Principles #30 and #31) in the future as part of negotiations of a draft hosting agreement and/ or subsequent studies/ discussions if the South Bruce Area is ultimately selected as the Project location. For clarity, development of these types of agreements/arrangements is not part of the objectives / work plan for this study.

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APPENDIX A

List of Socio-Economic Community Studies

List of Socio-Economic Community Studies

Study Name	Study Proponent	Lead Consultant
Local Economic Development Study and Strategy	MSB	MDB Insight (now Deloitte LLP)
Economic Development Study on Youth	MSB	MDB Insight (now Deloitte LLP)
Local Hiring Effects Study & Strategy	MSB	MDB Insight (now Deloitte LLP)
Agriculture Business Impact Study	MSB	MDB Insight (now Deloitte LLP)
Fiscal Impact and Public Finance Study	MSB	Watson & Associates Economists
Tourism Industry Effects Study and Strategy	MSB	MDB Insight (now Deloitte LLP)
Housing Needs and Demand Analysis Study	NWMO, MSB	Keir Corp.
Labour Baseline Study	NWMO	Keir Corp.
Workforce Development Study	NWMO	Keir Corp.
Regional Economic Development Study	NWMO	Keir Corp.
Effects on Recreational Resources	MSB	Tract Consulting
Local/Regional Education Study	NWMO, MSB	DPRA
Land Use Study	NWMO, MSB	DPRA
Social Programs Study	NWMO, MSB	DPRA
Emergency Services Study	NWMO	DPRA
Vulnerable Populations Study	NWMO	DPRA
Community Health Programs and Infrastructure Study	NWMO	DPRA
Aggregate Resources Study	NWMO, MSB	Keir Corp.
Infrastructure Baseline and Feasibility Study	NWMO	Morrison Hershfield
Local Traffic Study	NWMO	Morrison Hershfield
Road Conditions Study	NWMO	Morrison Hershfield

APPENDIX B

Inventory of Knowledge Holder Interviews

List of Knowledge Holder Interviews and Key Findings

The table below includes an inventory of Knowledge Holders interviewed in 2021 applicable to the *Road Conditions Study*. Names and titles have been excluded to respect the privacy of individuals.

Date	Knowledge Holder Organization	Applicable Studies
Oct 13, 2021	Bruce County	Road Conditions Local Traffic
Oct 14, 2021	Municipality of South Bruce, Public Works	Road Conditions Local Traffic Aggregate
Oct 14, 2021	Huron County	Road Conditions Local Traffic
Oct 20, 2021	Township of Huron-Kinloss	Road Conditions Local Traffic

The table below presents key findings from the Knowledge Holder interviews relevant to this study.

Topic	Key Findings
Traffic	• County Roads 4 (Hanover-Walkerton), 13 (near Sauble Beach) and 20 (near Bruce Power) are currently busy and may require future improvements. • There have been traffic concerns on the roads in proximity to Bruce Power, though these have subsided somewhat due to the pandemic. • Municipal roads are generally low-volume with significant agricultural traffic.
Pavements and Load Restrictions	• Reduced loads are required on some Bruce County roads in the spring. • Municipal (South Bruce) roads in proximity to the potential Project Site would require upgrades for heavy vehicles. Most roads are load restricted to 5,000 lbs. per axle in March and April of each year. Rare exceptions can be granted.
Road Condition Data	• Bruce County conducted a road condition review in 2020 and will be again in 2022. Ontario Structure Inspection Manual (OSIM) inspections take place regularly. • South Bruce does not have significant geotechnical information on municipal roads but completed a road condition assessment. • Huron-Kinloss has completed OSIM inspections on its structures.

Topic	Key Findings
Operations	• Highway 21 is occasionally shut down in the winter due to weather. • The primary truck access route to Bruce Power is via County Road 20, County Road 1 and Highway 9.
Planned Improvements	• Due to fatalities at Highway 9 and County Road 3, there has been pressure to upgrade this intersection. • Roundabouts are being considered for addition at numerous locations within Bruce and Huron Counties. • South Bruce upcoming planned work is primarily to maintain and resurface roads (as opposed to structural improvements). • Currently planned road works were available from some jurisdictions.
Mennonites	• Notable Mennonite population is located in the area around Holyrood. • These communities see higher levels of horse and buggy or pedestrian traffic. • Most municipal roads have narrow or no shoulders, therefore mitigation measures would need to be considered if traffic were to increase.

APPENDIX C

Road Conditions Data

Provided as a stand-alone pdf file

APPENDIX D

Road Conditions Study Network

Provided as a stand-alone pdf file

APPENDIX E

Load Restricted Roads

Provided as a stand-alone pdf file

APPENDIX F

Potential Road Improvements

Provided as a stand-alone pdf file

APPENDIX G

Truck Turning Templates

Provided as a stand-alone pdf file

APPENDIX H

List of Acronyms

List of Acronyms

APM..... Adaptive Phased Management
CSP ..... Corrugated Steel Pipe
DGR..... Deep Geological Repository
DPRA..... DPRA Canada Inc.
IA ..... Impact Assessment
MSB..... Municipality of South Bruce
MTO..... Ontario Ministry of Transportation
NWMO..... Nuclear Waste Management Organization
OSIM ..... Ontario Structure Inspection Manual
PCR ..... Pavement Condition Rating
RCR..... Ride Condition Rating
SADT ..... Seasonal Average Daily Traffic
UFTP ..... Used Fuel Transportation Package
UFTS ..... Used Fuel Transport System