APPENDIX A

Terms of Reference and Concordance Table

Saskatchewan Ministry of Highways - Highway 914 Extension and Key Lake By-pass Project

Terms of Reference for Environmental Impact Statement

Prepared for:
Saskatchewan Ministry of Environment – Environmental Assessment Branch

Prepared by:
Stantec Consulting Ltd. on behalf of Saskatchewan Ministry of Highways

July 20, 2016

Table of Contents

Stantec

1.0 INTRODUCTION

Saskatchewan Ministry of Highways and Infrastructure (MHI; the Proponent) is proposing a highway expansion project consisting of two components: 1) construction and operation of approximately 51 to 54 km of all-weather roadway that will extend Highway 914 starting near the McArthur River mine site to an existing road near the Cigar Lake mine site in northern Saskatchewan; and, 2) construction and operation of an approximate 5 km all-weather road by-pass to route traffic around Cameco's Key Lake uranium mine site. The two components are termed the Highway 914 Extension and the Key Lake By-pass, respectively, and collectively make up the Project. When completed, both components will become part of the public road network in the area. Additionally, MHI is considering a 14.4 km route option (as an alternative to a portion of the preferred route) to avoid the McArthur River Mine Site surface lease to prevent future development constraints, and for safety and security purposes. If the McArthur River By-pass option is selected as part of the final preferred route, the roadway would be 53.7 km in length.

The Project has been deemed a 'development' as defined by Section 2(d) of Saskatchewan's Environmental Assessment Act (SKEAA). The Project has been previously reviewed by the Canadian Environmental Assessment Agency (CEA Agency) pursuant to the Canadian Environmental Assessment Act (CEAA) and it was determined that the Project will not be subject to regulation under the Act as stated in a Notice of Termination issued by the CEA Agency (CEA Agency 2014).

These terms of reference (TORs) are intended to guide the preparation of the Environmental Impact Statement (EIS) in accordance with SKEAA with respect to the Project and have been prepared in consideration of the Saskatchewan Ministry of Environment's (SKMOE) *Guidelines for the Preparation of the Terms of Reference* (SKMOE 2014)

2.0 PROPOSED PROJECT OVERVIEW

2.1 PROJECT DESCRIPTION

MHI commits to providing a detailed project description of the proposed Project in the EIS. The project description will describe components of the Project phases, including construction, operation and maintenance, and decommissioning.

The project description will:

- Provide a profile of the proponent, name of the legal entity, contact person and mailing address.

- Identify the Project location (i.e., site coordinates) and provide maps that identify Project and local study areas in relation to nearby communities. Other past, present or reasonably foreseeable future projects in the study area will also be identified.
- Provide appropriately-scaled maps and/or figures of the Project components and activities. A GIS shapefile, in NAD 1983 datum Zone 13 of the Project's spatial boundaries will be included with the digital submission.
- Describe on-site components, associated on-site and off-site infrastructure and other facilities associated with the proposed Project. This will include, but not be limited to:
  - Associated Infrastructure (e.g., bridges, culverts, etc.)
  - Temporary work camps
  - Temporary work spaces
  - Borrow pits
  - Air emission management
  - Water management, including withdrawal volume and use.
  - Access Management
  - Wastewater management
  - Waste management
  - Environmental management framework
- Describe activities associated with the construction, operation, and decommissioning phases of the proposed Project.
- Indicate the expected arrangement of responsibilities for the construction and operation of the proposed Project.
- Describe the capital construction phase and the predicted duration of the Project.
- Describe the benefits of the Project, including jobs created, local training employment and business opportunities.

2.2 PROJECT BOUNDARIES

The Project's spatial and temporal boundaries will be defined in the EIS. The spatial and temporal boundaries will take into account ecological, technical and social considerations and, therefore, have the potential to vary for the different valued components (VCs), depending on the nature of potential environmental effects. Temporal and spatial boundaries will be developed for each VC in consideration of the:

- Nature and timing/scheduling of Project activities;
- Spatial extent of potential effects;
- Natural variations of each VC;
- Time required for recovery from an environmental effect; and

- Potential for cumulative environmental effects.

2.2.1 Spatial Boundaries

The spatial boundaries will reflect the geographic range over which the Project's environmental effects may occur, recognizing that some environmental effects will extend beyond the immediate Project area. Spatial boundaries include the following:

- **Project Development Area (PDA)** encompasses the Project footprint and is the anticipated area of physical disturbance associated with the construction and operation of the Project.
- **Local Assessment Area (LAA)** is the area in which both: a) project-related environmental effects (direct or indirect) can be predicted or measured with a level of confidence that allows for assessment; and b) there is a reasonable expectation that those potential effects in the LAA will be a concern. The LAA encompasses the PDA and is VC specific.
- **The Regional Assessment Area (RAA)** is the area that establishes the context for determining significance of project-specific effects. It is also the area within which potential cumulative effects are evaluated. The residual effects from the Project in combination with those of past, present and reasonably foreseeable projects are assessed. The RAA encompasses the PDA and the LAA.

2.2.2 Temporal Boundaries

Temporal boundaries identify when an environmental effect may occur in relation to specific Project activities and physical works. In the EIS, the temporal boundaries will be based on the timing and duration of Project activities and the nature of the interactions with each VC. The temporal boundaries of the Project will include construction, operation and maintenance, and decommissioning.

2.3 PROJECT ALTERNATIVES

Technically and economically feasible alternatives for the Project will be described and considered in the EIS. A discussion of the potential constraints (i.e., environmental, social, technical) that were considered relative to any such alternatives will be included in the EIS. The information presented will be in the form of tables, figures, and text presenting the issues and outcomes, and environmental advantages and disadvantages associated with alternative routes that were considered.

2.3.1 Selection of the Preferred Route and Description of the Full Project

A detailed description of the preferred route will be provided. The information presented will include the rationale for selection of the preferred route along with how the current environmental conditions, predicted environmental effects, and consultation and engagement results were considered in the decision making. The following details will be included in the description of the preferred route:

- Locations (depicted on a maps and explained in text) of highway routes and rights-of way, access roads, and intersections at an appropriate scale and with identifiable geographic and environmental features, surface and groundwater resources, current land use and nearby communities, residences, and industries;
- A detailed map showing the Project area in relation to surrounding topographic and land-use features. Mapping will place the Project in the context of current protected area reserves, Treaty land entitlement lands, recreational areas, wildlife protection lands, communities, and heritage resource sites;
- The anticipated schedule of all phases of the Project;
- Descriptions of timing and methods proposed for the activities related to stream crossing construction (e.g., bridge construction, culvert placement, coffer dams, dewatering, erosion control);
- Information for locations where the roadway will cross a fish-bearing stream;
- A summary of the potential environmental effects; and
- A description of mitigation measures for each potential environmental effects.

2.4 ANCILLARY PROJECTS

Locations of ancillary projects associated with the Project will be presented in the EIS if known. These locations will be presented at an appropriate scale and with identifiable geographic and environmental features, surface and ground water resources, current land use and nearby communities, residences, and industries.

2.5 REGULATORY REQUIREMENTS

The Project has been deemed a 'development' as defined by Section 2(d) of SKEAA. The Project has been previously reviewed by the CEA Agency pursuant to the CEAA and it was determined that the Project will not be subject to regulation under the Act as stated in a Notice of Termination issued by the CEA Agency (CEA Agency, 2014).

The EIS will describe the regulatory framework for the Project, including a listing of known required provincial and federal approvals, permits and licences for the Project should EA approval be provided for the Project to proceed.

3.0 VALUED COMPONENTS

The EIS will describe the existing environment of the Project area in sufficient detail to enable an understanding of how the current environmental conditions might be affected. The overall approach to identifying and describing Project effects will focus on VCs that will be presented in the EIS. VCs will focus on the environmental, social, cultural and economic factors that are of greatest relevance to the Project. The EIS will provide information that outlines the VC selection process, provide rationale as to why each VC was selected for assessment, summarize existing conditions for each VC, and describe potential Project related environmental interactions, effects and proposed mitigation.

The scoping of VCs in the EIS considers:

- Regulatory guidance and directives;
- Issues raised by Aboriginal peoples, regulatory agencies and other stakeholders;
- Technical aspects of the Project (i.e., the nature and extent of Project components and activities);
- Existing conditions where the Project will be located;
- Information collected related to the receiving environment during baseline field surveys
- Traditional knowledge (TK) obtained through Aboriginal engagement, and available traditional land use data and reports;
- Scientific literature;
- Data collected from previous environmental assessments in the Project area; and
- The professional judgment of the EA Study Team.

The VCs considered for assessment are listed below

- Atmospheric environment;
- Terrain and soil;
- Water resources;
- Aquatic resources, including fish and fish habitat;
- Vegetation and wetlands;
- Wildlife (including Species of Management Concern (SOMC)) and wildlife habitat;
- Traditional and non-traditional land and resource use; and
- Heritage resources.

Descriptions of potential VC's that were given consideration for the assessment are provided in the following sections.

3.1 ATMOSPHERIC ENVIRONMENT

3.1.1 Air Quality

Project construction activities will result in emissions of criteria air contaminants (CACs) and greenhouse gases (GHGs). These emissions are expected to be minor, transient in nature, and will occur only for a short period of time. Emissions resulting from construction activities for a road such as this are well understood and proven mitigation measures are known. It is anticipated that the resulting environmental effects can be managed to meet air quality guidelines using standard mitigation measures and best management practices.

Vehicle exhaust emissions during Project operation will similarly result in the release of CACs and GHGs to the atmospheric environment. However, given the low anticipated traffic volumes for the proposed highway, air emissions from Project operation are expected to represent only a negligible incremental increase above the air emissions associated with existing roads and highways currently operating in northern Saskatchewan. Furthermore, the proposed highway will offer a more direct route that will reduce total travel time for vehicles, thereby also reducing associated air emissions. Accordingly, this VC will not require assessment.

3.1.2 Acoustic Environment

Noise and vibration emissions resulting from construction activities for a road such as this are well understood and proven mitigation measures are known. Due to the remote nature of the Project, the lack of permanent residences within 5 km of the Project, the low traffic volumes during operation, it is anticipated that effects to the acoustic environment will be negligible. Accordingly, this VC will not require assessment.

3.2 TERRAIN AND SOIL

Due to the potential for environmental and construction related constraints, the alignment of the proposed highway will avoid sensitive areas of terrain and soil wherever practical. Any sensitive areas that are crossed will be subject to site-specific mitigation measures (e.g., installation of erosion and sediment control materials). The degree to which the effects will occur on these resources are negligible at the local and regional scales, therefore this VC will not require assessment.

3.3 WATER RESOURCES

3.3.1 Hydrology and Surface Water Quality

The Project has the potential to affect local drainage patterns. MHI will obtain information on watersheds and local drainage patterns. MHI will also identify known sensitive areas where drainage patterns may be at risk to alteration as a result of Project related erosion and/or flooding events. MHI will assess the potential environmental effects on hydrology and surface water quality in the EIS as part of the Aquatic Resources VC.

3.3.2 Drinking Water Sources

Two drinking water resources (i.e., private groundwater wells or municipal surface water supply areas) are located within 5 km of the proposed highway. The owners of these wells will be identified in the EIS. These wells are located approximately 4.8 km from the Project and are not anticipated to interact with the Project. Accordingly, potential effects to drinking water sources will not require assessment.

3.4 AQUATIC RESOURCES

Construction of the all-weather roadway near streams or lakes could result in effects to fish and fish habitat, including increased sediment loading into fish habitat and impedance to fish movement. Therefore, this VC will be included in the EIS.

Fish habitat assessments were completed in 2010 for the Project and included qualitative and quantitative descriptions of channel and riparian features such as channel morphology, substrate type, and vegetation. Fish species composition, distribution, and relative abundance data was also collected for the Project in 2010. Due to the relatively long time scale over which stream crossing, fish habitat and fisheries conditions change in this area, data that was collected in 2010 is considered current and representative of the site conditions.

Results from 2010 surveys will be included in the EIS and will be supplemented with existing public information and data collected by Cameco on the presence or absence of fish since the 2010 stream crossing and fish and fish habitat surveys. Surveys will be conducted in 2016 at potential stream crossing locations on the McArthur River route option to describe habitat and channel morphology, as these areas have not been surveyed.

The EIS will include a description of each watercourse or waterbody proposed to be crossed as well as fish species known to occur in these features. Each proposed crossing location will be identified on a map (i.e., 1:50,000 topographic map). Areas functioning as fish habitat at crossing locations will be identified and characterized.

The data from these surveys will assist in evaluating both direct effects at crossings and indirect effects from increased access. To mitigate effects to lakes and related fish resources, the road has been routed to avoid lakes and to reduce the number of watercourse crossings.

3.5 VEGETATION AND WETLANDS

A large proportion of the PDA is previously undisturbed and therefore, Project activities will create changes in vegetation species and communities, including wetlands and other natural habitats that may contain plant SOMC or communities. Consequently, the EIS will consider Vegetation and Wetlands as a VC.

3.5.1 Vegetation

In order to determine how vegetation might be affected by the Project, the EIS will identify SOMC and other species of interest or concern that the Project might affect. For the purposes of this VC, SOMC include species that are:

- Listed as endangered or threatened under the Saskatchewan *The Wildlife Act* (1998);
- Listed as extremely rare (S1) or rare (S2) by the Saskatchewan Conversation Data Centre (SK CDC);
- Listed as endangered, threatened or of Special Concern under the *Species at Risk Act* (2002) and Committee on the Status of Endangered Wildlife in Canada (COSEWIC);
- Species listed in the Saskatchewan Activity Restriction Guidelines for Sensitive Species (SK MOE 2015); and
- Species identified as culturally significant during stakeholder consultation.

Methods used to evaluate the effects of the Project on vegetation will apply several approaches, including the use of historical data available from publicly-available online data sources and other available information, TK and traditional land use (TLU) information, data derived from detailed desktop mapping of land cover for the LAA, and data collected by field surveys. Land cover types included in the PDA will be characterized and quantified by percentage as well as areal extent.

Historical data on SOMC occurrences will be obtained from the SK CDC's online database, as well as reports from previously conducted field surveys in the Project area.

Data obtained from vegetation surveys conducted in 2010 will be supplemented with field surveys completed in 2015 and 2016 to provide current information about the occurrence of SOMC where appropriate. Rare plant surveys conducted in 2016 will follow SK MOE approved survey protocols.

Due to the remoteness of the Project location, current land cover, and the associated access constraints, surveys will be conducted approximately every 500 m. Each survey site will be surveyed using one of the following methods:

- Detailed ground plots for the collection of comprehensive species lists, and estimates of species cover;
- Simplified ground sites to validate desktop classifications and compile a list of dominant species; or,
- Aerial survey site (i.e., characterization of vegetation types from the helicopter to verify mapping units usually completed where landing sites are limited which make completing a ground-based survey difficult).

Rare plant field survey site selection will be informed by the detailed land cover mapping produced for the Project EIS using publicly available and acquired imagery and existing land cover layers (i.e., Northern Digital Land Cover dataset). Rare plant survey sites will be conducted in early and late seasons (i.e., June and August), with survey intensity weighted to the late season as vegetation will be established at wetlands at this time, which can be potential habitat for SOMC. Rare plant surveys will focus on the PDA.

Feasible mitigation measures will be identified for plant species where potential effects of the Project may occur in order to reduce or avoid effects, and following which an assessment of residual effects will be completed for the EIS.

3.5.2 Wetlands

The EIS will describe the potential Project interactions with wetlands including peatlands. In order to determine how wetlands might be affected by the Project, the EIS will describe measures to reduce or avoid Project related effects. The EIS will include consideration of wetland change and disturbance resulting from Project ground disturbance, including changes to drainage patterns affecting wetlands in both the PDA and areas adjacent to it.

Methods used to evaluate the effects of the Project wetlands will apply the use of publicly-available online data sources, acquired imagery for the Project, TK and TLU information, data derived from detailed desktop mapping of wetland for the LAA, and data collected by field surveys.

Data obtained from vegetation surveys conducted in 2010 will be supplemented with field surveys completed in 2015 and 2016 to provide current information about wetlands (e.g., class, size, etc.) within the LAA.

3.6 WILDLIFE AND WILDLIFE HABITAT

The proposed road and related ancillary features have the potential to affect wildlife SOMC, species of importance to local residents, wildlife habitat and wildlife behaviour. In order to determine how wildlife might be affected by the Project, the EIS will identify SOMC and other species of interest or concern that the Project might affect. For the purposes of this VC, the same criteria are used to define SOMC as are used for vegetation and wetlands.

Methods used to evaluate the effects of the Project on wildlife and wildlife habitat will apply several approaches including the use of historical data available from publicly-available online data sources and other available information, TK and TLU information, data collected by field surveys, and data derived from desktop analyses of habitat suitability.

Historical data on SOMC occurrences will be obtained from the SK CDC's online database, as well as other sources including eBird and Environment and Climate Change Canada's Bird Conservation Region Plans and reports from previously conducted field surveys in the Project area.

Data obtained from wildlife surveys conducted in 2010 and 2011 will be supplemented with field surveys completed in 2016 to provide current information about occurrence of SOMC where appropriate. All field surveys conducted in 2016 will follow SK MOE approved survey protocols. Information on how methods used for wildlife surveys in 2010 and 2011 deviate from current protocols will be described. The 2016 wildlife survey program will include surveys for:

- Boreal caribou;
- Raptor nests; and
- Colonial waterbirds.

The targeted field surveys will focus on identifying sensitive habitat features in the Project area that require specific mitigation measures to reduce or avoid effects. Due to the remoteness of the Project location and relative contiguous landscape of forest in the area, a habitat suitability approach will be applied to determine the potential Project effects to other wildlife SOMC. The habitat suitability approach will be based on known habitat requirements and preferences of wildlife SOMC and detailed land cover mapping produced for the Project EIS using publicly available and acquired imagery and existing land cover layers (i.e., Northern Digital Land Cover dataset). An assessment of change in suitable habitat will be used to infer potential effects to populations of wildlife SOMC and effects to populations.

Mitigation measures will be identified for wildlife species where potential effects of the Project may occur in order to reduce or avoid effects, and following which an assessment of residual effects will be completed for the EIS.

3.7 TRADITIONAL AND NON-TRADITIONAL LAND AND RESOURCE USE

3.7.1 Traditional Land and Resource Use

The Project and related ancillary features have the potential to affect lands and resources associated with traditional use and values of Aboriginal communities. Aboriginal communities to be engaged with regards to traditional land and resource use (TLRU) will be defined in consultation with the SK MOE.

The EIS will describe traditional hunting and gathering activities, and spiritual and ceremonial practices to expand on work currently available from the 2011 *Social and Environmental Impact Assessment for the Construction of Highway 914: Local and Traditional Knowledge Contribution* prepared by the Athabasca Land Office of the Prince Albert Grand Council.

In continuing this work, MHI will take guidance from the Government of Saskatchewan First Nation and Métis Consultation Policy Framework (Government of Saskatchewan 2010). MHI will continue and expand on the discussions with traditional harvesters and knowledge holders from the communities named above to gather meaningful data on TLRU that may be affected by the Project. Methods include community engagement and participant interviews. From community engagement, agreements for sharing TLRU information that are meaningful to the community will be made. Following that, data will be gathered through participant interviews. Available existing traditional land use material for the area will be consulted as well. Data will be recorded in the form of interview notes and map biographies. Maps containing spatial information on TLRU in relation to the proposed development will be created. Description of TLRU will include the following study tasks:

- Literature review (establishing current baseline data);
- Engagement with affected communities (see Section 6.0);
- TLRU interviews and map biographies. Individual or group interviews to record traditional use activities and areas relevant to the Project;
- Draft report; and
- Verification and release of TLRU information to the EIS. Participants in the TLRU study will review the draft report, verify its content and/or suggest revisions. Once there is a verified version of the report, an agreement will be made with each community to release those TLRU data they consider appropriate for informing the EIS.

3.7.2 Non-Traditional Land and Resource Use.

Project construction activities may result in changes to land and resource use. As well, the operation of the roadway, may create environmental effects on current and future adjacent land and resource uses. Consequently, the EIS will consider Land and Resource Use as a VC.

The Proponent will establish the current baseline regarding non-traditional uses and values, associated with the lands and resources (e.g. hunting, trapping, fishing, outfitting, mining, tourism, recreation, wilderness, etc.) that may be affected by the Project. Data will include the known locations of planned facilities, including recreational facilities and outfitting camps in the area of the proposed road.). Natural and recreational resources also will be described for areas relevant to the Project. These data will be obtained from appropriate government sources and engagement with:

- Regional economic development agencies;
- Regional communities;
- Aboriginal communities and organizations; and
- The public through open houses, questionnaires and feedback from communications on regarding the Project.

3.8 HERITAGE RESOURCES

The Project has the potential to interact with heritage resources; therefore, heritage resources are considered as a VC. Field work for a Heritage Resource Impact Assessment (HRIA) was conducted on the preferred route in 2010. Additional field work was conducted in 2015 on a section of the preferred route that was not surveyed in 2010. Field work followed the criteria set by Saskatchewan Ministry of Parks Culture and Sport – Heritage Conservation Branch and therefore, data collected is considered valid and will be presented in the EIS.

A HRIA will be completed for the components of the Project not examined in the 2010 or 2015 studies. These include the McArthur River By-pass option and the Key Lake By-pass component.

The HRIA will include:

- Permitting: The study will be done under a permit from the Heritage Conservation Branch (HCB) of the Saskatchewan Ministry of Parks, Culture and Sport, to fulfill regulations and requirements of the *Heritage Property Act*;
- Pre-field Planning: Pre-field activities include reviewing existing baseline data, preparing field maps and equipment and developing a safe work plan and arranging transportation and local logistics;
- Fieldwork: Fieldwork will include two pedestrian transects and test excavations at locations considered by the Project archaeologist to be of high archaeological potential. Any archaeological resources encountered will be recorded for description in the report and development of mitigation strategies. A Saskatchewan Archaeological Resource Record (SARR) will be completed for each resource discovered in the study area; and
- Reporting: A report of background, methods, results and recommendations as well as completed SARRs will be completed and submitted to HCB for review.

4.0 ENVIRONMENTAL ASSESSMENT

In developing an EIS that reflects current environmental conditions in the study area, existing data will be used to the extent possible. Existing data will be supplemented with field data as necessary to describe the environment and potential effects. The data in the EIS will satisfy the following criteria:

- The baseline data will describe the existing environment at an appropriate level of detail and scope to support the assessment of environmental effects; and
- The EIS will concentrate on those issues of major environmental and social importance.

4.1 BASELINE INFORMATION

An overview of the environmental setting will be described in the EIS to a level of detail that supports the assessment of environmental effects. This includes an overview of information for VCs that were screened out for inclusion in the Project-specific effects assessment. With respect to the VCs selected for the Project, the biophysical and socio-economic components that may be affected by the Project will be discussed in detail in the EIS. Baseline information on the following biophysical and socio-economic components will be provided in the EIS for the purposes of undertaking the effects assessment:

- Aquatic resources
- Terrestrial Environment (i.e., vegetation and wetlands, and wildlife and wildlife habitat)
- Traditional and non-traditional land and resource use; and
- Heritage resources

For this discussion, baseline characteristics will be described in a manner that allows for the evaluation of how VCs may be affected by the Project throughout the different Project phases. Additionally, data collected for other studies in the Project area will be used to supplement field data and predict potential Project-related effects. Data that is presented in the EIS will be summarized as appropriate.

4.2 EFFECTS ASSESSMENT

In conducting the EA, potential environmental effects will be considered in a systematic manner. The EA methodology used will be described in the EIS. The results of the EA will be presented using matrices and tabular summaries where appropriate. For the environmental effects (including cumulative effects) that are identified by the EA, feasible mitigation measures will be described. Residual effects of the Project and a determination regarding the significance of effects after mitigation measures will be discussed.

4.2.1 Project-Specific Effects Assessment

The EA will evaluate the significance of the Project-specific effects on each selected VC in the EIS. Potential effects will be characterized in terms of their direction, magnitude, geographic extent, and frequency during each of the Project phases. The methods and assumptions used to estimate the Project-specific effects will be documented and a rationale provided for the conclusions. Gaps in the quality of data that limit the analysis and conclusions will be explained and appropriate limitations placed on the confidence in predictions.

4.2.2 Regional Effects Assessment

Potential cumulative environmental effects will be identified in consideration of potential interactions with other projects or activities in the vicinity of the Project. The discussion of cumulative effects will consider the existing environmental conditions and identification of existing or reasonably foreseeable projects (i.e., projects that have been approved or are currently advancing through the regulatory approvals process). The assessment of cumulative environmental effects will only be carried out with respect to Project-related residual environmental effects that are considered likely to substantially overlap with the residual environmental effects of another past, present, or future project or activity.

4.2.3 Effects of the Environment on the Project

Effects of the environment on the Project will be assessed in the EIS. The assessment will consider natural events that could affect the Project and, in turn, cause environmental effects. This includes the sensitivity of the Project to variations in meteorological conditions and to natural hazards. The discussion of effects of the environment on the Project includes potential Project interactions and planned design and mitigation strategies for reducing the likelihood of a significant effect on the Project, thereby also reducing the likelihood of any potentially resultant environmental effects.

4.2.4 Accidents and Malfunctions

The EIS will identify the potential for environmental effects resulting from accidents, malfunctions, and other unplanned events for each phase of the Project. The likelihood of these event occurring will be discussed, as well as the implementation of mitigation and contingency plans to address various potential situations.

4.3 EFFECT MITIGATION AND MONITORING

Measures that will be implemented to reduce or avoid adverse Project-specific and cumulative effects on VCs will be described in the EIS. A description of the mitigation measures proposed to reduce or eliminate potential environmental effects, including best management practices and environmental protection measures will be provided in the EIS for each identified VC. A table summarizing the mitigation measures for the identified potential effects of the Project will be presented in the EIS to facilitate the review of the document. Mitigation and monitoring plans will be developed following EA approval and prior to construction.

4.4 RESIDUAL EFFECTS

The residual effects on VCs will be described in the EIS. Where residual effects are identified, an assessment of the significance of these effects will be conducted. The significance of these effects will be determined. Residual effects will be characterized with respect to direction, magnitude, geographic extent, frequency, duration, reversibility, and ecological and social context. These evaluation criteria will inform the determination of the significance of residual adverse environmental effects. The characterization will include consideration of the following:

- Information obtained during issues scoping;
- Available information on the status and characteristics of each VC;
- Applicable environmental standards, guidelines, or objectives where they are available; and
- The professional judgment of the EA Study Team

5.0 DECOMMISSIONING, RECLAMATION AND INSTITUTIONAL CONTROL

Although it is expected that detailed plans will be developed at later stages of the Project, the EIS will provide information on a conceptual decommissioning plan, reclamation activities and institutional control these processes to the extent feasible.

6.0 PUBLIC ENGAGEMENT AND CONSULTATION PLAN

6.1 PUBLIC INVOLVEMENT

Public engagement activities began in 2010 to inform potentially affected Aboriginal communities, relevant stakeholders and the public regarding the Project. These engagement activities included the mail-out of Project information packages, in-person meetings in 12 communities, and a traditional land and resource use study. Due to the length of time since these engagement activities were conducted and recent changes to Project details, additional engagement activities will be completed for the Project and will include the following:

Project Update Letters - A Project update letter will be developed and distributed to potentially affected Aboriginal communities, regional communities, and relevant stakeholders including economic development agencies, businesses with interests relevant to the Project and individuals potentially affected by the Project (e.g., trappers, outfitters and cabin owners near the proposed route). The update letter will provide opportunities for feedback by email, post or telephone. All outgoing and incoming communications will be recorded in an Engagement Log and tabulated in a Record of Communication.

Open Houses - The Proponent will hold Open Houses for the Project in La Ronge, Stony Rapids, Black Lake and Fond du Lac. The Open Houses are an opportunity to present the Project to the interested public, stakeholders and potentially affected Aboriginal communities. Feedback mechanisms such as questionnaires and surveys and engagement facilitators will be used to receive feedback and answer questions.

Aboriginal Engagement - The Open Houses will provide the opportunity for the Proponent to discuss the scope with leadership in attendance from Aboriginal communities, including methods, information sharing, potential participants, schedule, verification and release of information for traditional land and resource use studies. The Open House may also be an opportunity to hear concerns and issues and recommended mitigations that will inform consultation activities conducted by the Province or MHI according to the Duty to Consult and Accommodate.

Record of Communication - The Proponent will record all communications with the public, stakeholders and Aboriginal people on Engagement Logs for tabulation in a Record of Communication. These will include names, affiliations, topics discussed, type of communication, issues and concerns raised and recommended actions.

Reporting - Engagement activities and results will be summarized in the EIS and inform reporting on and assessment of VCs in the EIS.

6.2 DUTY TO CONSULT WITH FIRST NATIONS AND MÉTIS

The Proponent will support the Responsible Authority's Duty to Consult and Accommodate taking guidance from the Government of Saskatchewan First Nation and Métis Consultation Policy Framework (Government of Saskatchewan 2010), by providing relevant information arising from engagement activities and TLRU studies and facilitating meetings, (if requested by First Nations and/or Métis groups).

7.0 CONDITIONS MANAGEMENT

7.1 COMMITMENTS REGISTER

The EIS will include a commitments register outlining each commitment made to mitigate the environmental effects of the Project and to meet regulatory requirements. The register will provide a brief description of the commitment, indicate how the commitment is to be implemented, indicate how and when the implementation of the commitment is to be assessed, and describe any follow-up action items.

8.0 REFERENCES

CEA Agency. 2014. Notice of Termination for the Highway 914 - All Weather Roadway - McArthur River Mine Site to Cigar Lake Mine Site Project. http://www.ceaa.gc.ca/050/document-eng.cfm?document=100293. Accessed June 2016.

Government of Saskatchewan. 2010. First Nation and Métis Consultation Policy Framework. https://www.saskatchewan.ca/residents/first-nations-citizens/duty-to-consult-first-nations-and-metis-communities. Accessed May 2016.

Government of Canada. 2012. Canadian Environmental Assessment Act. Chapter 19, Section 52 of the Statutes of Canada, 2012. http://laws-lois.justice.gc.ca/PDF/C-15.21.pdf. Accessed May 2016.

Prince Albert Grand Council. 2011. Social and Environmental Impact Assessment for the Construction of Highway 914 – Local and Traditional Knowledge Contribution. 48pp.

SKMOE. 2014. Guidelines for the Preparation of the Terms of Reference. Available at: http://www.environment.gov.sk.ca/EATermsOfReferenceGuidelines. Accessed: May 2016.

SKMOE.1980. *The Environmental Assessment Act*. Available at http://www.qp.gov.sk.ca/documents/English/Statutes/Statutes/E10-1.pdf. Accessed: May 2016.

A.2 CONCORDANCE TABLE

Concordance Between the Terms of Reference and Environmental Impact Statement

Terms of Reference	Environmental Impact Statement Section
1.0 INTRODUCTION	1.0 Introduction
2.0 PROJECT OVERVIEW	2.0 Project Description
2.1 Project Description	2.0 Project Description
2.2 Project Boundaries	2.2 Project Location
2.2.1 Spatial Boundaries	4.2.3.2 Spatial Boundaries
2.2.2 Temporal Boundaries	5.1.1.5.2 Temporal Boundaries
2.3 Project Alternatives	2.4 Project Alternatives; Appendix C
2.4 Ancillary Projects	2.6 Project Components
2.5 Regulatory Requirements	1.3 Regulatory Framework; Appendix A
3.0 VALUED COMPONENTS	4.2.1 Selection of Valued Components; 5.0 Valued Components Effects and Mitigation Assessments
3.1 Atmospheric Environment	4.2.1 Selection of Valued Components
3.1.1 Air Quality	4.2.1 Selection of Valued Components
3.1.2 Acoustic Environment	4.2.1 Selection of Valued Components
3.2 Terrain and Soil	4.2.1 Selection of Valued Components
3.3 Water Resources	5.1 Assessment of Potential Environmental Effects on Aquatic Resources; Appendix E; Appendix H
3.3.1 Hydrology and Surface Water Quality	5.1 Assessment of Potential Environmental Effects on Aquatic Resources; Appendix E; Appendix H
3.3.2 Drinking Water Sources	4.2.1 Selection of Valued Components
3.4 Aquatic Resources	5.1 Assessment of Potential Environmental Effects on Aquatic Resources; Appendix E; Appendix H
3.5 Vegetation and Wetlands	5.2 Assessment of Potential Environmental Effects on Vegetation and Wetlands; Appendix G; Appendix H
3.5.1 Vegetation	5.2 Assessment of Potential Environmental Effects on Vegetation and Wetlands
3.5.2 Wetlands	5.2 Assessment of Potential Environmental Effects on Vegetation and Wetlands; Appendix G; Appendix H
3.6 Wildlife and Wildlife Habitat	5.3 Assessment of Potential Environmental Effects on Wildlife and Wildlife Habitat; Appendix H; Appendix I
3.7 Traditional and Non-Traditional Land and Resource Use	5.4 Assessment of Potential Environmental Effects on Land and Resource Use; Appendix F
3.7.1 Traditional Land and Resource Use	5.4 Assessment of Potential Environmental Effects on Land and Resource Use; Appendix F
3.7.2 Non-Traditional Land and Resource Use	5.4 Assessment of Potential Environmental Effects on Land and Resource Use
3.8 Heritage Resources	5.5 Assessment of Potential Environmental Effects on Heritage Resources; Appendix J

4.0 ENVIRONMENTAL ASSESSMENT	5.0 Valued Component Effects and Mitigation Assessment
4.1 Baseline Information	5.1.2 Existing Conditions for Aquatic Resources; 5.2.2 Existing Conditions for Vegetation and Wetlands; 5.3.2 Existing Conditions for Wildlife and Wildlife Habitat; 5.4.2 Existing Conditions for Land and Resource Use; 5.5.2 Existing Conditions for Heritage Resources; Appendix E; Appendix F; Appendix G; Appendix H; ; Appendix I
4.2 Effects Assessment	5.1.4 Assessment of Residual Effects on Aquatic Resources; 5.2.4 Assessment of Residual Effects on Vegetation and Wetlands; 5.3.4 Assessment of Residual Effects on Wildlife and Wildlife Habitat; 5.4.4 Assessment of Residual Effects on Land and Resource Use; 5.5.4 Assessment of Changes to Heritage Resource Sites
4.2.1 Project-Specific Effects Assessment	5.1.4 Assessment of Residual Effects on Aquatic Resources; 5.2.4 Assessment of Residual Effects on Vegetation and Wetlands; 5.3.4 Assessment of Residual Effects on Wildlife and Wildlife Habitat; 5.4.4 Assessment of Residual Effects on Land and Resource Use; 5.5.4 Assessment of Changes to Heritage Resource Sites
4.2.2 Regional Effects Assessment	5.1.4 Assessment of Residual Effects on Aquatic Resources; 5.2.4 Assessment of Residual Effects on Vegetation and Wetlands; 5.3.4 Assessment of Residual Effects on Wildlife and Wildlife Habitat; 5.4.4 Assessment of Residual Effects on Land and Resource Use; 5.5.4 Assessment of Changes to Heritage Resource Sites; Appendix I
4.2.3 Effects of the Environment on the Project	6.0 Effects of the Environment on the Project
4.2.4 Accidents and Malfunctions	7.0 Accidents and Malfunctions
4.3 Effect Mitigation and Monitoring	5.1.4.2.2 Mitigation; 5.1.6 Follow-up and Monitoring; 5.2.4.2.2 Mitigation; 5.2.6 Follow-up and Monitoring; 5.3.4.2.2 Mitigation; 5.3.7 Follow-up and Monitoring; 5.4.4.2.2 Mitigation; 5.4.6 Follow-up and Monitoring; 5.5.7 Mitigation, Follow-up and Monitoring; Appendix B
4.4 Residual Effects	5.1.4.2.3 Project Residual Effect; 5.1.4.3.3 Project Residual Effect; 5.1.4.4.3 Project Residual Effect; 5.1.4.5 Summary of Residual Environmental Effects on Aquatic Resources; 5.2.4.2.3 Project Residual Effect; 5.2.4.3.3 Project Residual Effect; 5.2.4.4 Summary of Residual Environmental Effects on Vegetation and Wetlands; 5.3.4.1.3 Residual Effects; 5.3.4.2.3 Residual Effects; 5.3.4.3.3 Residual Effects; 5.3.5 Summary of Project Residual Effects; 5.4.4.2.3 Project Residual Effect; 5.4.4.3.3 Project Residual Effect; 5.4.4.4.3 Project Residual Effect; 5.4.4.5.3 Project Residual Effect; 5.4.4.6 Summary of Residual Environmental Effects on Land and Resource Use; 5.6 Assessment of Cumulative Effects; 6.4 Summary Residual Effects of the Environment on the Project
5.0 DECOMMISSIONING, RECLAMATION AND INSTITUTIONAL CONTROL	2.7.4 Decommissioning and Reclamation
6.0 PUBLIC ENGAGEMENT AND CONSULTATION PLAN	3.0 Consultation and Engagement; Appendix D

6.1 Public Involvement	3.2 Identification of Interested Parties; 3.3 Consultation and Engagement Methods for Indigenous Communities and Public Stakeholders; Appendix D
6.2 Duty to Consult with First Nations and Métis	3.3 Consultation and Engagement Methods for Indigenous Communities and Public Stakeholders; 3.4 Summary of Consultation and Engagement Activities; Appendix D; Appendix F
7.0 CONDITIONS MANAGEMENT	2.8.1 Commitments Register; Appendix B
7.1 Commitments Register	2.8.1 Commitments Register; Appendix B
8.0 REFERENCES	9.0 References

APPENDIX B

Commitments Register

ID	Commitment	Section in EIS	Condition in Approval	Permit # (if available)	Name and Section of Additional Report	Approving Agency/ Branch	Measure of Compliance	Commitment Status (met, not met, in progress)	Preventative or Corrective Action	Adaptive Action	Commitment Due Date	Actual Completion Date	Comments
1	Reduce or avoid changes in surface water quality and quantity	5.1.4.2.2			Appendix E	DFO (Fisheries and Oceans Canada)	Adherence to DFO's *Measures to Protect Fish and Fish Habitat*	In progress	• A setback of 45 m is recommended for intermittent and small and moderate permanent watercourses; a setback of 100 m is recommended for large watercourses; and a setback of 15 m is recommended for ephemeral draws • Confirm that machinery arriving on site in a clean condition and is maintained free of fluid leaks, invasive species, and noxious weeds • Develop and implement an erosion and sediment control management plan • Install effective erosion and sediment control measures before starting work • Place excavated materials and debris above the high-water mark and away from drainage pathways back into the watercourse • Treat any wastewater to an equal or better water quality prior to returning to waterbodies • Wherever possible, leave vegetation in place to reduce sedimentation into waterbodies • Use only approved solutions or water for dust control during operation and maintenance		Upon completion of reclamation activities		

ID	Commitment	Section in EIS	Condition in Approval	Permit # (if available)	Name and Section of Additional Report	Approving Agency/ Branch	Measure of Compliance	Commitment Status (met, not met, in progress)	Preventative or Corrective Action	Adaptive Action	Commitment Due Date	Actual Completion Date	Comments
2	Protect fish and fish habitat	5.1.4.3.2			Appendix E	DFO (Fisheries and Oceans Canada)	Adherence to DFO's *Measures to Protect Fish and Fish Habitat*	In progress	• Time instream works with respect to the timing windows to protect fish during sensitive time periods (e.g., restricted activity timing window). • Reduce amount and duration of instream work during construction • Secure appropriate provincial permits and complete fish scare and rescue within isolations to reduce chance of direct mortality • Wherever feasible, operate machinery above the high-water mark • Isolate areas where instream work is to occur (unless watercourse is dry or frozen to bottom), and limit works to these areas • Install effective erosion and sediment control measures before starting work • Use clean materials for construction, free of fines and debris • Limit the clearing of riparian vegetation to the extent feasible • Follow DFO's interim code of practice for end-of-pipe guidelines (DFO 2019b) to prevent entrainment or impingement of fish when conducting water withdrawals or dewatering activities		Upon completion of reclamation activities		
3	Avoid loss of plant Species at Risk (SAR), species of management concern (SOMC), or plants of interest to Indigenous communities	5.2.5			n/a	Saskatchewan Ministry of Environment	Adherence to appropriate Saskatchewan Activity Restriction Guidelines for Sensitive Species	In progress	• No plant SAR have been detected during field surveys to date. • Contractor personnel will review all mitigation measures for plant SOMC in advance of construction. • Current Project layout avoids locations of plant SOMC. • Any changes to the Project layout will avoid known locations of plant SOMC and the recommended 30 m setback. If avoidance is not possible, Saskatchewan Ministry of Environment will be consulted	• If previously unidentified plant SOMC are found on the construction footprint prior or during construction, consult with the Saskatchewan Ministry of Environment to develop mitigation or a contingency plan	Upon completion of construction activities.		

ID	Commitment	Section in EIS	Condition in Approval	Permit # (if available)	Name and Section of Additional Report	Approving Agency/ Branch	Measure of Compliance	Commitment Status (met, not met, in progress)	Preventative or Corrective Action	Adaptive Action	Commitment Due Date	Actual Completion Date	Comments
4	Reduce or avoid the introduction or spread of non-native or invasive species	5.2.5			n/a	Government of Saskatchewan	No introductions of prohibited or noxious weeds listed under *The Weed Control Act*	In progress	• No invasive or non-native species were observed during the field surveys to date. • Contractor personnel will review all mitigation measures for invasive non-native weeds in advance of construction. • Contractor field management representatives will confirm that all equipment, including ground protective mats, must arrive at the Project site clean and free of soil or vegetative debris. • All construction material sources used will be visually inspected to ensure they are free of listed weeds to the extent practical.	• Any equipment, including mats, which do not arrive in appropriate condition shall not be allowed on the construction footprint until they have been cleaned, re-inspected by the Environmental Inspector(s) or designate(s), and deemed suitable for use. • If invasive non-native species are found on the construction footprint, implement the *Invasive Species Management Plan*	Upon completion of construction activities.		
5	Avoid loss or alteration of wetlands	5.2.5			n/a	Water Security Agency	Wetland mitigation measures are properly implemented as per the Aquatic Habitat Protection Permit to be acquired prior to construction	In progress	• Restrict all construction activities to the approved construction footprint. • Avoid environmentally sensitive features during clearing as identified by the appropriate signage and/or fencing. • Chemical and fuel storage requirements away from wetlands and waterbodies • Maintenance of hydrology (e.g., through appropriate culvert placement) • Install erosion and sediment control measures, where required, to reduce erosion on slopes and near wetlands and waterbodies. • Install appropriately sized and spaced culverts to maintain drainage patterns to and from wetlands and watercourses intersected by the Project.		Upon completion of construction activities.		
6	Avoid loss or alteration of upland ecosites	5.2.5			n/a	Saskatchewan Ministry of Environment	Impacted areas have similar vegetation communities post-reclamation as pre-construction	In progress	• Restrict all construction activities to the approved construction footprint. • Avoid environmentally sensitive features during clearing as identified by the appropriate signage and/or fencing. • Road embankment slopes will be revegetated after construction		Upon completion of reclamation activities		
7	Avoid caribou	5.3.5.1.1			Appendix I	Environment and Climate Change Canada, Saskatchewan Ministry of Environment	Adhere to setbacks and timing restrictions stated in the Conservation Strategy for Boreal Woodland Caribou in Saskatchewan (SKMOE 2013) and the federal recovery strategy for boreal (woodland) caribou (Environment Canada 2012, ECCC 2019).		• Contractor personnel will review a Wildlife Mitigation and Monitoring Plan to be developed in advance of construction • Avoid activity within the Highrock-Key caribou range between January 15 and April 30 (McLoughlin et al. 2016), where possible. • Avoid blasting during caribou calving period (May 1 to June 30 (McLoughlin et al. 2016). • Determine that noise abatement equipment on machinery is in good working order.		Upon completion of construction and reclamation activities		

ID	Commitment	Section in EIS	Condition in Approval	Permit # (if available)	Name and Section of Additional Report	Approving Agency/ Branch	Measure of Compliance	Commitment Status (met, not met, in progress)	Preventative or Corrective Action	Adaptive Action	Commitment Due Date	Actual Completion Date	Comments
8	Avoid sensitive wildlife features, reduce sensory disturbance wildlife	5.3.5.1.2			n/a	Government of Canada, Government of Saskatchewan	Adhere to setbacks and applicable timing restrictions stated in the *Migratory Birds Convention Act* and the Saskatchewan Activity Restriction Guidelines for Sensitive Species	In progress	• Restrict all construction activities to the approved construction footprint. All construction traffic will adhere to safety and road closure regulations. • Contractor personnel will review all mitigation measures for wildlife (e.g., caribou) and the Wildlife Mitigation and Monitoring Plan • Workers will be provided with wildlife awareness training prior to the start of construction activities focusing on local wildlife species that might be encountered (e.g., boreal caribou, black bear) • Conduct species- specific pre-construction surveys, as required • Determine that noise abatement equipment on machinery is in good working order.	• Temporarily suspend construction activities if wildlife species at risk or species of management concern including caribou, or other large mammals (e.g., black bear) or furbearers (e.g., wolverine) are encountered within or near the ROW.	Upon completion of construction and reclamation activities		
9	Avoid or reduce effects on availability of resources currently used for traditional purposes				n/a		Adhere to buffers and hunting restrictions	In progress	• Establishment of a no-hunting buffer (e.g., game corridor) along the highway • Prohibiting timber harvest near eagle and osprey nesting sites • Maintaining forested buffers along water-bodies		Upon completion of construction activities.		
10	Avoid or reduce effects on access to resources or areas currently used for traditional purposes	5.4.4.3.2			n/a		Notifications sent to Indigenous communities and signage posted	In progress	• Provide Indigenous communities with the proposed Project construction schedule and maps. • Notify active trappers within the PDA with proposed Project construction schedule and maps. • Post signage to discourage unauthorized public access onto the construction footprint during construction. • Clearly delineate areas that have access restrictions. Restrict access to construction personnel only. • Restrict all construction activities to the approved construction footprint. All construction traffic will adhere to safety and highway closure regulations.		Upon completion of construction activities.		
11	Avoid or reduce effects on traditional cultural and spiritual sites and areas	5.4.4.4.2			n/a		Adhere to buffers markings around sensitive features	In progress	• Prior to the start of clearing, clearly mark sensitive cultural resources. • Following clearing, re-mark all sensitive resources as necessary.	• If traditional cultural spiritual sites not previously identified are found on the construction footprint during construction, implement the "Chance Find" protocol that will be outlined in the Environmental Management Plan. • If a burial is uncovered during construction, all work will immediately stop and the Royal Canadian Mounted Police (RCMP), Project Manager, and Heritage Conservation Branch will be immediately contacted.	Upon completion of construction activities.		

ID	Commitment	Section in EIS	Condition in Approval	Permit # (if available)	Name and Section of Additional Report	Approving Agency/ Branch	Measure of Compliance	Commitment Status (met, not met, in progress)	Preventative or Corrective Action	Adaptive Action	Commitment Due Date	Actual Completion Date	Comments
12	Reduce effects on non-traditional use				n/a		Adhere to buffers and hunting restrictions	In progress	• Post signage to inform potential users and discourage unauthorized public access onto the construction footprint during construction. • Clearly delineate areas that have access restrictions. Restrict access to construction personnel only. • Restrict all construction activities to the approved construction footprint. All construction traffic will adhere to safety and highway closure regulations.		Upon completion of construction activities.		

APPENDIX C

Routing Studies

CLUNIE CONSULTING ENGINEERS

MR – 07 - 008

McArthur River
to
Cigar Lake Haul Road

Pre-Feasibility Study

CAMECO CORPORATION

May 23, 2007

EXECUTIVE SUMMARY

1.0 PROJECT DESCRIPTION

This is the Pre-Feasibility Report for a future Haul Road from McArthur River to Cigar Lake Mine site.

2.0 ALTERNATE ROUTES CONSIDERED

Route 1 involves construction of a haul road from a point at km 70.0 on the road from Key Lake to McArthur River to the Cigar Lake site for a total distance of approximately 52.6 km.
Route 7 involves construction of a haul road with a more direct location from south of McArthur River site to the Cigar Lake site for a total distance of 48.7 km. These roads are identified in Dwg. No. 1.

3.0 ESTIMATED COST OF ROUTE 1 vs ROUTE 7

Expenditure Category	*Route 1 $*	*Route 7 $*
Contract Items	33,787,144	27,599,179
Force Account	1,280,000	1,280,000
Materials	624,436	576,872
Sundries	650,000	450,000
Pre-Feasibility Study	57,000	57,000
Feasibility Study	200,000	200,000
Design Engineering	2,454,700	2,021543
Construction Engineering	4,208,057	3,465,501
Terrain Mapping & Gravel Search	0	42,000
Enviro. Const. Monitoring	260,000	180,000
Miscellaneous	478,663	627,905
Sub Total	44,000,000	36,500,000
Escalator	4,000,000	4,000,000
Estimated Total Cost	48,000,000	40,500,000

Table 1 – Cost Estimate Route 1 vs Route 7

Note:
1) Costs not included in the estimate.
   - Environmental Impact Study
   - Design & Construction of Bridges
2) This report utilized market prices in the year 2005. Considering escalation of 3% per year and construction in 2009, this may be in the order of 12%.
3) Cost estimate is based on a conventional Design and Tender
4) Design and Construction Engineering Costs include flights to site, meals, accommodation, fuel and field investigation.

4.0 DISCUSSION

Upon the completion of the construction of a route between McArthur River and Cigar Lake site, this route will become the main haul road corridor to the major sites in the north. The standard of the road will be superior to the existing route north of La Ronge, on Highway No. 102 & Highway No. 905. Northern Resources Trucking will prefer this route to supply the northern development sites.

The travel distance from Key Lake Site to Cigar Lake Site utilizing Route No. 1 is approximately 122.5km. The travel distance from McArthur River to Cigar Lake Site along Route No. 1 is approximately 62.5km. The travel distance from McArthur River site to Cigar Lake site, on Route 7, is approximately 48.7km.

Item	Route 1	Route 7
Length of Construction (km)	52.6	48.7
Total Cost	$48,000,000	$40,500,000
Cost per km	$912,500	$831,600
Steep Grades	4	Not Available
Sidehill Construction	5	4
Heavy Boulder Concentration	7	Not Available
Heavy Earthwork	1	Not Available
Tight Alignment	4	1
Major Water/Stream Crossing	3	2
Impacted Water Bodies	13	5 & Close Lake
Potential Erosion Control Areas	7	5
No of Bridges	0	Unknown

Table 2 – Route 1 vs Route 7

Note: The 2 Stream crossings on Route 7 may require bridges, further information required along with field inspections.

5.0 RECOMMENDATIONS

Route 7 has considerably better terrain for construction than Route 1 and considering the comparisons as per Table 2, **I recommend Route 7.**

PROFESSIONAL ENGINEER
R. B. CLUNIE
PRINCE ALBERT
SASKATCHEWAN

Russell B Clunie, P.Eng.
Clunie Consulting Engineers Ltd.

Dated: May 23, 2007

Table of Contents

List of Appendices

1.1.0 INTRODUCTION

1.1.1 Location/Scope of Study

The project is an all weather haul road between McArthur River Mine Site and Cigar Lake Mine Site, in northern Saskatchewan. The objective of this study is to provide a pre-feasibility assessment, conceptual design, and capital cost estimate for the haul road.

1.1.2 History of Activities to Date

In 1985 Cameco Corporation began investigations and studies into the feasibility of constructing a haul road from Key Lake to the future Cigar Lake Mine Site. J.D. Mollard & Associates (JDMA) completed this study and submitted their report dated December 1985. This report examined two routes; 1 and 2, with various alternates within their lengths. These routes are indicated in Dwg. No. 1 in the appendix. Dwg. No. 1 also highlights the preferred alternates within these routes. J.D. Mollard & Associates recommended Route 1 from Key Lake Mine Site to Cigar Lake Mine Site.

In 1997 the construction of the road from Key Lake Mine Site to McArthur River Mine Site was completed. This road followed Route 1 from Key Lake to JDMA km 70 and then approximately 10 km north to McArthur River Mine Site.

In April 2007 Cameco Corporation engaged Clunie Consulting Engineers to provide the pre-feasibility assessment of completing the haul road from km 70 on JDMA Route 1 to Cigar Lake Mine Site. Details of the original scope of work are included in the appendix. Subsequently, the scope of work was expanded to also assess a location identified as segment 44 on Dwg. No. 1. The details of the expanded scope are also included. Our report will refer to segment 44 as Route 7.

1.1.3 Summary Factors for J.D. Mollards 1985 Recommendation of Route 1

- Route 1 had a number of advantages as summarized in Table 1
- Shortest Route by 4.6km
- Less construction costs
- Less operating costs
- Circumvents the Key Lake lease area
- Considerable less length of permafrost affected terrain (Route 1 @ 0.2 km vs Route 2 @ 1.3 km)
- Only one bridge on Route 1 vs two bridges on Route 2
- Less steep grades
- Fewer “tight” side hill construction sections

Item	Route 1	Comments	Route 2	Comments
Length (km)	122.6		127.2	
Total Const. Cost	$10.963M	1985 Prices	$11.720M	1985 Prices
Const. Cost per km	$89,000	1985 Prices	$92,000	1985 Prices
No. Bridges	1	Wheeler 60m	2	Wheeler - 90m McArthur - 20m
No. of Drainage Channels	0		6	McClean R – km 74 Channel – km 80.5 Channel – km 85.5 Phillips – km 101.7 Channel – km 111.0 Channel – km 118.55
No. of Water Crossings	3	km 90 – 50m km 93.9 – 30m km 101.5 – 100m	1	km 19.2 – 50m

Table 1 - Route 1 vs Route 2 (JDMA Report 1985)

1.1.4 Existing Available Information

- J.D.Mollard & Associates (JDMA) Terrain Mapping Report (1985) for the proposed road from Key Lake Mine Site to Cigar Lake Mine Site (Route 1 &2)
- Air Photo mosaics and Air Photos at low level (Routes 1 & 2)
- McArthur River & Cigar Lake Mine Site infrastructure drawings
- Key Lake to McArthur River road construction drawings
- Cigar Lake Permanent Road construction drawings
- 138 kV Transmission Line Island Falls to Points North (Design)
- DOT, DFO, & SE Guidelines and regulations pertaining to road construction

1.2.0 ROUTE 1, SEGMENTS 45 & 45D

1.2.1 Areas of Conflict with SPC 138Kv Transmission Line

The transmission line conflicts with Route 1 at a number of locations based on the electronic location information provided by Saskatchewan Power Corporation (SPC). The SPC line crosses Route 1 at km 70.0, 75.3 & km 79.2. It runs adjacent to Route 1 in the vicinity of km 81.5. The exact location of the line & towers will have to be determined to assess the degree of interference or relocation costs. In addition the SPC information indicates the transmission line will coincide with Route 1 from km 83.5 to km 87.0.

We have also obtained information on the SPC Line from Google satellite photos. This information is different than the information from SPC.

The information received from SPC is probable design while Google satellite imagery shows the as-built location. This information is shown on Dwg. 4, Photo-mosaic Sheets.

1.2.2 Potential Construction Problem Areas

These potential problem areas include the following:

- Steep Grades (4 Locations)
- Sidehill Construction (5 Locations)
- Heavy Boulder Concentration(7 Location)
- Heavy Earthwork(1 Location)
- Tight Alignment (4 Locations)
- Major Water/Stream Crossings (3 Locations)

The Airphoto Alignment Mosaics provided in JDMA Report 1985, were scanned and are utilized in Dwg. No. 4, sheets 1 to 8.

The potential construction problem areas are coded and identified on Dwg. No. 4 Photo-mosaic sheets. The degree of the problem cannot be assessed in further detail until the new Low Level Photography & Digital Terrain Model has been obtained. Table 2 also identifies these areas.

Steep Grades	Sidehill Construction	Heavy Boulder	Heavy Earthwork	Tight Horizontal Alignment	Major Stream/Water Crossings
70.2 - 70.7	88.4 - 89.9	69.6 - 70.1	119.6 - 120.1	70.0 Intersection	89.90 - 89.95
88.4 - 88.5	93.4 - 93.9	74.1 - 75.6		78.0 - 78.7	93.9 - 94.0
99.6 - 99.8	96.6 - 97.9	75.8 - 75.9		90.2 - 90.4	101.4 - 101.5
100.4 - 100.8	99.6 - 99.8	76.1 - 77.0		96.0 - 99.0	
	104.8 - 105.6	78.9 - 80.5			
		93.9 - 94.0			
		99.6 - 99.8			

Table 2 - Potential Construction Problem Areas Route 1

1.2.3 Major Water/Stream Crossings

There are three crossings on Route 1: km 90.0 (50m long), km 93.9 (30m long) and km 101.5m (100m long). These locations are presently considered to have no flow. In addition, the depth of water is estimated to be shallow. Further field inspection is required to determine the actual width, the actual depth of water, and the actual flow rates at these locations. The crossing at km 101.5 can be shifted to the right to avoid the water crossing, but this will involve more swamp and muskeg.

1.2.4 Impacted Water Bodies

There are 13 water bodies within 100m of the centerline on Route 1, from km 70.0 to Cigar Lake, these are located in the following table.

Lt Km	Lt Km		Rt Km	Rt Km
72.0	72.4		71.0	71.5
80.3	80.5		78.8	79.0
81.5	82.5		89.5	90.2
85.3	85.6		93.5	94.0
101.0	101.8		96.4	97.9
115.2	115.7		113.8	114.2
119.9	120.3			

Table 3 - Impacted Water Bodies Route 1

1.2.5 Potential Major Erosion Control Areas

The requirement of major erosion control is usually at construction sections along the sidehill, large cut/fill, particularly if these areas drain into adjacent water bodies. There are a total of 7 locations where erosion control may be required.

km	km	Comments
70.2	70.7	Steep grade at possible intersection with stub to McArthur,
88.3	90.0	Steep grade for 200m, km88.3 to 88.5, sidehill const. km88.4 to km90.0, with a lake km89.3 to 90.0
93.5	94.0	Sidehill with a Lake Rt
96.3	98.0	Sidehill with a Lake Rt
99.6	99.8	Sidehill & Steep Grade
100.4	101.9	Steep Grade - Possible alignment shift to avoid water crossing
105.0	105.6	Sidehill & Steep Grade

Table 4 - Potential Erosion Control Areas Route 1

1.2.6 Horizontal Alignment Conditions

The horizontal curve data has been assessed from km 70.0 to Cigar Lake. The intersection angles were determined, design radius set, tangent lengths and length of curve calculated. This was completed to determine if design distance requirements between curves can be maintained.

There are three locations where desirable horizontal alignment is not met.

McArthur River to Cigar Lake Haul Road
Pre-Feasibility Study
Horizontal Alignment Details Route 1

Note:
1) Locations are approx. as determined from Photo-mosaics only, no field survey.
2) Desirable distance between reverse curves 300m, minimum 180m
3) Desirable distance between curves in same direction 600m

PI Location	Delta Deg - Min.	Lt/Rt	Radius m	S.E.	Spiral Length	Tan L. m	L C m	T S Location	S T Location	Distance to Curve Ahead	Comments
71+935	7 - 42	Rt	4,000	0	N/A	266.19	537.56	71+669	72+206	2,552	Simple Curve BC & EC
75+130	15 - 54	Rt	2,300	0.02	100	371.22	538.27	74+758	75+497	676	
76+543	21 - 18	Lt	1,700	0.025	100	369.73	531.98	76+173	76+905	675	
77+783	19 - 18	Rt	900	0.049	100	203.11	203.16	77+580	77+983	248	< Desirable > min 180m
78+522	30 - 00	Lt	900	0.049	100	291.27	371.24	78+231	78+802	1,060	
80+217	37 - 24	Rt	900	0.049	100	354.79	487.48	79+862	80+550	790	
81+652	29 - 24	Lt	1,000	0.043	100	312.45	413.13	81+340	81+953	908	
83+000	5 - 6	Rt	2,000	0.022	100	139.08	78.02	82+861	83+139	1,916	
85+217	6 - 24	Lt	2,000	0.022	100	161.83	123.40	85+055	85+379	1,264	
86+782	5 - 6	Rt	2,000	0.022	100	139.08	78.02	86+643	86+921	544	
87+826	20 - 42	Lt	1,700	0.025	100	360.52	514.81	87+465	88+180	356	
88+826	13 - 42	Rt	2,000	0.022	100	290.28	378.22	88+536	89+114	512	
89+913	61 - 12	Lt	400	0.078	100	287.15	327.26	89+626	90+153	232	< Desirable > min 180m
90+652	46 - 48	Rt	500	0.073	100	266.71	308.41	90+385	90+894	1,668	
92+783	8 - 30	Rt	2,300	0.02	100	220.93	241.21	92+562	93+003	597	
94+000	32 - 30	Rt	1,200	0.036	100	399.87	580.68	93+600	94+381	428	
95+000	7 - 0	Lt	2,300	0.02	100	190.68	181.00	94+809	95+190	930	
96+478	17 - 30	Lt	2,000	0.022	100	357.86	510.87	96+120	96+831	520	< 600m Decrease Radius
97+652	31 - 12	Lt	900	0.049	100	301.41	390.09	97+351	97+941	115	< Min 180m
98+326	24 - 48	Rt	1,000	0.043	100	269.52	332.84	98+056	98+589	439	< 600m
99+174	4 - 48	Rt	2,300	0.02	100	146.41	92.68	99+028	99+320	1,237	
100+783	11 - 48	Rt	1,700	0.025	100	225.70	250.11	100+557	101+007	838	
102+000	6 - 0	Rt	2,000	0.022	100	154.83	109.44	101+845	102+154	705	
103+000	5 - 12	Lt	2,000	0.022	100	140.83	81.51	102+859	103+141	1,334	
104+739	12 - 12	Rt	2,000	0.022	100	263.76	325.86	104+475	105+001	313	
105+652	16 - 24	Lt	2,000	0.022	100	338.23	338.00	105+314	105+839	1,158	
107+348	17 - 06	Rt	2,000	0.022	100	350.72	496.9	106+997	107+694	657	
108+565	9 - 24	Lt	2,000	0.022	100	214.45	228.12	108+351	108+779	1,588	
110+478	3 - 30	Rt	2,000	0.022	100	111.11	22.17	110+367	110+589	1,274	
112+000	5 - 0	Rt	2,000	0.022	100	137.33	74.53	111+863	112+138	1,894	
114+217	7 - 42	Lt	2,000	0.022	100	184.61	168.78	114+032	114+401	943	
115+652	28 - 54	Lt	1,000	0.043	100	307.79	404.4	115+344	115+949	2,135	
118+304	9 - 42	Rt	2,000	0.022	100	219.72	238.59	118+084	118+523	1,576	
120+435	16 - 18	Rt	2,000	0.022	100	336.45	468.98	120+099	120+768		

Table 5 - Horizontal Curves Route 1

1.2.7 Potential Aggregate Sources

JDMA identified numerous aggregate sources applicable to Route 1 between km 70.0 & km 122.6. These locations have been reduced to the higher potential locations. These locations are indicated on Dwg. No. 4 when they are within the width of the photos.

- Prospect No. 22 has a fair rating. This prospect is located approximately 3 km east of Route 1 location, in the vicinity of 70.0
- Prospect No. 26 has a poor/fair rating and is located adjacent at km 74.5.
- Prospect No. 27 does not have a rating and is located adjacent to Route 1 at km 79.0.
- Prospect No. 37 is rated poor and is located adjacent to Route 1 at km 84.5.
- Prospect No. 38 is rated poor, located approximately 4.0 km west of Route 1 at km 97.5.
- Prospect No. 38A is rated poor, located approximately 8.0 km west of Route 1 at km 97.5.
- Prospect No. 39 is rated poor, located approximately 9.0 km west of Route 1 at km 97.5.
- Prospect No. 40 is rated very poor, located west of km 106.5.
- Prospect 40A is rated poor/fair, located 3.0 km west of Route 1 at km 112.0.
- Prospect No. 44 is the source north of the Whitford River, which has been utilized for a number of years and requires considerable reject.

Possible sources No. 26, 27 and 44 appear to be the only possibilities. The other alternate is to utilize the waste rock at the Cigar Lake Site, should any be available.

Further investigations are required to resolve practical aggregate sources for this project.

1.2.8 Environmental Considerations

As previously discussed, there are 5 locations of sidehill construction that may require erosion control.

Water crossings at km 89.9, km 94.0 and km 101.5 may require consideration should they contain fish.

The locations where the SPC Transmission Line is close to Route 1 may have active Bald Eagle, Osprey and Raptor nests.

1.2.9 Estimated Construction Quantities

The calculations for construction quantities are detailed in Appendix VI.

The main item, Earth Excavation is estimated at 2,720,000 m^3 or 51,700 m^3/km.

Contract Item	Unit	Quantity
Clear & Grub.	ha	260
Waste Excavation	m^3	55,000
Earth Excavation	m^3	2,720,000
Remove Overburden	m^3	10,000
Disposal Surplus Rock	m^3	108,000
Haul on Earth Excavation	m^3hm	10,880,000
Hauling Aggregate	m^3km	1,245,042
Watering on Road	m^3	55,000
Subgrade Prep. $ Compaction	m^2	452,360
Traffic Gravel Type 100	m^3	31,580
Apply Traffic Gravel Type 100	m^3	31,560
Traffic Gravel Type 104	m^3	15,780
Apply Traffic Gravel Type 104	m^3	15,780
Reject Aggregate	m^3	10,000
Traffic Gravel in Stockpile	m^3	15,780
Culverts	L.S.	$683,000
Rip Rap	m^3	6,500
Granular Backfill	m^3	8,000
Mobilization	L.S.	$1,000,000
De-Mobilization	L.S.	$1,000,000

Table 6 - Contract Items Route 1

1.2.10 Estimated Construction Costs

The detailed cost estimate is included in Appendix VI

Expenditure Category	Estimated Cost $
Contract Items	33,787,144
Force Account	1,280,000
Materials	624,436
Sundries	650,000
Pre-feasibility Study	57,000
Feasibility /Preliminary Study	200,000
Construction Engineering	2,454,700

Expenditure Category	Estimated Cost $
Design Engineering	4,208,057
Environmental Monitoring	260,000
Miscellaneos	478,663
Sub Total	44,000,000
Escalators (9.1%)	4,000,000
Total Estimated Cost Route 1	48,000,000

Table 7 - Construction Costs Route 1

Costs do not include:

- Environmental Impact Study
- Design & Construction of Bridges

1.2.11 Critical Additional Field Inspections

All areas identified as potential construction problems in 1.2.2 should be inspected in the field.

Water bodies at km 89.9, km 94.0 & km 101.5 should be checked to determine length, depth of water and if there is flow.

Examine sidehill for construction at the five indicated locations.

In addition, the following should be inspected:

- Intersection at km 70.7,
- Location of access to Cigar Lake in the vicinity south of the airstrip and north of the Whitford River.

1.2.12 Possible Route Modifications

When the Digital Terrain Model and Contours are available the location can be refined to best fit the vertical and horizontal alignment. Other route modifications may include:

- Intersection at km 70.0
- Sidehill construction areas adjacent to water bodies
- Cigar Lake Access

1.3.0 ROUTE 7, SEGMENT 44

Route 7, (Segment 44) is shown on Dwg. No. 1 and is located from south of the McArthur River Mine Site along the east side of Close Lake to the Cigar Lake Mine Site for a total length of 48.7 km. The Terrain Analysis for Route 7 was completed by JDMA on May 9, 2007, utilizing 1:60,000 airphotos flown in 1951. Therefore, the detail of the Terrain Mapping does not compare to Route 1 accuracy. This also affects the accuracy and available detail for this report.

1.3.1 Areas of Conflict with SPC 138Kv Transmission Line

There are no major conflicts with the transmission line with Route 7. The SPC line feeding McArthur River Mine Site crosses Route 7 at km 1.2 and the line feeding Cigar Lake Mine Site at km 44.4. The final detailed location selected for Route 7 should ensure there is not a conflict with SPC towers.

1.3.2 Potential Construction Problem Areas

These potential problem areas include the following;
Note that detail not available from High Level Photos (N/A)

- Steep Grades (N/A)
- Sidehill Construction (4 Locations)
- Heavy Boulder Concentration(N/A)
- Heavy Earthwork(N/A)
- Tight Alignment (6km @ Close Lake)
- Major Water/Stream Crossings (2 Locations)

The degree of problems cannot be assessed in further detail until new Low Level Photography & Digital Terrain Model has been obtained.

1.3.3 Major Water/Stream Crossings

There are two crossings on Route 7, one at km 2.9 at Read Creek and the other at km 15.0 at May Creek. Further field inspection is required to determine the width, the depth of water, and the flow at these locations. Read Creek on the existing Road north of the Security Gate had 2-1800 mm Corrugated Steel Pipe culverts installed at the time of construction. However, it is understand these may be removed and replaced with a large arch or bridge. The crossing at May Creek on the existing road south of McArthur River Mine Site had a Structural Plate Arch 6246mm x 3922mm pipe installed during construction. Bridges may have to be installed at these two sites.

1.3.4 Impacted Water Bodies

There are 5 water bodies within 100m of the centerline on Route 7:

Lt Km	Lt Km		Rt Km	Rt Km
0.5	1.0		6.0	6.5
15.0	18.0		37.5	38.0
42.0	42.5			

Table 8 - Impacted Water Bodies Route 7

1.3.5 Potential Major Erosion Control Areas

The requirement of major erosion control is usually at construction sections with sidehill, large cut/fill, particularly if these areas drain into adjacent water bodies. There are a total of 5 locations where erosion control may be required.

km	km	Comments
5.5	6.0	Sidehill
6.0	6.5	Sidehill with a Lake Rt
6.5	7.9	Sidehill
21.5	24.9	Sidehill
44.4	45.2	Sidehill

Table 9 - Potential Erosion Control Areas Route 7

1.3.6 Horizontal Alignment Conditions

The horizontal curve data cannot be assessed from the High Level Airphotos. There may be tight alignment in the vicinity the access to Cigar Lake Mine Site, depending on the final location.

1.3.7 Potential Aggregate Sources

A search for Potential Aggregate Sources has not been completed for Route 7. Waste rock at either McAthur River Mine Site and/or Cigar Lake Mine Site could be used should any be available.

Further investigations are required to identify potential aggregate sources for this project. An average haul distance of 24.3 km has been assumed for this study.

1.3.8 Environmental Considerations

As previously discussed, there are 5 locations of sidehill construction that may require erosion control.

Creek crossings at km 2.9 and km 15.0 will have requirements for erosion, fish, etc.

The locations where the SPC Transmission Line crosses Route 7 may have active Bald Eagle, Osprey and Raptor nests.

Should the Regulatory Agencies consider the preferred location along the east side of Close Lake to be unacceptable, the segment presents problems. The topography and resulting cost of alternate 44A, shown in Dwg. No. 6, would be significant. This alternate is approximately 8 km in length, from km 12 to 20. There are some steep grades in the order of 8% to 10% with increased earth work.

1.3.9 Estimated Construction Quantities

The calculations for construction quantities are detailed in Appendix VI.

The main item, Earth Excavation is estimated at 2,110,000 m^3 or 43,300 m^3/km.

Contract Item	Unit	Quantity
Clear & Grub.	ha	240
Waste Exc.	m^3	43,000
Earth Exc.	m^3	2,110,000
Removal of Overburden	m^3	10,000
Disposal Surplus Rock	m^3	84,400
Haul on Earth Exc.	m^3hm	8,440,000
Hauling Aggregate	m^3km	1,067261
Watering on Road	m^3	43,000
Subgrade Prep. & Comp.	m^2	420,000
Traffic Gravel Type 100	m^3	29,220
Apply Traffic Gravel Type 100	m^3	29,220
Traffic Gravel Type 104	m^3	14,610
Apply Traffic Gravel Type 104	m^3	14,610
Reject Aggregate	m^3	9,000
Traffic Gravel in Stockpile	m^3	14,610
Supply & Install Culverts	L.S.	$633,100
Rip Rap	m^3	5,900

Contract Item	Unit	Quantity
Granular Backfill	m^3	7,300
Mobilization	L.S.	$1,000,000
De-Mobilization	L.S.	$1,000,000

Table 10 - Construction Quantities Route 7

1.3.10 Estimated Construction Costs

The detailed cost estimate is included in Appendix VI

Expenditure Category	Estimated Cost $
Contract Items	27,599,179
Force Account	1,280,000
Materials	576,872
Sundries	450,000
Pre-feasibility Study	57,000
Feasibility /Preliminary Study	200,000
Construction Engineering	2,021,543
Design Engineering	3,465,501
Terrain Mapping &Gravel Search	42,000
Environmental Monitoring	180,000
Miscellaneous	627,905
Sub Total	36,500,000
Escalators	4,000,000
Total Estimated Cost Route 7	40,500,000

Table 11 - Estimated Construction Costs Route 7

Costs do not include:

- Environmental Impact Study
- Design & Construction of Bridges

1.3.11 Critical Additional Field Inspections

All areas identified as potential construction problems in 1.3.2 should be inspected in the field.

Creek Crossings at km 2.9 & km 15.0 should be checked to determine length, depth of water and the flow.

Examine sidehill for construction at the five indicated locations.

In addition, the following should be inspected:

- Intersections at km 0.0 and km 48.7.

1.3.12 Possible Route Modifications

Refinement of Route 7 should be completed after the Low Level Photos are available for Terrain Mapping and Digital Terrain Model. The contours will assist in refinement of the location. Other route modifications may include:

- Intersection at km 0.0.
- Sidehill construction areas adjacent to water bodies.
- Cigar Lake Mine Site Access at km 48.7.

1.4.0 ACCESS TO McARTHUR RIVER & CIGAR LAKE MINE SITES

1.4.1 Access at McArthur River Mine Site

Route 1 access to McArthur River Mine Site would be at an intersection approximately 10.0 km south of the site. This intersection will require further assessment as it involves steep grades. Additional information such as new Low Level Airphotos and Digital Terrain Modeling with Contours are required to refine the exact intersection location. (Dwg. No.4 sheet 1 of 8).

The preferred Route 7 access to the McArthur River Mine Site is at location 1 as identified on Dwg. No. 7 sheet 1 of 2 which intersects the existing road approximately 2.1 km south of McArthur River Mine Site. This also requires further assessment as the existing road profile is superior for an intersection at approximately 1.8 km south of the McArthur River Mine Site. There were four additional locations assessed identified as locations 2, 3, 4 & 5, however, these were not considered desirable. Location 3 is undesirable because it separates the airstrip from the mine site and locations 2, 4 and 5 involve additional construction length. In addition, all taffic would be required to pass at the existing security gate.

1.4.2 Access at Cigar Lake Mine Site

Route 1 and Route 7 access at Cigar will be the same. (Dwg. No. 7, sheet 2 of 2) It is undesirable for the route to enter the mine site directly as shown in JDMA (1985) Photo-mosaics. The preferred access is south of the airport and north of the Whitford River. Alternates are shown on Dwg. No.7, sheet 2 of 2. Location 1, 2 & 3 involve an intersection on a curve which is undesirable. In order to eliminate this situation, approximately 1 km of the recently constructed permanent access road to Highway No. 905 would have to be re-constructed on a new alignment. Locations 4 & 5 involve additional muskeg construction. Further assessment of a location combining location 1 & 4 is required. Additional information such as new Low Level Airphotos and Digital Terrain Modeling with Contours are required to refine the location.

1.5.0 COMPARISON ROUTE 1 VS ROUTE 7

The following table summarizes the comparison items for the two routes.

Item	Route 1	Route 7
Length of Construction	52.6km	48.7
Total Cost	$48,000,000	$40,500,000
Cost per km	$912,500	$831,600
Steep Grades	4	Not Available
Sidehill Construction	5	4
Heavy Boulder Concentration	7	Not Available
Heavy Earthwork	1	Not Available
Tight Alignment	4	1
Major Water/Stream Crossing	3	2
Impacted Water Bodies	13	5 & Close Lake
Potential Erosion Control Areas	7	5
No of Water Crossings	3	0
No of Bridges	0	Unknown

Table 12 - Comparison Route 1 vs Route 7

Note: The 2 Stream crossings on Route No. 7 may require bridges, further information required along with field inspections.

Route 7 advantages vs Route 1:

- Shorter construction distance
- Less construction Cost
- Less Sidehill Construction
- Less tight alignment
- Fewer Water Bodies Impacted
- Fewer Potential Erosion Control Areas
- No water crossings
- One less Water/Stream Crossing

One major concern is the proximity of Route 7 to Close Lake between km 15 & km 18. Will this be acceptable to the regulatory agencies.

Route 7 is the desirable haul road from McArthur River Mine Site to Cigar Lake Mine Site.

1.6.0 FEASIBILITY STUDY & PRELIMINARY DESIGN

1.6.1 Activities Required for Completion of Feasibility Study & Preliminary Design

The following is a list of activities required to complete the feasibility study and perform a preliminary design of the haul road from McArthur River Mine Site to Cigar Lake Mine Site.

1) Field check Major Stream Crossing and Concern Areas as Identified in the Pre-Feasibility Study

2) Review Locations with Agencies, areas of Concern to the Environment, DFO and Nav. Waters

3) Conduct Environmental Impact Study

4) Prepare Required Information and Drawings for Environmental Approvals and or Permits

5) Finalize Route Location

6) Fly Final Route and Produce Aerial Photos

7) Preparation of Strip Mosaics of the Final Route; Route 7 also requires Terrain Mapping

8) Obtain Contours of Route, width 100 m, possibly wider at areas requiring further refinement

9) Develop Profiles at Centerline and Hub Lines

10) Develop Cross Sections at 25 m intervals

11) Set Design Gradeline

12) Identify Environmental and Erosion Areas of Concern

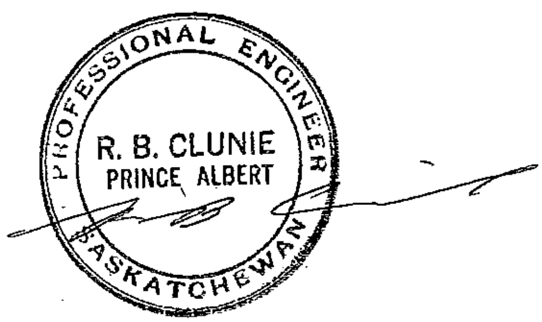
13) Complete Design

14) Develop Earthwork Quantities and Construction Units

15) Prepare Construction Cost Estimate for all Items
- Contract Items
- Materials
- Design and Construction Engineering

16) Prepare Recommended Construction Schedule
- Winter Clearing/Muskeg Padding/Construct Tote Road
- Main Construction Schedule

17) Assessment of Conventional Design, Tender and Construction vs Design Build



MR – 07 - 008

Appendices

for

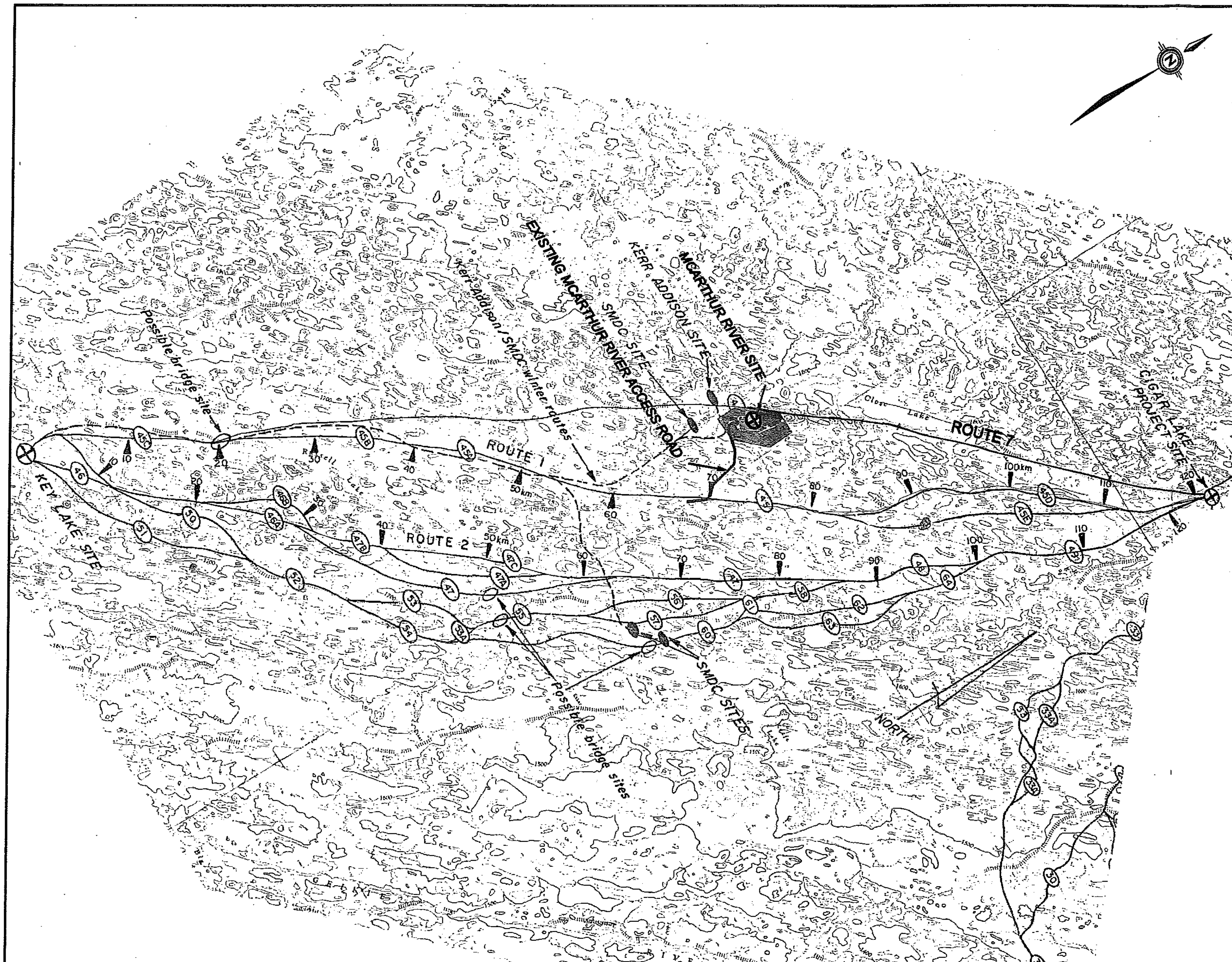
McArthur River
to
Cigar Lake Haul Road

Pre-Feasibility Study

CAMECO CORPORATION

May 23, 2007

List of Appendices



CONSULTANT

CLUNIE CONSULTING ENGINEERS
4271 5th AVENUE EAST BAG #5800,
PRINCE ALBERT SASKATCHEWAN, CANADA
S6V 7V8
PH: 306-764-4896, FAX:306-764-1037

Note:

DRAWING ISSUE

NO	DATE	DESCRIPTION	BY
4			
3			
2			
1			

DRAWING REVISIONS

NO	DATE	DESCRIPTION	BY
6			
5			
4			
3			
2			
1			

PROJECT TITLE

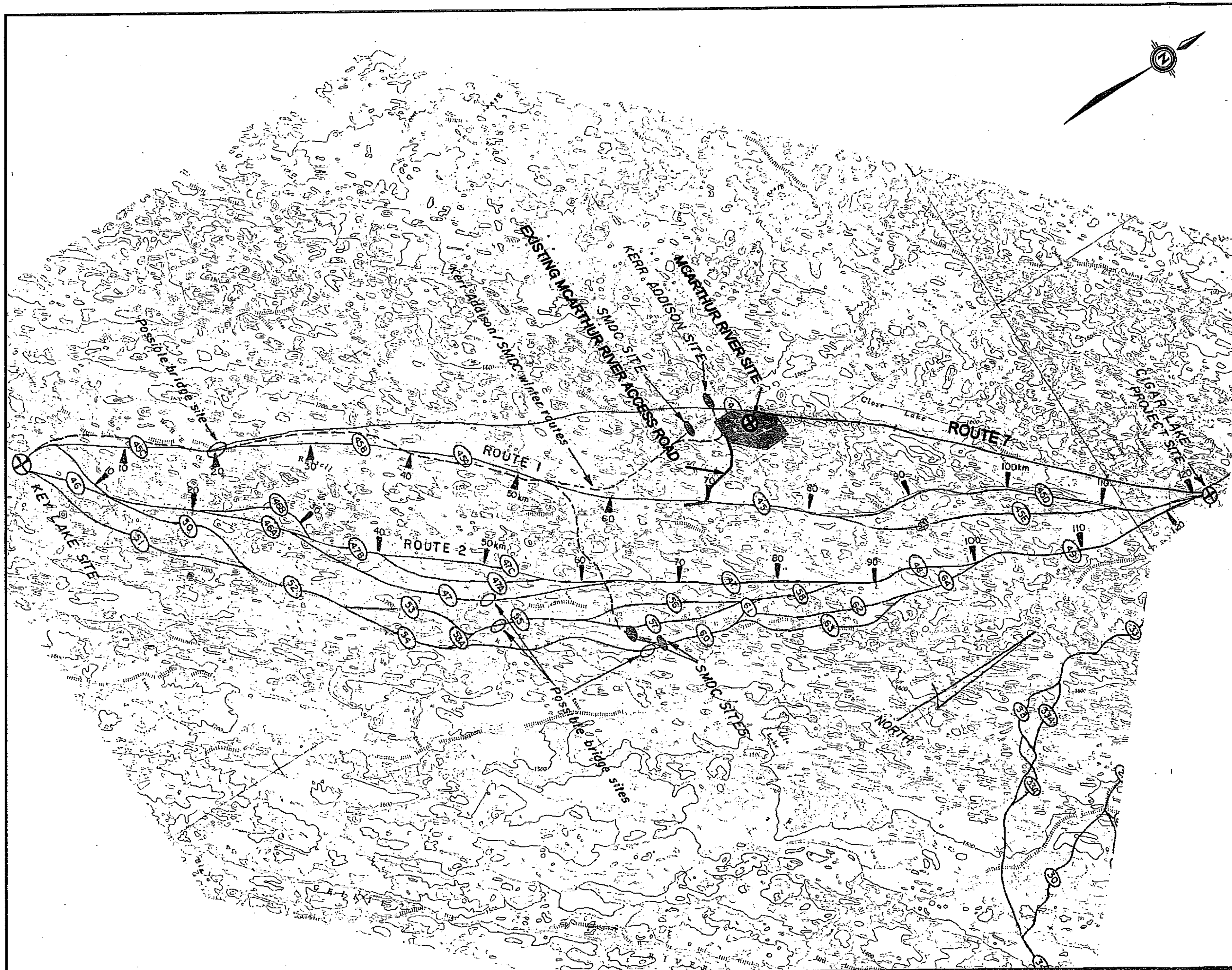
PRE-FEASIBILITY STUDY
MCARTHUR RIVER TO
CIGAR LAKE HAUL ROAD

DRAWING TITLE

OVERVIEW OF ROUTES
KEY LAKE TO
MCARTHUR RIVER
TO CIGAR LAKE

DRAWING LOCATION : C:\projects\2007\McArthur River Cigar Lake Haul Road\Design Haul Road.dwg

PROJECT NO.		FILE NO.	
MR-07-008		CAMECO	
DATE 5/8/2007	SCALE NTS	DWG. NO.	SHEET
DRAWN BDS	CHECKED	1	1OF1



CONSULTANT

CLUNIE CONSULTING ENGINEERS

4271 5th AVENUE EAST BAG #5800,
PRINCE ALBERT SASKATCHEWAN, CANADA
S6V 7V6
PH: 306-764-4896, FAX:306-764-1037

Note:

DRAWING ISSUE

NO	DATE	DESCRIPTION	BY
4			
3			
2			
1			

DRAWING REVISIONS

NO	DATE	DESCRIPTION	BY
6			
5			
4			
3			
2			
1			

PROJECT TITLE

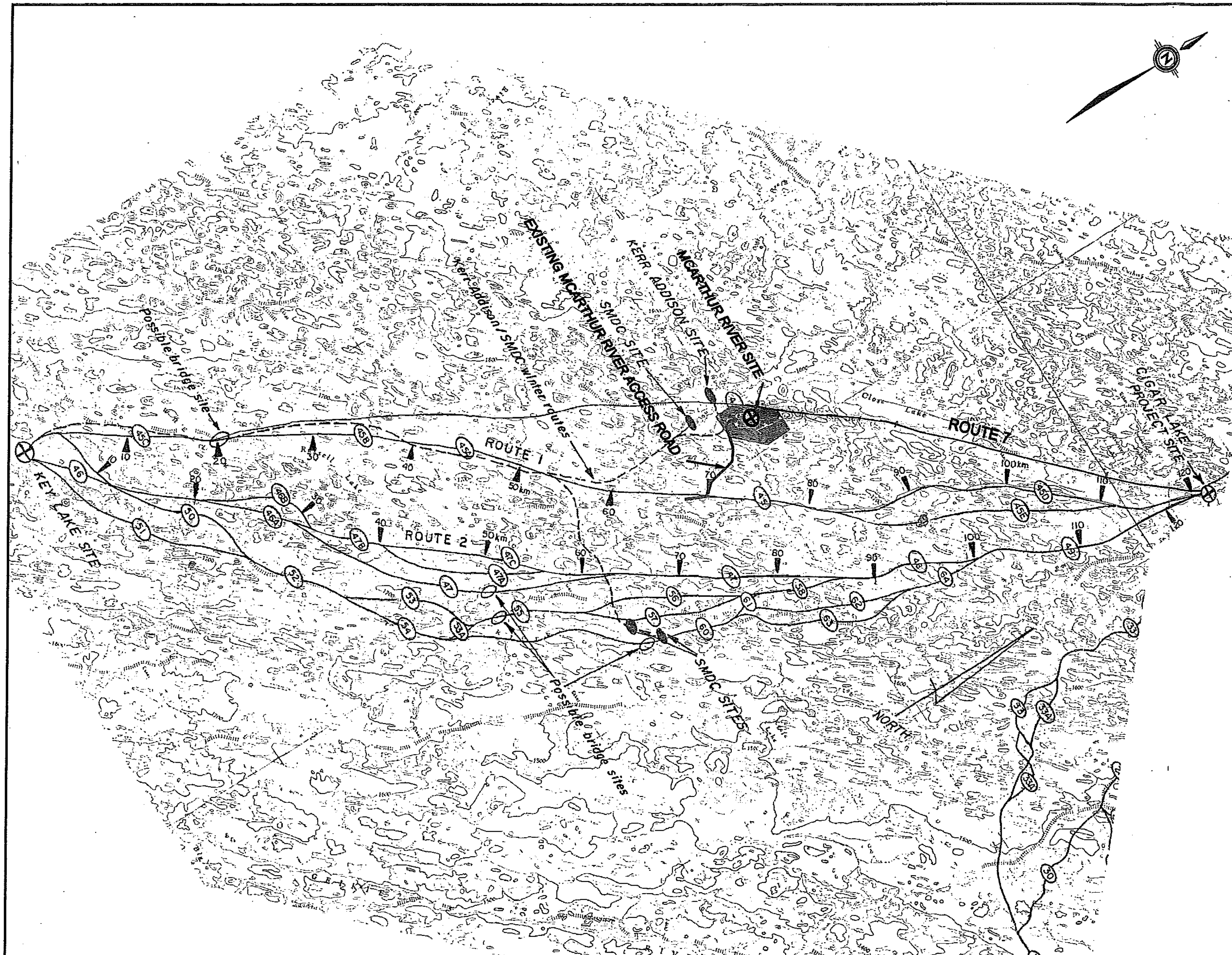
PRE-FEASIBILITY STUDY
MCARTHUR RIVER TO
CIGAR LAKE HAUL ROAD

DRAWING TITLE

OVERVIEW OF ROUTES
KEY LAKE TO
MCARTHUR RIVER
TO CIGAR LAKE

DRAWING LOCATION : C:\projects\2007\McArthur River Cigar Lake Haul Road\Design Haul Road.dwg

PROJECT NO.		FILE NO.	
MR-07-008		CAMECO	
DATE 5/8/2007	SCALE NTS	DWG. NO.	SHEET
DRAWN BDS	CHECKED	1	1OF1



CONSULTANT

CLUNIE CONSULTING ENGINEERS
4271 5th AVENUE EAST BAG #5800,
PRINCE ALBERT SASKATCHEWAN, CANADA
S6V 7V6
PH: 306-764-4896, FAX:306-764-1037

Note:

DRAWING ISSUE			
4			
3			
2			
1			
NO	DATE	DESCRIPTION	BY

DRAWING REVISIONS			
6			
5			
4			
3			
2			
1			
NO	DATE	DESCRIPTION	BY

PROJECT TITLE

PRE-FEASIBILITY STUDY MCARTHUR RIVER TO CIGAR LAKE HAUL ROAD

DRAWING TITLE

OVERVIEW OF ROUTES KEY LAKE TO MCARTHUR RIVER TO CIGAR LAKE

DRAWING LOCATION : C:\projects\2007\McArthur River Cigar Lake Haul Road\Design Haul Road.dwg

PROJECT NO.		FILE NO.	
MR-07-008		CAMECO	
DATE 5/8/2007	SCALE NTS	DWG. NO. 1	SHEET 1OF1
DRAWN BDS	CHECKED		

6.0 Road Design Criteria

The road will be designed to the following geometrics:

- right-of-way (ROW) width of 44 m;
- design speed of 100 km/h;
- maximum gradient of 7.0 %;
- roadway total top width of 8.6 m, outside shoulder to shoulder;
- roadway cross slope maximum 4.0 %;
- graveled all weather, undivided roadway surface;
- ditch width of 4.0 m; ditch cross slope of 5.0 %;
- ditch side slopes: standard 4 horizontal:1 vertical (4:1), and not steeper than 3 horizontal:1 vertical (3:1);
- ditch back slopes: 3 horizontal:1 vertical (3:1)
- Height above high water table – 1.0m minimum, 1.5m recommended.

7.0 Kick-off Meeting

The Engineer will meet with Cameco's project lead in Cameco's office to review and confirm project parameters and resolve any outstanding issues.

8.0 Schedule

Bid closing March ~~23~~ 26, 2007
Contract Award will be made no later than April 3, 2007.
Completion of the pre-feasibility study is required by May 18, 2007.

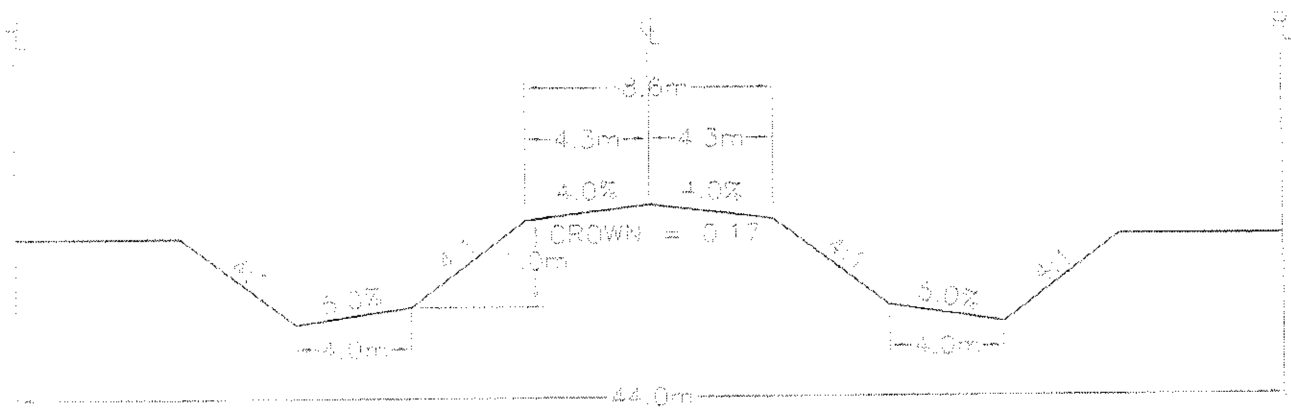
9.0 Reporting

The Engineer will provide weekly updates on progress and costs related to the project. The report for the week is to be provided by e-mail or fax no later than 4:00 P.M. each Friday.

10.0 Proposal Requirements

As a minimum include the following with the proposal:

- Proposed approach and a detailed work plan
- Schedule
- Additional information (if any) required to complete the work
- A cost estimate to complete the above scope of work
- List of exceptions, qualifications, and deviations to bid.
- List of key project personnel



SUB-CONSULTANT

CLUNIE CONSULTING ENGINEERS

4271 5th AVENUE EAST BAG #5800,
PRINCE ALBERT SASKATCHEWAN, CANADA
S6V 7V6
PH: 306-764-4896, FAX:306-764-1037

Note:

EXISTING GROUND IS BLACK
TYPICAL SECTION IS RED

DRAWING ISSUE

NO	DATE	DESCRIPTION	BY
4			
3			
2			
1			

DRAWING REVISIONS

NO	DATE	DESCRIPTION	BY
6			
5			
4			
3			
2			
1			

PROJECT TITLE

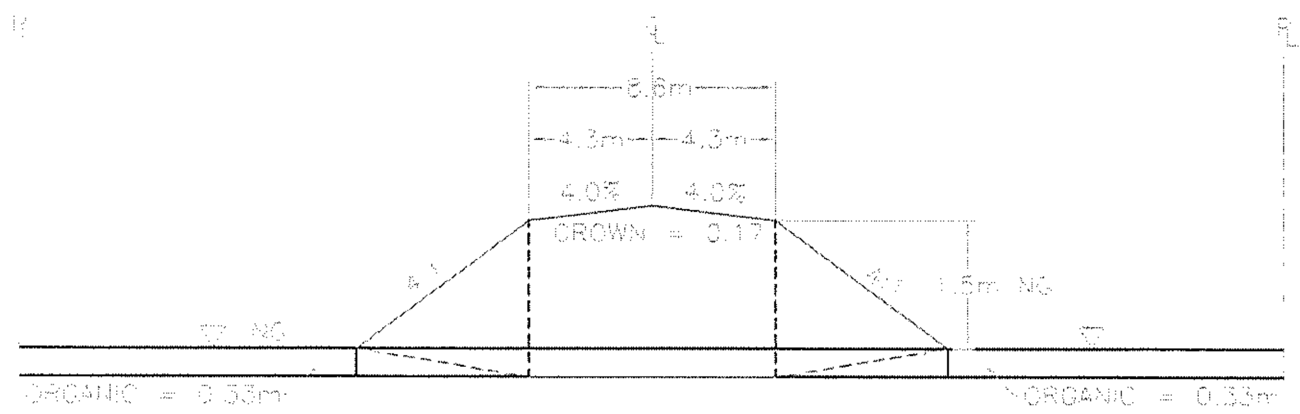
PRE-FEASIBILITY STUDY
MCCARTHUR RIVER TO
CIGAR LAKE HAUL ROAD

DRAWING TITLE

TYPICAL CROSS SECTION
TERRAIN TYPE Gl

DRAWING LOCATION : C:\Projects\2007\McArthur River Cigar Lake Haul Road\Drawings\Typical Cross Section 1.dwg

PROJECT NO.		FILE NO.	
MR-07-008		CAMECO	
DATE 5/8/2007	SCALE N.T.S.	DWG. NO.	SHEET
DRAWN BDS	CHECKED	2	1OF8



SUB-CONSULTANT

CLUNIE CONSULTING ENGINEERS

4271 5th AVENUE EAST BAG #5800,
PRINCE ALBERT SASKATCHEWAN, CANADA
S6V 7V6
PH: 306-764-4896, FAX:306-764-1037

Note:

EXISTING GROUND IS BLACK
TYPICAL SECTION IS RED

DRAWING ISSUE

NO	DATE	DESCRIPTION	BY
4			
3			
2			
1			

DRAWING REVISIONS

NO	DATE	DESCRIPTION	BY
6			
5			
4			
3			
2			
1			

PROJECT TITLE

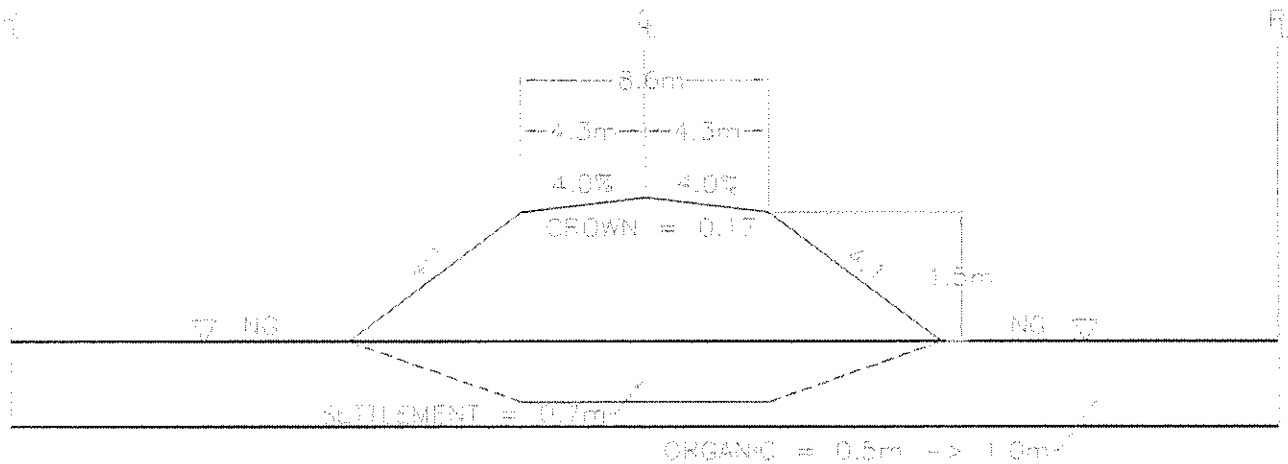
PRE-FEASIBILITY STUDY
MCCARTHUR RIVER TO
CIGAR LAKE HAUL ROAD

DRAWING TITLE

TYPICAL CROSS SECTION
TERRAIN TYPE W

DRAWING LOCATION : C:\Projects\2007\McArthur River Cigar Lake Haul Road\Drawings\Typical Cross Section 2.dwg

PROJECT NO.		FILE NO.	
MR-07-008		CAMECO	
DATE 3/8/2007	SCALE N.T.S.	DWG. NO.	SHEET
DRAWN BDS	CHECKED	2	2OF8



SUB-CONSULTANT

CLUNIE CONSULTING ENGINEERS

4271 5th AVENUE EAST BAG #5800,
PRINCE ALBERT SASKATCHEWAN, CANADA
S6V 7V6
PH: 306-764-4696, FAX:306-764-1037

Note:

EXISTING GROUND IS BLACK
TYPICAL SECTION IS RED

DRAWING ISSUE			
4			
3			
2			
1			
NO	DATE	DESCRIPTION	BY

DRAWING REVISIONS			
6			
5			
4			
3			
2			
1			
NO	DATE	DESCRIPTION	BY

PROJECT TITLE

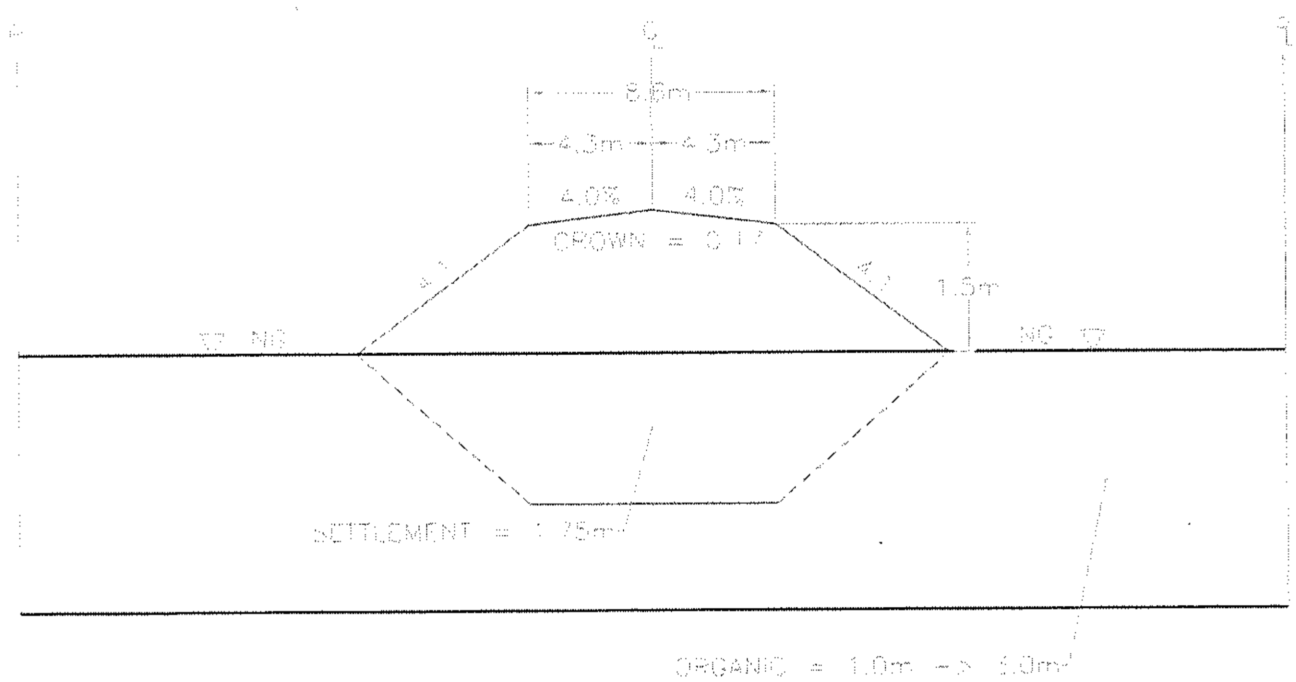
PRE-FEASIBILITY STUDY
MCCARTHUR RIVER TO
CIGAR LAKE HAUL ROAD

DRAWING TITLE

TYPICAL CROSS SECTION
TERRAIN TYPE S

DRAWING LOCATION : C:\Projects\2007\McArthur River Cigar Lake Haul Road\Drawings\Typical Cross Section 3.dwg

PROJECT NO. MR-07-008		FILE NO. CAMECO	
DATE 5/8/2007	SCALE N.T.S.	DWG. NO.	SHEET
DRAWN BDS	CHECKED	2	3OF8



SUB-CONSULTANT

CLUNIE CONSULTING ENGINEERS

4271 5th AVENUE EAST BAG #5800,
PRINCE ALBERT SASKATCHEWAN, CANADA
S6V 7V6
PH: 306-764-4890, FAX:306-764-1037

Note:

EXISTING GROUND IS BLACK
TYPICAL SECTION IS RED

DRAWING ISSUE

NO	DATE	DESCRIPTION	BY
4			
3			
2			
1			

DRAWING REVISIONS

NO	DATE	DESCRIPTION	BY
6			
5			
4			
3			
2			
1			

PROJECT TITLE

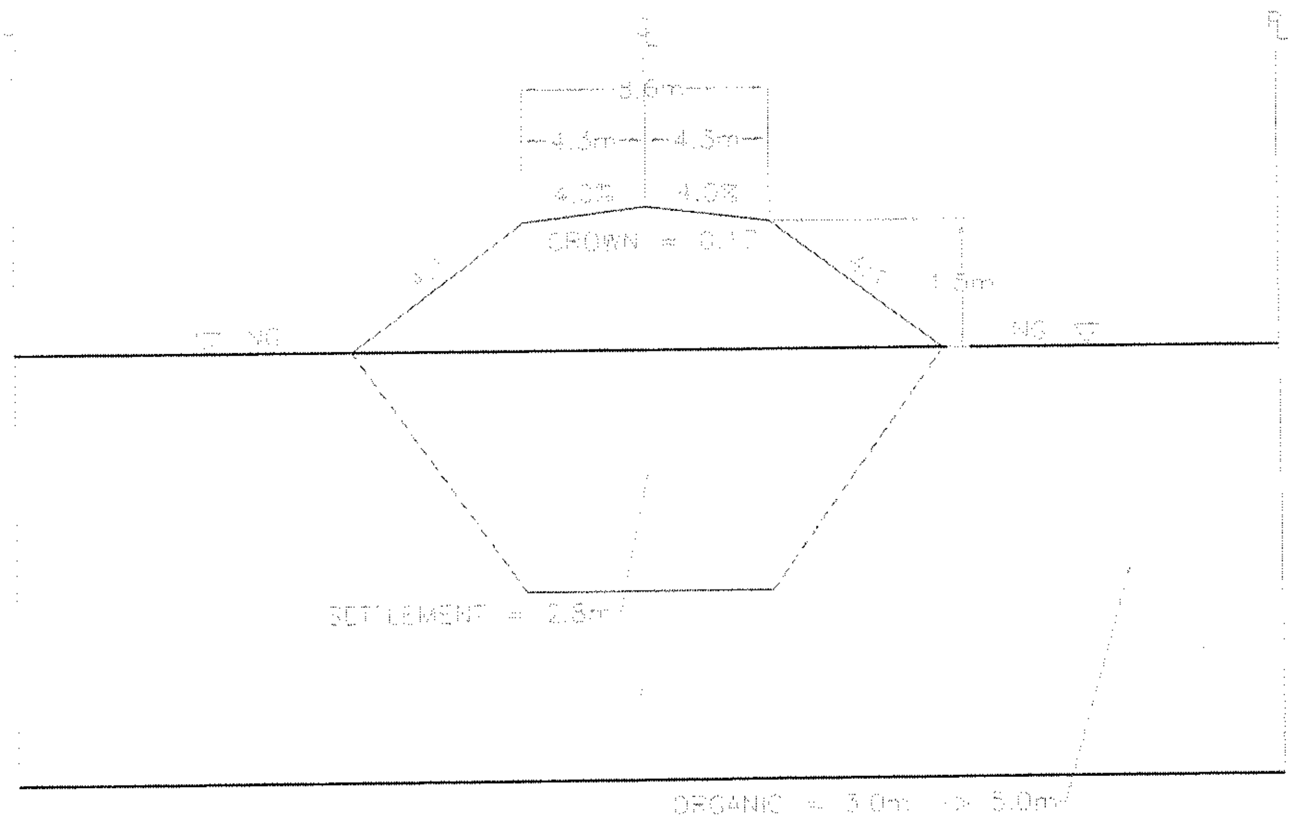
PRE–FEASIBILITY STUDY
MCCARTHUR RIVER TO
CIGAR LAKE HAUL ROAD

DRAWING TITLE

TYPICAL CROSS SECTION
TERRAIN TYPE M

DRAWING LOCATION : C:\Projects\2007\McArthur River Cigar Lake Haul Road\Drawings\Typical Cross Section 4.dwg

PROJECT NO. MR-07-008		FILE NO. CAMECO	
DATE 5/8/2007	SCALE N.T.S.	DWG. NO.	SHEET
DRAWN BDS	CHECKED	2	4OF8



SUB-CONSULTANT

CLUNIE CONSULTING ENGINEERS

4271 5th AVENUE EAST BAG #5800,
PRINCE ALBERT SASKATCHEWAN, CANADA
S6V 7V6
PH: 306-764-4896, FAX:306-764-1037

Note:

EXISTING GROUND IS BLACK
TYPICAL SECTION IS RED

DRAWING ISSUE			
NO	DATE	DESCRIPTION	BY
4			
3			
2			
1			

DRAWING REVISIONS			
NO	DATE	DESCRIPTION	BY
6			
5			
4			
3			
2			
1			

PROJECT TITLE

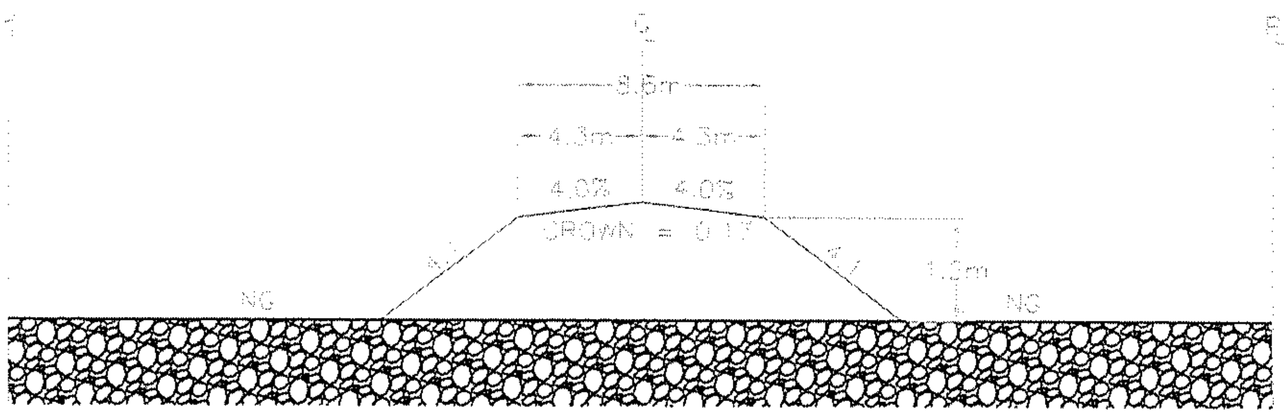
PRE-FEASIBILITY STUDY
MCCARTHUR RIVER TO
CIGAR LAKE HAUL ROAD

DRAWING TITLE

TYPICAL CROSS SECTION
TERRAIN TYPE C

DRAWING LOCATION : C:\Projects\2007\McArthur River Cigar Lake Haul Road\Drawings\Typical Cross Section 5.dwg

PROJECT NO.		FILE NO.	
MR-07-008		CAMECO	
DATE 3/8/2007	SCALE N.T.S.	DWG. NO.	SHEET
DRAWN BDS	CHECKED	2	5OF8



SUB-CONSULTANT
CLUNIE CONSULTING ENGINEERS
4271 5th AVENUE EAST BAG #5800,
PRINCE ALBERT SASKATCHEWAN, CANADA
S6V 7V6
PH: 306-764-4898, FAX:306-764-1037

Note:

EXISTING GROUND IS BLACK
TYPICAL SECTION IS RED

DRAWING ISSUE

NO	DATE	DESCRIPTION	BY
4			
3			
2			
1			

DRAWING REVISIONS

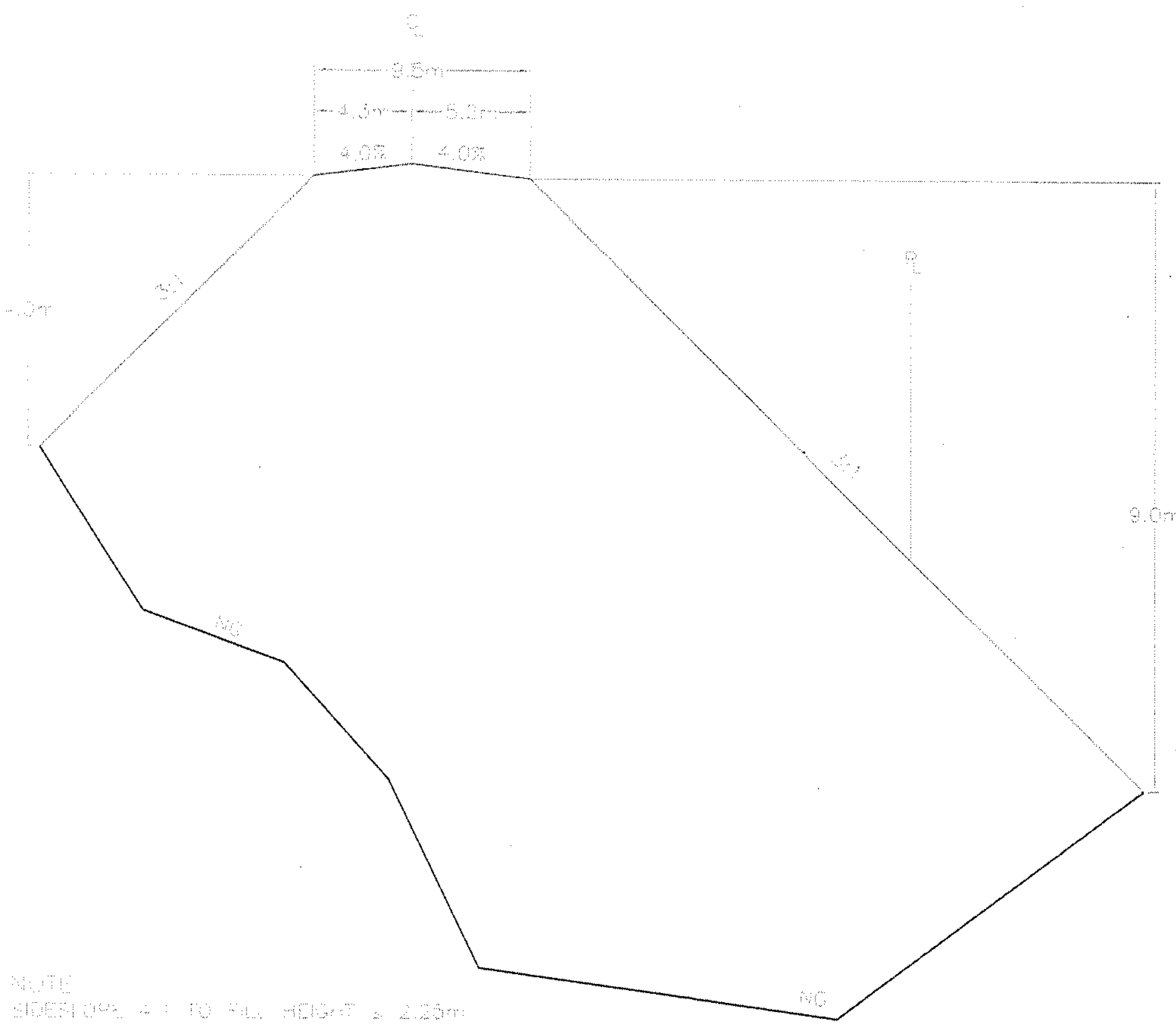
NO	DATE	DESCRIPTION	BY
6			
5			
4			
3			
2			
1			

PROJECT TITLE
PRE-FEASIBILITY STUDY
MCCARTHUR RIVER TO
CIGAR LAKE HAUL ROAD

DRAWING TITLE
TYPICAL CROSS SECTION
TERRAIN TYPE H

DRAWING LOCATION : C:\Projects\2007\McArthur River Cigar Lake Haul Road\Drawings\Typical Cross Section 8.dwg

PROJECT NO.		FILE NO.	
MR-07-008		CAMECO	
DATE 5/8/2007	SCALE N.T.S.	DWG. NO.	SHEET
DRAWN BDS	CHECKED	2	6OF8



NOTE
SIDESLOPE 4:1 TO FILL HEIGHT ≤ 2.25m
2.25m < FILL HEIGHT < 3.0m MAINTAIN TOE OF SIDESLOPE
AT 13.3m O/S FROM C/L
3:1 FOR FILL HEIGHT > 3.0m
IF FILL HEIGHT > 6.0m WIDEN ROAD TOP 0.9m

SUB-CONSULTANT
CLUNIE CONSULTING ENGINEERS
4271 5th AVENUE EAST BAG #5800,
PRINCE ALBERT SASKATCHEWAN, CANADA
S6V 7V6
PH: 306-764-4896, FAX:306-764-1037

Note:

EXISTING GROUND IS BLACK
TYPICAL SECTION IS RED

DRAWING ISSUE			
4			
3			
2			
1			
NO	DATE	DESCRIPTION	BY

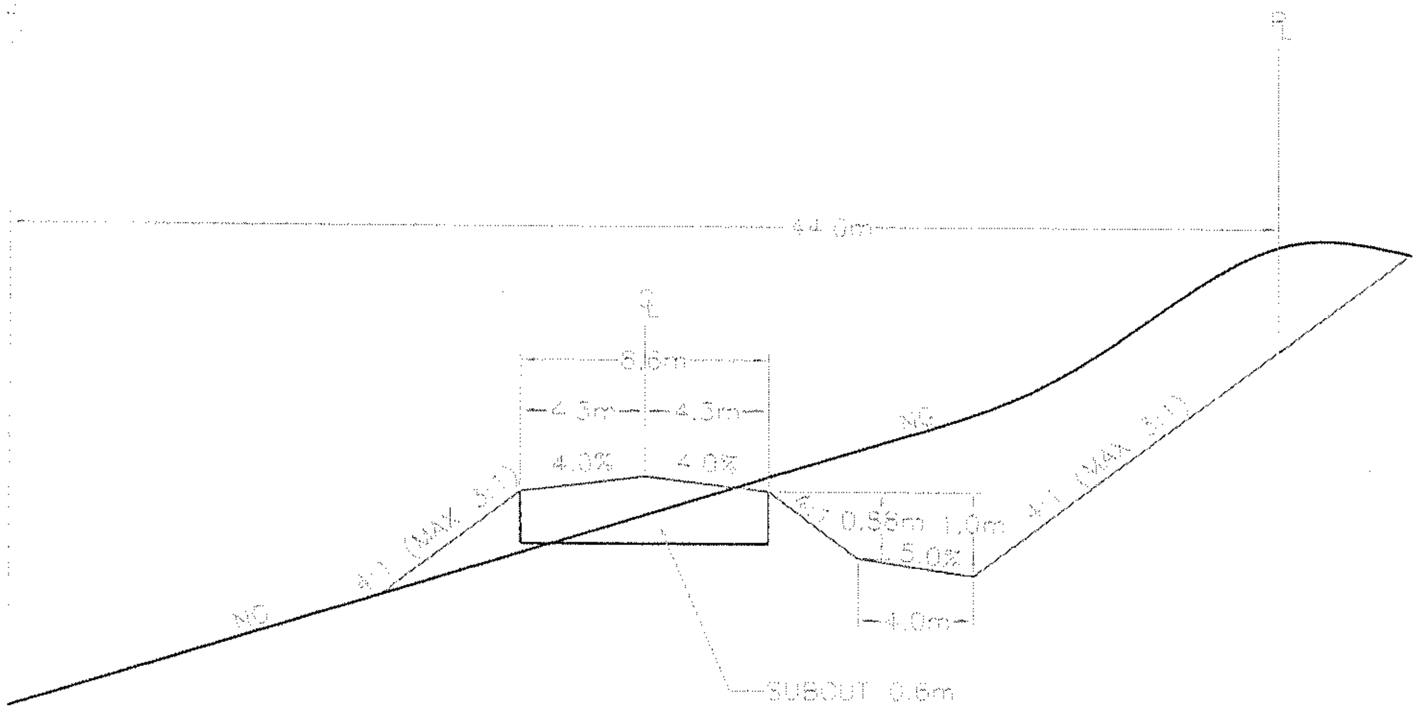
DRAWING REVISIONS			
6			
5			
4			
3			
2			
1			
NO	DATE	DESCRIPTION	BY

PROJECT TITLE
PRE-FEASIBILITY STUDY
MCCARTHUR RIVER TO
CIGAR LAKE HAUL ROAD

DRAWING TITLE
TYPICAL CROSS SECTION
FILL SECTION

DRAWING LOCATION : C:\Projects\2007\McArthur River Cigar Lake Haul Road\Drawings\Typical Cross Section 7.dwg

PROJECT NO. MR-07-008		FILE NO. CAMECO	
DATE 5/9/2007	SCALE N.T.S.	DWG. NO.	SHEET
DRAWN BDS	CHECKED	2	7OF8



NOTE:
BACKSLOPE MAINTAINED AT
4:1 TO 22m O/S FROM C/L
[illegible] MAXIMUM BACKSLOPE

SUB-CONSULTANT
CLUNIE CONSULTING ENGINEERS
4271 5th AVENUE EAST BAG #5800,
PRINCE ALBERT SASKATCHEWAN, CANADA
S6V 7V6
PH: 306-764-4896, FAX:306-764-1037

Note:

EXISTING GROUND IS BLACK
TYPICAL SECTION IS RED

DRAWING ISSUE

NO	DATE	DESCRIPTION	BY
4			
3			
2			
1			

DRAWING REVISIONS

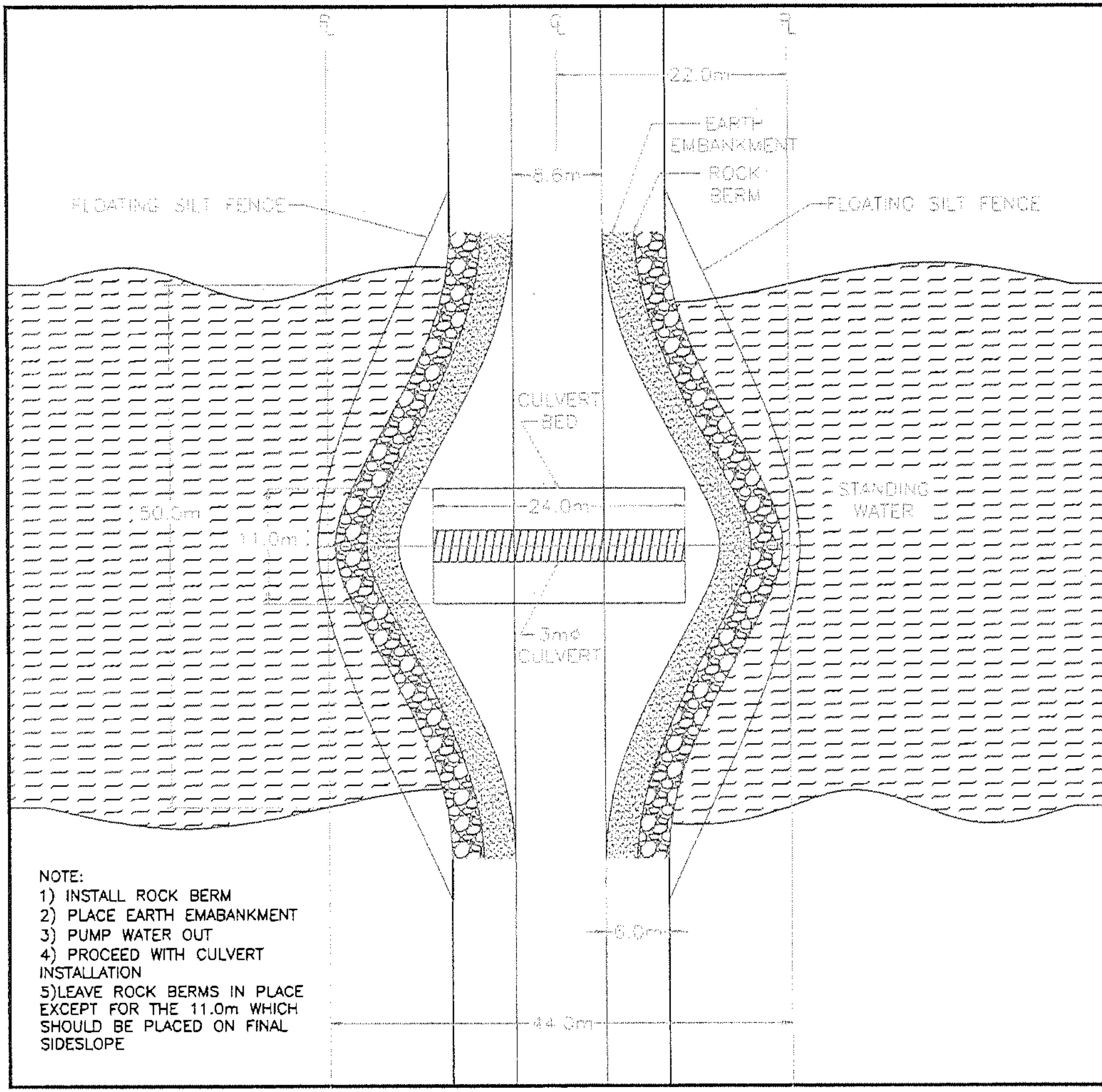
NO	DATE	DESCRIPTION	BY
6			
5			
4			
3			
2			
1			

PROJECT TITLE
PRE-FEASIBILITY STUDY
MCCARTHUR RIVER TO
CIGAR LAKE HAUL ROAD

DRAWING TITLE
TYPICAL CROSS SECTION
CUT-FILL SECTION

DRAWING LOCATION : C:\Projects\2007\McArthur River Cigar Lake Haul Road\Drawings\Typical Cross Section 8.dwg

PROJECT NO. MR-07-008		FILE NO. CAMECO	
DATE 5/8/2007	SCALE N.T.S.	DWG. NO.	SHEET
DRAWN BDS	CHECKED	2	8OF8



NOTE:
1) INSTALL ROCK BERM
2) PLACE EARTH EMABANKMENT
3) PUMP WATER OUT
4) PROCEED WITH CULVERT INSTALLATION
5)LEAVE ROCK BERMS IN PLACE EXCEPT FOR THE 11.0m WHICH SHOULD BE PLACED ON FINAL SIDESLOPE

SUB-CONSULTANT
CLUNIE CONSULTING ENGINEERS
4271 5th AVENUE EAST BAG #5800,
PRINCE ALBERT SASKATCHEWAN, CANADA
S6V 7V6
PH: 306-764-4886, FAX:306-764-1037

Note:

DRAWING ISSUE

NO	DATE	DESCRIPTION	BY
4			
3			
2			
1			

DRAWING REVISIONS

NO	DATE	DESCRIPTION	BY
6			
5			
4			
3			
2			
1			

PROJECT TITLE
PRE-FEASIBILITY STUDY MCCARTHUR RIVER TO CIGAR LAKE HAUL ROAD

DRAWING TITLE
TYPICAL MAJOR CULVERT INSTALLATION

DRAWING LOCATION : C:\Projects\2007\McArthur River Cigar Lake Haul Road\Drawings\Typical Major Culvert Installation Dwg3.dwg

PROJECT NO.	FILE NO.
MR-07-008	CAMECO

DATE	SCALE	DWG. NO.	SHEET
5/23/2007	N.T.S.	3	1OF1
DRAWN BDS	CHECKED		

LEGEND

G Glaciofluvial sand and gravel deposits: includes esker ridges, kame mounds or hummocks, flat-lying outwash and subglacial waterlaid deposits. Often eskers, kames and outwash will occur together as a complex. G_r and G_m terrain may have a boulder cover at surface, especially on crests or hilltops; the maximum boulder dimension is expected to be somewhat less here than on D terrain thus G terrain may be more manageable, from the boulder aspect, than construction in D terrain. G terrain may be topographically rough (G_r), of medium roughness (G_m), or, essentially level (G_ℓ). G_ℓ is expected to have fewer boulders on the surface and to be composed mainly of fine to coarse sand; in many instances, G_ℓ may be partially or totally derived by subglacial waterlaid deposition as opposed to outwash-type of deposition, thus accounting for the presence of some boulders on its surface.

D Drumlinized morainal deposits: generally north northeast/south southwest trending ridges; dry on top and sides of ridges with relatively wetter lower slopes (flanks); may be bouldery on surface particularly along crests and upper slopes; locally the lower slopes and saddles between drumlinized ridges may harbour fewer large boulders; drumlins are likely composed mainly of bouldery gravelly sandy-to-silty till this being indicated wherever erosion has breached a drumlin; steep-sided ridges are the dominant topographic feature. Where D is topographically rougher, and steeper grades are anticipated, it is mapped as D_r.

H Hummocky moraine deposits: topography in these areas tends to be rougher with smaller and choppier topography; knobs are prominent. Surface boulder occurrence increases in H areas to very bouldery. H terrain incudes some better-graded sand and gravel in kamey knobs but most knobs are composed mainly of sandy-to-gravelly silt till with boulder inclusions.

W Wet, bouldery, sandy slopewash or till deposits: these deposits follow the lower footslopes of ridges or are located in shallow saucer-shaped depressions. Expect some boulders and a water table somewhat nearer ground surface -- therefore a wetter surface -- than in D or G terrain. Generally covered by a sparse, stunted coniferous forest. Frequent old burnlines can be seen in the airphotos. Expect only a thin (<1/3 m) organic cover with little or no standing surface water. W areas are often too wet to be acceptable borrow sources.

S Treed swamp: these areas often follow flat-bottomed, low-gradient drainage courses. This terrain includes relatively minor occurrences of string bogs. The water table may often be at, or slightly above, ground surface and there is little or no microrelief. The peat is thought to be quite shallow, generally less than one (1) metre and often less than one-half (1/2) metre in thickness.

M Muskeg: mainly string-bog (ribbed fen) patterns. Individual strings are separated by narrow slit-like pools of stagnant water. Moreover, the strings are oriented approximately normal to the direction of surface runoff and groundwater flow. Peat is thickest in the strings and shallowest below the pools, called "flarks." We anticipate some minor amounts of permafrost in M terrain, particularly on the more northern route alternatives; this even when not mapped in association with C. Muskeg is normally mapped as M but, in Figure 3, it is often mapped as Mk. Expect deeper organic deposits in M than in S terrain -- say one (1) to three (3) metres. (In areas where permafrost is well expressed by the presence of thaw scars such areas will be mapped as M+C or C.)

C Complex pattern of deep muskeg pockets (sometimes up to 3 or 4 metres deep) and adjacent mounds composed of layered peat, ice, and mineral soils (palsas). Individual ice-layered peat mounds are too small to be separated out on scale 1 inch = 1000 foot photos. The map-unit C occurs in organic terrain in poorly-drained depressional tracts and usually (but not always) overlies fine-grained waterlaid soils that, in many places, has the consistency of a soft toothpaste. Small near-circular whitish areas in the muskeg are places where former large ground-ice inclusions in the peat and underlying mineral soils have melted out and formed thaw ponds that were subsequently colonized by water-loving sedges amd mosses. The densely wooded black-spruce "islands" are actually peat plateaus and palsas containing ground-ice layers. Thus "C" complex terrain type should be avoided where feasible to do so -- especially the wooded islands and sedge-covered meadows within such areas.

R Bedrock: mainly Precambrian meta-arkose and calc-silicate rocks.

D/R Drift over bedrock: patchy thin glacial drift overlay over bedrock. The drift may be less than one or two metres thick over rock in such areas and is usually comprised of till.

S+G,W+S etc. Complexes of various terrain combinations; such mixtures are commonly taken as 50 percent of each for terrain summary purposes.

K Kettlehole: may be muskeg-filled (M/K) or dry (K)

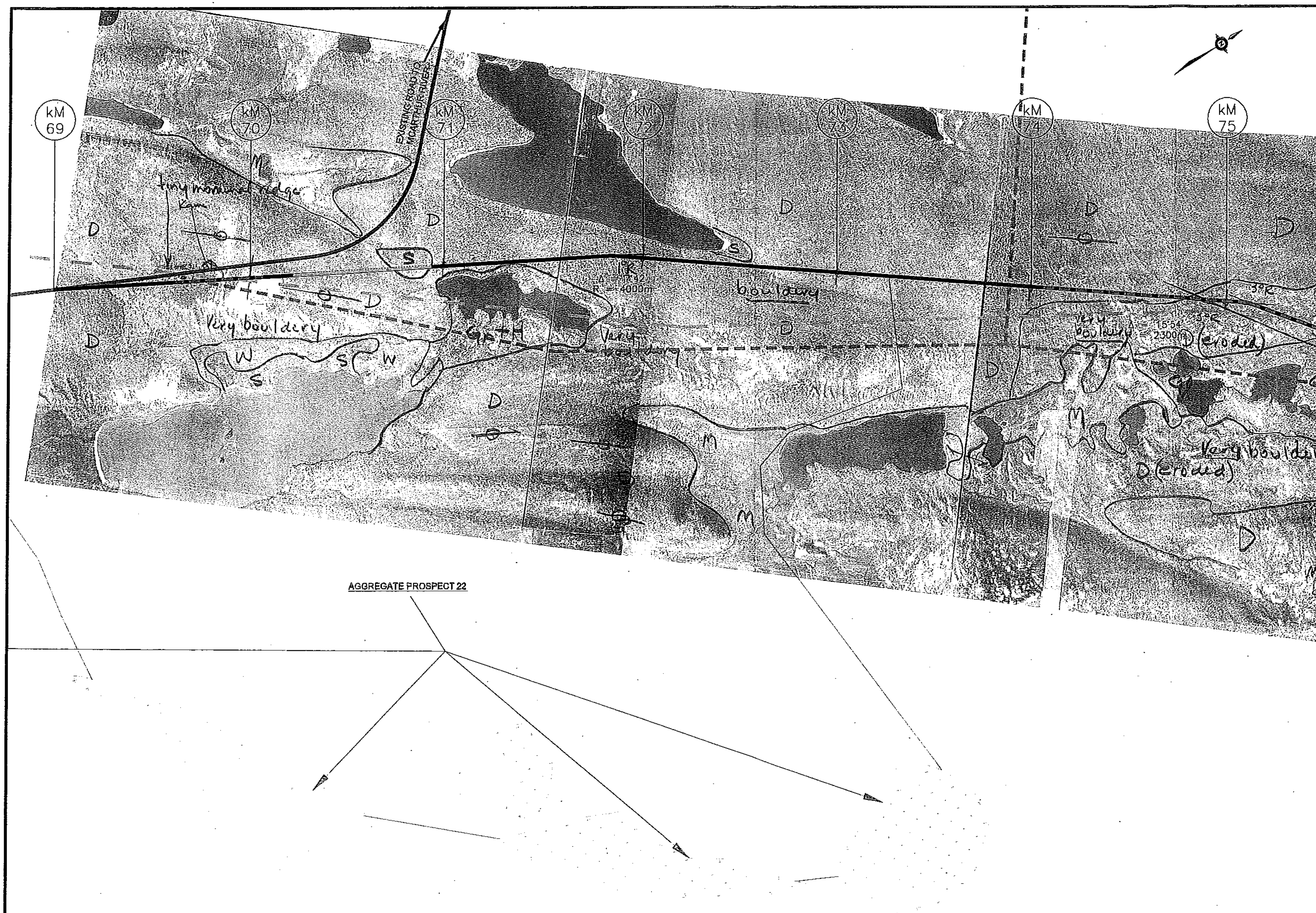
L Water bodies: lake, river or pond

GRAPHIC LEGEND

<<<< Esker

 Sand dunes

 Direction of "grain" of ridges (D); symbol usually placed on crest of drumlin ridge.



COLUNIE CONSULTING ENGINEERS

4271 5th AVENUE EAST BAG #5000,
PRINCE ALBERT SASKATCHEWAN, CANADA
S6V 7V6
PH: 306-764-4266, FAX:306-764-1037

LEGEND
- WET GROUND
- STEEP GRADE
- SWAMP OF MUSKEG (MAY NEED WINTER PADDING)
- SIDEHILL CONSTRUCTION
- HEAVIER THAN AVERAGE CONCENTRATIONS OF BOULDERS OR FELSENMEER
- HEAVY EARTHWORK LOCALLY
- WATER CROSSING
- TIGHT HORIZONTAL ALIGNMENT
- BEDROCK EXPOSURES OR NEAR SURFACE BEDROCK
- TRANSMISSION LINE DESIGN
- TRANSMISSION LINE ASBUILT
- PROPOSED RIGHT OF WAY
- EXISTING ROAD

Note:

FILES USED:
CIGAR TRANSMISSION LINE.TIF
CLUNIE_820.TIF
CLUNIE1.TIF
CLUNIE2.TIF
CLUNIE3C.TIF
CLUNIE4.JPG
CLUNIE5.TIF
CLUNIE6.TIF
CLUNIE7.TIF
GRIDDED IMAGE.DWG
GRIDDED IMAGE_1x3.TIF
GRIDDED IMAGE_2x3.TIF
GRIDDED IMAGE_3x3.TIF
LOWER MCARTHUR LAKE.BMP
MIDDLE MCARTHUR LAKE.BMP
OVERALL.BMP
UPPER MCARTHUR LAKE.BMP
WATERBURY LAKE.TIF

TERRAIN TYPE:

G Level	SAND & GRAVEL, TOPOGRAPHICALLY LEVEL
Gm	SAND & GRAVEL, TOPOG. MEDIUM ROUGHNESS
Gr	SAND & GRAVEL, TOPOGRAPHICALLY ROUGH
D	DRUMLINIZED MORAIN DEPOSITS
Dr	DRUMLINIZED MORAIN, TOPOGRAPHICALLY ROUGHER
H	HUMMOCKY MORAIN DEPOSITS, BOULDERY
W	WET, BOULDERY, ORGANICS 0.3m DEPTHS
S	TREED SWAMP, WATER @ SURFACE, ORGANICS 1.0m-0.5m
M	MUSKEG 1.0m-3.0m, SOME PERMAFROST
C	COMPLEX PATTERN, ORGANICS 3.0m-5.0m, PERMAFROST
R	BEDROCK
DR	DRIFT OVER BEDROCK, DRIFT 1.0m-2.0m DEPTH
K	KETTLEHOLE, MK INDICATES MUSKEG FILLED
L	WATER BODIES

0m 100m 200m 300m 400m 500m

DRAWING ISSUE

NO	DATE	DESCRIPTION	BY
5			
4			
3			
2			
1			

DRAWING REVISIONS

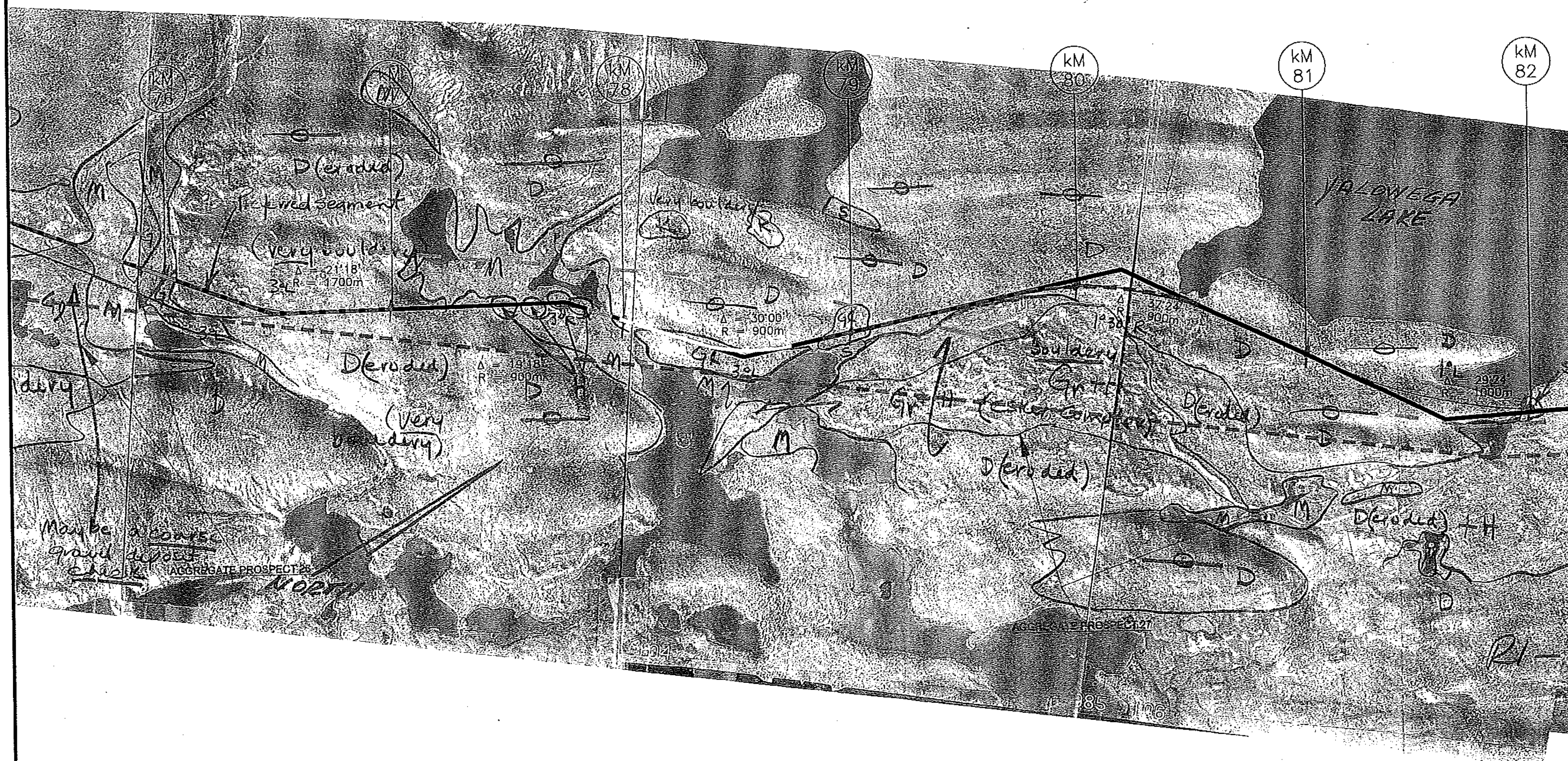
NO	DATE	DESCRIPTION	BY
6			
5			
4			
3			
2			
1			

PROJECT TITLE
PRE-FEASIBILITY STUDY
MCARTHUR RIVER TO
CIGAR LAKE HAUL ROAD

DRAWING TITLE
ROUTE 1
PHOTOMOSAIC SHEETS

DRAWING LOCATION : C:\projects\2007\McArthur River Cigar Lake Haul Road\Design Haul Road.dwg

PROJECT NO. MR-07-006		FILE NO. CAMECO	
DATE 5/8/2007	SCALE N.T.S.	DWG. NO. 4	SHEET 1OF8
DRAWN BDS	CHECKED		



COLUNIE CONSULTING ENGINEERS
4271 5th AVENUE EAST BAG #5800,
PRINCE ALBERT SASKATCHEWAN, CANADA
S6V 7V6
PH: 306-764-4898, FAX:306-764-1037

LEGEND

- WET GROUND
- STEEP GRADE
- SWAMP OF MUSKEG (MAY NEED WINTER PADDING)
- SIDEHILL CONSTRUCTION
- HEAVIER THAN AVERAGE CONCENTRATIONS OF BOULDERS OR FELSENMEER
- HEAVY EARTHWORK LOCALLY
- WATER CROSSING
- TIGHT HORIZONTAL ALIGNMENT
- BEDROCK EXPOSURES OR NEAR SURFACE BEDROCK
- TRANSMISSION LINE DESIGN
- TRANSMISSION LINE ASBUILT
- PROPOSED RIGHT OF WAY
- EXISTING ROAD

Note:

FILES USED:
CIGAR TRANSMISSION LINE.TIF
CLUNIE_820.TIF
CLUNIE1.TIF
CLUNIE2.TIF
CLUNIE3C.TIF
CLUNIE4.JPG
CLUNIE5.TIF
CLUNIE6.TIF
CLUNIE7.TIF
GRIDDED IMAGE.DWG
GRIDDED IMAGE_1x3.TIF
GRIDDED IMAGE_2x3.TIF
GRIDDED IMAGE_3x3.TIF
LOWER MCARTHUR LAKE.BMP
MIDDLE MCARTHUR LAKE.BMP
OVERALL.BMP
UPPER MCARTHUR LAKE.BMP
WATERBURY LAKE.TIF

TERRAIN TYPE:

G Level	SAND & GRAVEL, TOPOGRAPHICALLY LEVEL
Gm	SAND & GRAVEL, TOPOGL. MEDIUM ROUGHNESS
Gr	SAND & GRAVEL, TOPOGRAPHICALLY ROUGH
D	DRUMLINIZED MORAIN DEPOSITS
Dr	DRUMLINIZED MORAIN, TOPOGRAPHICALLY ROUGHER
H	HUMMOCKY MORAIN DEPOSITS, BOULDERY
W	WET, BOULDERY, ORGANICS 0.3m DEPTHS
S	TREED SWAMP, WATER @ SURFACE, ORGANICS 1.0m-0.5m
M	MUSKEG 1.0m-3.0m, SOME PERMAFROST
C	COMPLEX PATTERN, ORGANICS 3.0m-5.0m, PERMAFROST
R	BEDROCK
D/R	DRIFT OVER BEDROCK, DRIFT 1.0m-2.0m DEPTH
K	KETTLEHOLE, M/K INDICATES MUSKEG FILLED
L	WATER BODIES

0m 100m 200m 300m 400m 500m

DRAWING ISSUE

NO	DATE	DESCRIPTION	BY
5			
4			
3			
2			
1			

DRAWING REVISIONS

NO	DATE	DESCRIPTION	BY
5			
4			
3			
2			
1			

PROJECT TITLE

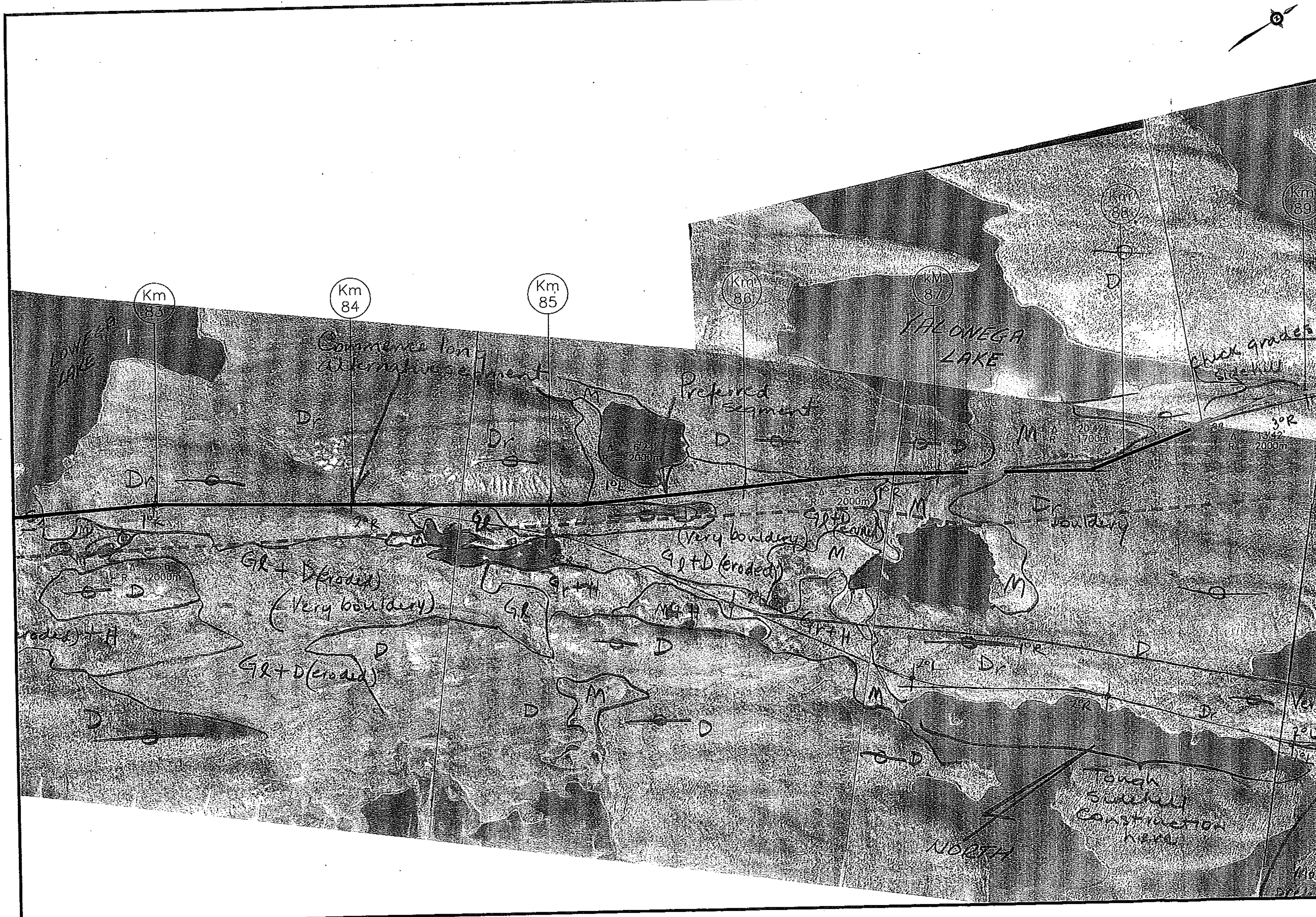
PRE-FEASIBILITY STUDY
MCARTHUR RIVER TO
CIGAR LAKE HAUL ROAD

DRAWING TITLE

ROUTE 1
PHOTOMOSAIC SHEETS

DRAWING LOCATION : C:\projects\2007\McArthur River Cigar Lake Haul Road\Design Haul Road.dwg

PROJECT NO. MR-07-008		FILE NO. CAMECO	
DATE 5/8/2007	SCALE N.T.S.	DWG. NO. 4	SHEET 2OF8
DRAWN BDS	CHECKED		



CLUNIE CONSULTING ENGINEERS

4271 5th AVENUE EAST BAG #5800,
PRINCE ALBERT SASKATCHEWAN, CANADA
S6V 7V6
PH: 306-764-4596, FAX:306-764-1037

LEGEND
WET GROUND
STEEP GRADE
SWAMP OF MUSKEG (MAY NEED WINTER PADDING)
SIDEHILL CONSTRUCTION
HEAVIER THAN AVERAGE CONCENTRATIONS OF BOULDERS OR FELSENMEER
HEAVY EARTHWORK LOCALLY
WATER CROSSING
TIGHT HORIZONTAL ALIGNMENT
BEDROCK EXPOSURES OR NEAR SURFACE BEDROCK
TRANSMISSION LINE DESIGN
TRANSMISSION LINE ASBUILT
PROPOSED RIGHT OF WAY
EXISTING ROAD

Note:

FILES USED:
CIGAR TRANSMISSION LINE.TIF
CLUNIE_S20.TIF
CLUNIE1.TIF
CLUNIE2.TIF
CLUNIE3O.TIF
CLUNIE4.JPG
CLUNIE5.TIF
CLUNIE6.TIF
CLUNIE7.TIF
GRIDDED IMAGE.DWG
GRIDDED IMAGE_1of3.TIF
GRIDDED IMAGE_2of3.TIF
GRIDDED IMAGE_3of3.TIF
LOWER MCARTHUR LAKE.BMP
MIDDLE MCARTHUR LAKE.BMP
OVERALL.BMP
UPPER MCARTHUR LAKE.BMP
WATERBURY LAKE.TIF

TERRAIN TYPE:

G Level	SAND & GRAVEL, TOPOGRAPHICALLY LEVEL
Gm	SAND & GRAVEL, TOPOG. MEDIUM ROUGHNESS
Gr	SAND & GRAVEL, TOPOGRAPHICALLY ROUGH
D	DRUMLINIZED MORAIN DEPOSITS
Dr	DRUMLINIZED MORAIN, TOPOGRAPHICALLY ROUGHER
H	HUMMOCKY MORAIN DEPOSITS, BOULDERY
W	WET, BOULDERY, ORGANICS 0.5m DEPTHS
S	TREED SWAMP, WATER @ SURFACE, ORGANICS 1.0m-0.5m
M	MUSKEG 1.0m-3.0m, SOME PERMAFROST
C	COMPLEX PATTERN, ORGANICS 3.0m-5.0m, PERMAFROST
R	BEDROCK
D/R	DRIFT OVER BEDROCK, DRIFT 1.0m-2.0m DEPTH
K	KETTLEHOLE, M/K INDICATES MUSKEG FILLED
L	WATER BODIES

0m 100m 200m 300m 400m 500m

DRAWING ISSUE

NO	DATE	DESCRIPTION	BY
5			
4			
3			
2			
1			

DRAWING REVISIONS

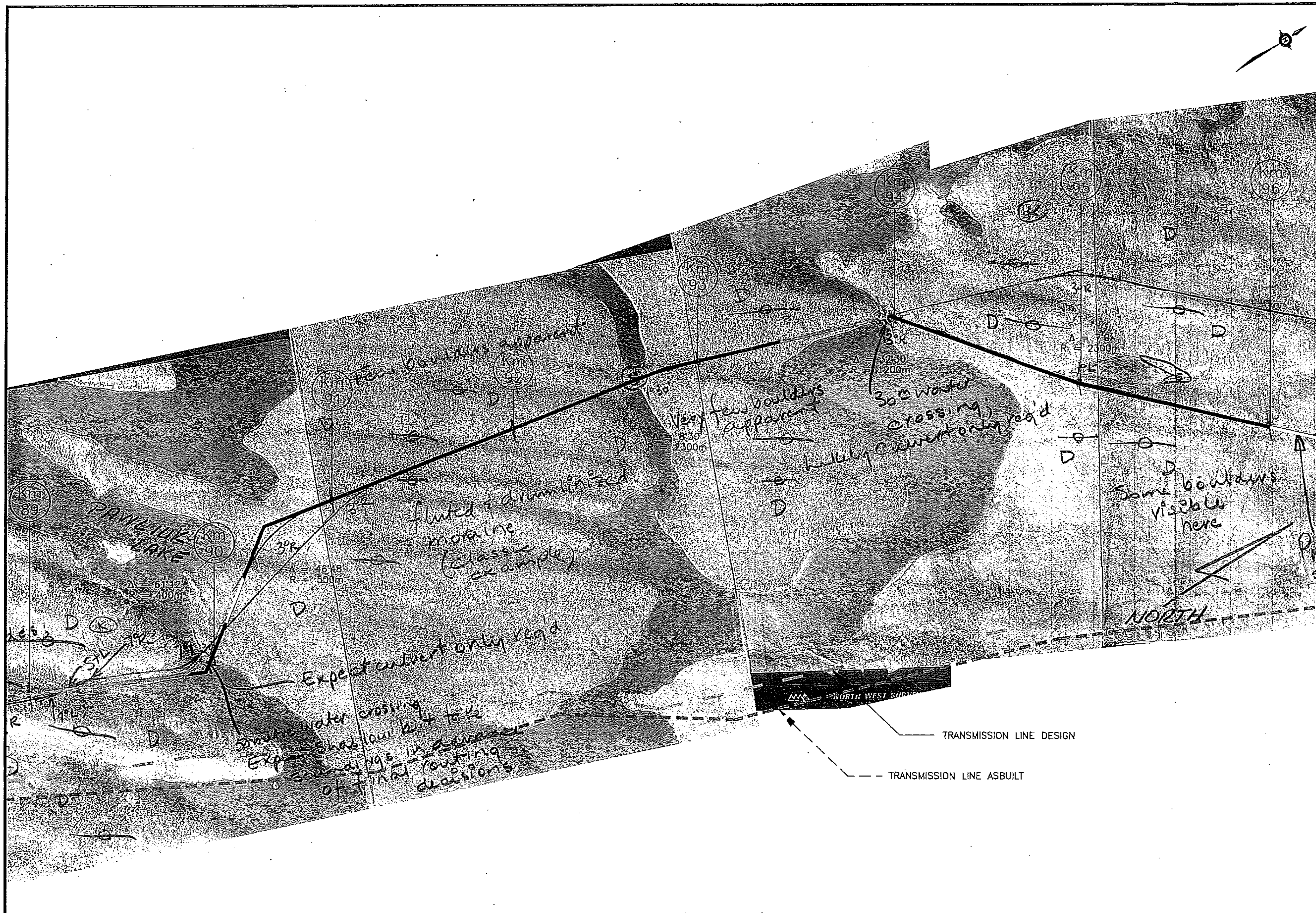
NO	DATE	DESCRIPTION	BY
6			
5			
4			
3			
2			
1			

PROJECT TITLE
PRE-FEASIBILITY STUDY
MCARTHUR RIVER TO
CIGAR LAKE HAUL ROAD

DRAWING TITLE
ROUTE 1
PHOTOMOSAIC SHEETS

DRAWING LOCATION : C:\projects\2007\McArthur River Cigar Lake Haul Road\Design Haul Road.dwg

PROJECT NO. MR-07-008		FILE NO. CAMECO	
DATE 6/8/2007	SCALE N.T.S.	DWG. NO. 4	SHEET 3OF8
DRAWN BDS	CHECKED		



CLUNIE CONSULTING ENGINEERS

4271 5th AVENUE EAST BAG #5800,
PRINCE ALBERT SASKATCHEWAN, CANADA
S6V 7V6
PH: 306-764-4896, FAX:306-764-1037

LEGEND
- WET GROUND
- STEEP GRADE
- SWAMP OF MUSKEG (MAY NEED WINTER PADDING)
- SIDEHILL CONSTRUCTION
- HEAVIER THAN AVERAGE CONCENTRATIONS OF BOULDERS OR FELSENMEER
- HEAVY EARTHWORK LOCALLY
- WATER CROSSING
- TIGHT HORIZONTAL ALIGNMENT
- BEDROCK EXPOSURES OR NEAR SURFACE BEDROCK
- TRANSMISSION LINE DESIGN
- TRANSMISSION LINE ASBUILT
- PROPOSED RIGHT OF WAY
- EXISTING ROAD

Note:

FILES USED:
CIGAR TRANSMISSION LINE.TIF
CLUNIE_020.TIF
CLUNIE1.TIF
CLUNIE2.TIF
CLUNIE30.TIF
CLUNIE4.JPG
CLUNIE5.TIF
CLUNIE6.TIF
CLUNIE7.TIF
GRIDDED IMAGE.DWG
GRIDDED IMAGE_1x3.TIF
GRIDDED IMAGE_2x3.TIF
GRIDDED IMAGE_3x3.TIF
LOWER MCARTHUR LAKE.BMP
MIDDLE MCARTHUR LAKE.BMP
OVERALL.BMP
UPPER MCARTHUR LAKE.BMP
WATERBURY LAKE.TIF

TERRAIN TYPE:

G Level	SAND & GRAVEL, TOPOGRAPHICALLY LEVEL
Gm	SAND & GRAVEL, TOPOG. MEDIUM ROUGHNESS
Gr	SAND & GRAVEL, TOPOGRAPHICALLY ROUGH
D	DRUMLINIZED MORAIN DEPOSITS
Dr	DRUMLINIZED MORAIN, TOPOGRAPHICALLY ROUGHER
H	HUMMOCKY MORAIN DEPOSITS, BOULDERY
W	WET, BOULDERY, ORGANICS 0.3m DEPTHS
S	TREED SWAMP, WATER @ SURFACE, ORGANICS 1.0m-0.5m
M	MUSKEG 1.0m-3.0m, SOME PERMAFROST
C	COMPLEX PATTERN, ORGANICS 1.0m-5.0m, PERMAFROST
R	BEDROCK
D/R	DRIFT OVER BEDROCK, DRIFT 1.0m-2.0m DEPTH
K	KETTLEHOLE, M/K INDICATES MUSKEG FILLED
L	WATER BODIES

0m 100m 200m 300m 400m 500m

DRAWING ISSUE

NO	DATE	DESCRIPTION	BY
5			
4			
3			
2			
1			

DRAWING REVISIONS

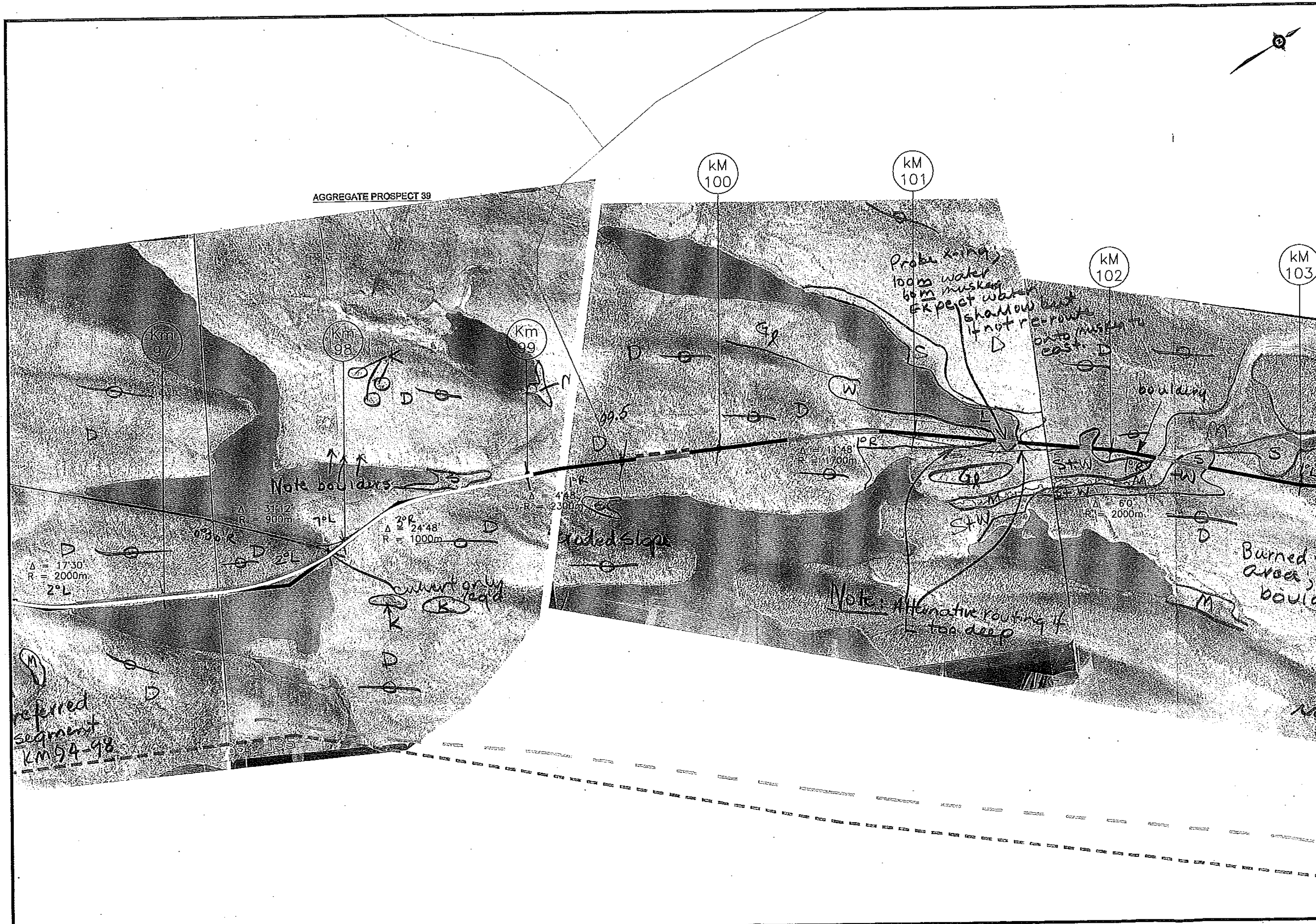
NO	DATE	DESCRIPTION	BY
6			
5			
4			
3			
2			
1			

PROJECT TITLE
PRE-FEASIBILITY STUDY MCARTHUR RIVER TO CIGAR LAKE HAUL ROAD

DRAWING TITLE
ROUTE 1 PHOTOMOSAIC SHEETS

DRAWING LOCATION : C:\projects\2007\McArthur River Cigar Lake Haul Road\Design Haul Road.dwg

PROJECT NO. MR-07-008		FILE NO. CAMECO	
DATE 6/8/2007	SCALE N.T.S.	DWG. NO. 4	SHEET 4OF8
DRAWN BDS	CHECKED		



CLUNIE CONSULTING ENGINEERS

427 1 5th AVENUE EAST BAG #5800,
PRINCE ALBERT SASKATCHEWAN, CANADA
S6V 7V8
PH: 306-764-4896, FAX:306-764-1037

LEGEND
- WET GROUND
- STEEP GRADE
- SWAMP OF MUSKEG (MAY NEED WINTER PADDING)
- SIDEHILL CONSTRUCTION
- HEAVIER THAN AVERAGE CONCENTRATIONS OF BOULDERS OR FELSENMEER
- HEAVY EARTHWORK LOCALLY
- WATER CROSSING
- TIGHT HORIZONTAL ALIGNMENT
- BEDROCK EXPOSURES OR NEAR SURFACE BEDROCK
- TRANSMISSION LINE DESIGN
- TRANSMISSION LINE ASBUILT
- PROPOSED RIGHT OF WAY
- EXISTING ROAD

Note:

FILES USED:
CIGAR TRANSMISSION LINE.TIF
CLUNIE_020.TIF
CLUNIE1.TIF
CLUNIE2.TIF
CLUNIE3O.TIF
CLUNIE4.JPG
CLUNIE5.TIF
CLUNIE6.TIF
CLUNIE7.TIF
GRIDDED IMAGE.DWG
GRIDDED IMAGE_1o3.TIF
GRIDDED IMAGE_2o3.TIF
GRIDDED IMAGE_3o3.TIF
LOWER MCARTHUR LAKE.BMP
MIDDLE MCARTHUR LAKE.BMP
OVERALL.BMP
UPPER MCARTHUR LAKE.BMP
WATERBURY LAKE.TIF

TERRAIN TYPE:

G Level	SAND & GRAVEL, TOPOGRAPHICALLY LEVEL
Gm	SAND & GRAVEL, TOPOG. MEDIUM ROUGHNESS
Gr	SAND & GRAVEL, TOPOGRAPHICALLY ROUGH
D	DRUMLINIZED MORAIN DEPOSITS
Dr	DRUMLINIZED MORAIN, TOPOGRAPHICALLY ROUGHER
H	HUMMOCKY MORAIN DEPOSITS, BOULDERY
W	WET, BOULDERY, ORGANICS 0.5m DEPTHS
S	TREED SWAMP, WATER @ SURFACE, ORGANICS 1.0m-5.5m
M	MUSKEG 1.0m-3.0m, SOME PERMAFROST
C	COMPLEX PATTERN, ORGANICS 3.0m-5.0m, PERMAFROST
R	BEDROCK
DR	DRIFT OVER BEDROCK, DRIFT 1.0m-2.0m DEPTH
K	KETTLEHOLE, MK INDICATES MUSKEG FILLED
L	WATER BODIES

0m 100m 200m 300m 400m 500m

DRAWING ISSUE

NO	DATE	DESCRIPTION	BY
5			
4			
3			
2			
1			

DRAWING REVISIONS

NO	DATE	DESCRIPTION	BY
6			
5			
4			
3			
2			
1			

PROJECT TITLE

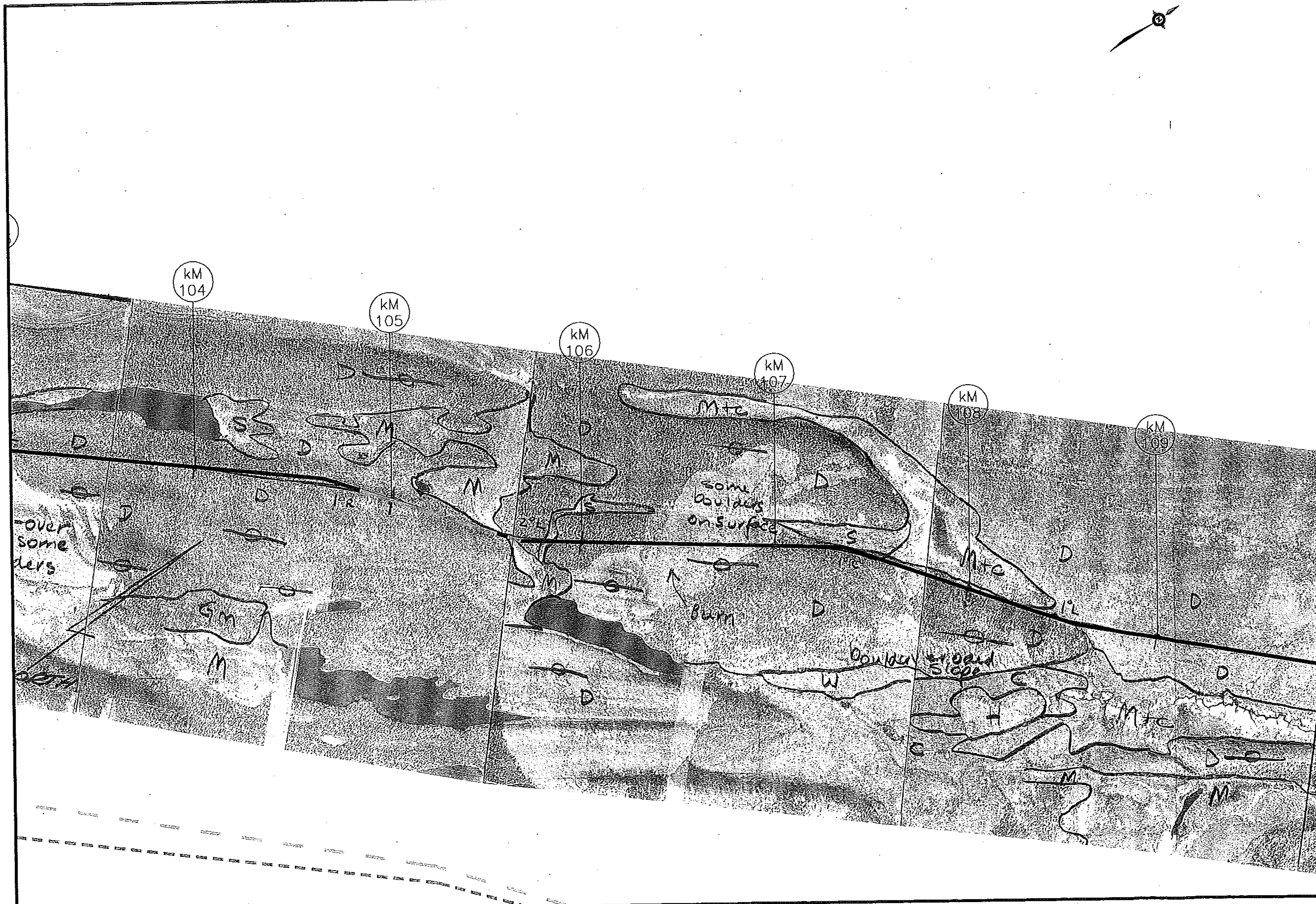
PRE-FEASIBILITY STUDY
MCARTHUR RIVER TO
CIGAR LAKE HAUL ROAD

DRAWING TITLE

ROUTE 1
PHOTOMOSAIC SHEETS

DRAWING LOCATION : C:\projects\2007\McArthur River Cigar Lake Haul Road\Design Haul Road.dwg

PROJECT NO.	FILE NO.		
MR-07-008	CAMECO		
DATE 5/8/2007	SCALE N.T.S.	DWG. NO. 4	SHEET 5OF8
DRAWN BOS	CHECKED		



CLUNIE CONSULTING ENGINEERS

4271 5th AVENUE EAST BAG #5900,
PRINCE ALBERT SASKATCHEWAN, CANADA
S6V 7V6
PH: 306-764-4398, FAX:306-764-4037

LEGEND
- WET GROUND
- STEEP GRADE
- SWAMP OF MUSKEG (MAY NEED WINTER PADDING)
- SIDEHILL CONSTRUCTION
- HEAVIER THAN AVERAGE CONCENTRATIONS OF BOULDERS OR FELSENMEER
- HEAVY EARTHWORK LOCALLY
- WATER CROSSING
- TIGHT HORIZONTAL ALIGNMENT
- BEDROCK EXPOSURES OR NEAR SURFACE BEDROCK
- TRANSMISSION LINE DESIGN
- TRANSMISSION LINE ASSULT
- PROPOSED RIGHT OF WAY
- EXISTING ROAD

Note:

FILES USED:
CIGAR TRANSMISSION LINE.TIF
CLUNIE_020.TIF
CLUNIE1.TIF
CLUNIE2.TIF
CLUNIE3G.TIF
CLUNIE4.JPG
CLUNIE5.TIF
CLUNIE6.TIF
CLUNIE7.TIF
GRIDDED IMAGE.DWG
GRIDDED IMAGE_1of3.TIF
GRIDDED IMAGE_2of3.TIF
GRIDDED IMAGE_3of3.TIF
LOWER MCARTHUR LAKE.BMP
MIDDLE MCARTHUR LAKE.BMP
OVERALL.BMP
UPPER MCARTHUR LAKE.BMP
WATERBURY LAKE.TIF

TERRAIN TYPE:

G Level	SAND & GRAVEL, TOPOGRAPHICALLY LEVEL
Gm	SAND & GRAVEL, TOPOG. MEDIUM ROUGHNESS
Gr	SAND & GRAVEL, TOPOGRAPHICALLY ROUGH
D	DRUMLINIZED MORAIN DEPOSITS
Dr	DRUMLINIZED MORAIN, TOPOGRAPHICALLY ROUGHER
H	HUMMOCKY MORAIN DEPOSITS, BOULDERY
W	WET, BOULDERY, ORGANICS 0.3m DEPTHS
S	TREED SWAMP, WATER @ SURFACE, ORGANICS 1.0m-0.5m
M	MUSKEG 1.0m-3.0m, SOME PERMAFROST
C	COMPLEX PATTERN, ORGANICS 3.0m-5.0m, PERMAFROST
R	BEDROCK
D/R	DRIFT OVER BEDROCK, DRIFT 1.0m-2.0m DEPTH
K	KETTLEHOLE, M/K INDICATES MUSKEG FILLED
L	WATER BODIES

0m 100m 200m 300m 400m 500m

DRAWING ISSUE

NO	DATE	DESCRIPTION	BY
5			
4			
3			
2			
1			

DRAWING REVISIONS

NO	DATE	DESCRIPTION	BY
6			
5			
4			
3			
2			
1			

PROJECT TITLE

PRE-FEASIBILITY STUDY MCARTHUR RIVER TO CIGAR LAKE HAUL ROAD

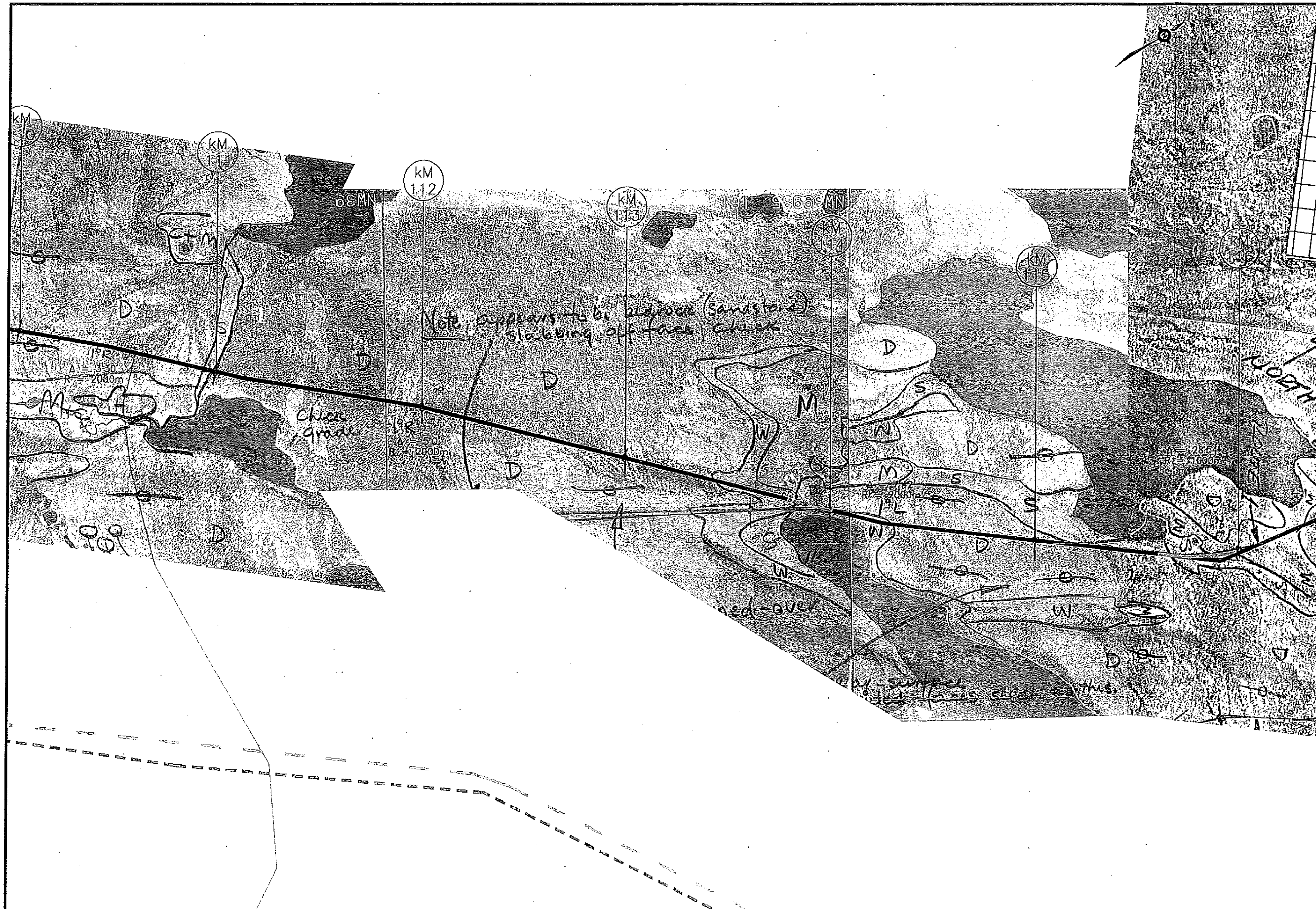
DRAWING TITLE

ROUTE 1 PHOTOMOSAIC SHEETS

DRAWING LOCATION : C:\projects\2007\McArthur River Cigar Lake Haul Road\Design Haul Road.dwg

PROJECT NO. MR-07-008	FILE NO. CAMECO

DATE 6/8/2007	SCALE N.T.S.	DWG. NO. 4	SHEET 6OF8
DRAWN BDS	CHECKED		



CLUNIE CONSULTING ENGINEERS
4271 5th AVENUE EAST BAG #5800,
PRINCE ALBERT SASKATCHEWAN, CANADA
S6V 7V5
PH: 306-764-4856, FAX:306-764-1057

LEGEND
- WET GROUND
- STEEP GRADE
- SWAMP OF MUSKEG (MAY NEED WINTER PADDING)
- SIDEHILL CONSTRUCTION
- HEAVIER THAN AVERAGE CONCENTRATIONS OF BOULDERS OR FELSENMEER
- HEAVY EARTHWORK LOCALLY
- WATER CROSSING
- TIGHT HORIZONTAL ALIGNMENT
- BEDROCK EXPOSURES OR NEAR SURFACE BEDROCK
- TRANSMISSION LINE DESIGN
- TRANSMISSION LINE ASBUILT
- PROPOSED RIGHT OF WAY
- EXISTING ROAD

Note:

FILES USED:
CIGAR TRANSMISSION LINE.TIF
CLUNIE_020.TIF
CLUNIE1.TIF
CLUNIE2.TIF
CLUNIE3C.TIF
CLUNIE4.JPG
CLUNIE5.TIF
CLUNIE6.TIF
CLUNIE7.TIF
GRIDDED IMAGE.DWG
GRIDDED IMAGE_1of3.TIF
GRIDDED IMAGE_2of3.TIF
GRIDDED IMAGE_3of3.TIF
LOWER MCARTHUR LAKE.BMP
MIDDLE MCARTHUR LAKE.BMP
OVERALL.BMP
UPPER MCARTHUR LAKE.BMP
WATERBURRY LAKE.TIF

TERRAIN TYPE:

G Level	SAND & GRAVEL, TOPOGRAPHICALLY LEVEL
Gm	SAND & GRAVEL, TOPOG. MEDIUM ROUGHNESS
Gr	SAND & GRAVEL, TOPOGRAPHICALLY ROUGH
D	DRUMLINIZED MORAIN DEPOSITS
Dr	DRUMLINIZED MORAIN, TOPOGRAPHICALLY ROUGHER
H	HUMMOCKY MORAIN DEPOSITS, BOULDERY
W	WET, BOULDERY, ORGANICS 0.3m DEPTHS
S	TREED SWAMP, WATER @ SURFACE, ORGANICS 1.0m-0.5m
M	MUSKEG 1.0m-3.0m, SOME PERMAFROST
C	COMPLEX PATTERN, ORGANICS 3.0m-5.0m, PERMAFROST
R	BEDROCK
D/R	DRIFT OVER BEDROCK, DRIFT 1.0m-2.0m DEPTH
K	KETTLEHOLE, M/K INDICATES MUSKEG FILLED
L	WATER BODIES

DRAWING ISSUE

NO	DATE	DESCRIPTION	BY
6			
4			
3			
2			
1			

DRAWING REVISIONS

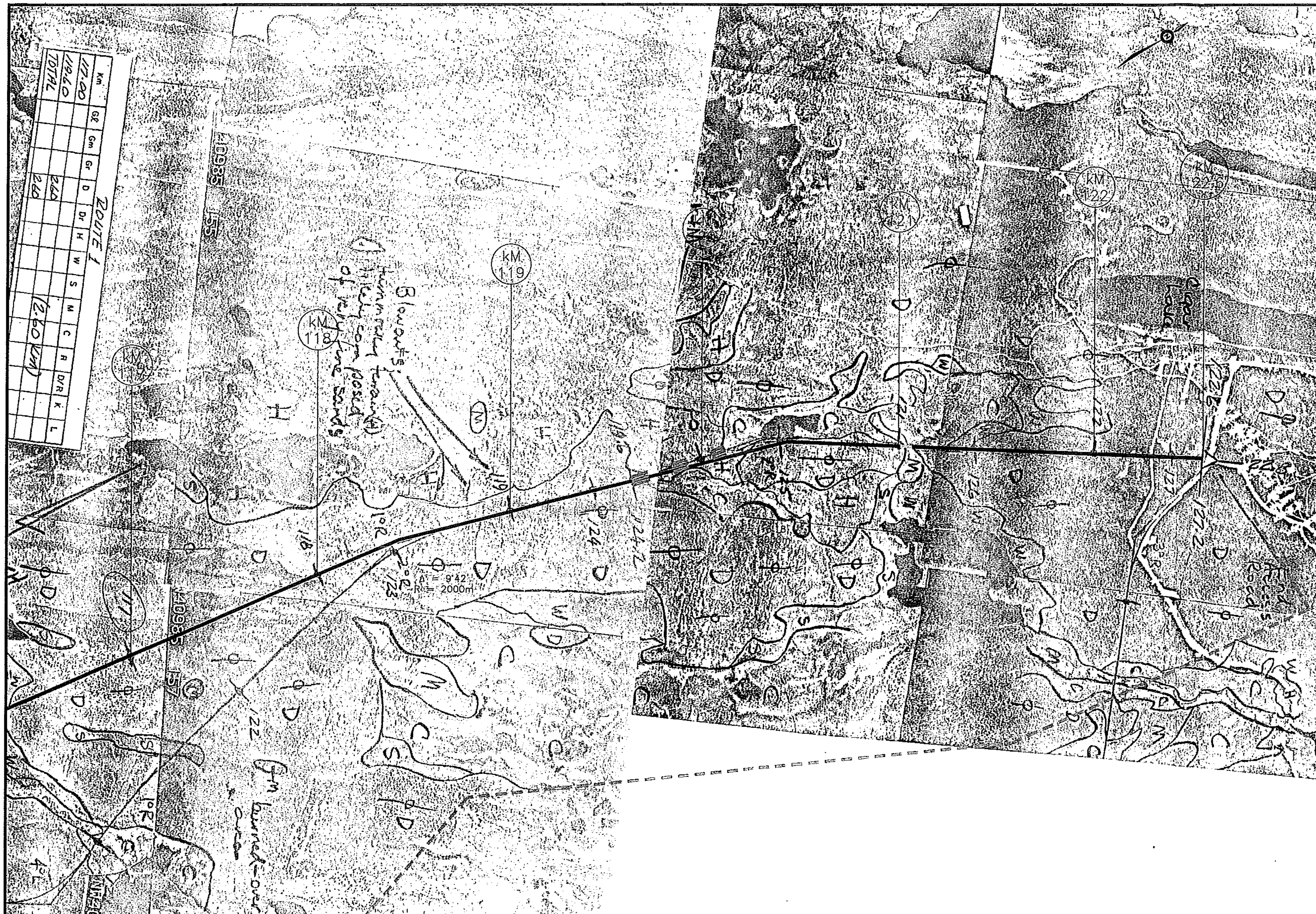
NO	DATE	DESCRIPTION	BY
6			
5			
4			
3			
2			
1			

PROJECT TITLE
PRE-FEASIBILITY STUDY MCARTHUR RIVER TO CIGAR LAKE HAUL ROAD

DRAWING TITLE
ROUTE 1 PHOTOMOSAIC SHEETS

DRAWING LOCATION : C:\projects\2007\McArthur River Cigar Lake Haul Road\Design Haul Road.dwg

PROJECT NO. MR-07-008		FILE NO. CAMECO	
DATE 5/8/2007	SCALE N.T.S.	DWG. NO. 4	SHEET 7OF8
DRAWN BDS	CHECKED		



COLUNIE CONSULTING ENGINEERS

4271 5th AVENUE EAST BAG #5300,
PRINCE ALBERT SASKATCHEWAN, CANADA
S6V 7V6
PH: 306-764-4588, FAX:306-764-1037

LEGEND

- WET GROUND
- STEEP GRADE
- SWAMP OF MUSKEG (MAY NEED WINTER PADDING)
- SIDEHILL CONSTRUCTION
- HEAVIER THAN AVERAGE CONCENTRATIONS OF BOULDERS OR FELSENMEER
- HEAVY EARTHWORK LOCALLY
- WATER CROSSING
- TIGHT HORIZONTAL ALIGNMENT
- BEDROCK EXPOSURES OR NEAR SURFACE BEDROCK
- TRANSMISSION LINE DESIGN
- TRANSMISSION LINE ASBUILT
- PROPOSED RIGHT OF WAY
- EXISTING ROAD

Note:

FILES USED:
CIGAR TRANSMISSION LINE.TIF
CLUNIE_020.TIF
CLUNIE1.TIF
CLUNIE2.TIF
CLUNIE3C.TIF
CLUNIE4.JPG
CLUNIE5.TIF
CLUNIE6.TIF
CLUNIE7.TIF
GRIDDED IMAGE.DWG
GRIDDED IMAGE_1of3.TIF
GRIDDED IMAGE_2of3.TIF
GRIDDED IMAGE_3of3.TIF
LOWER MCARTHUR LAKE.BMP
MIDDLE MCARTHUR LAKE.BMP
OVERALL.BMP
UPPER MCARTHUR LAKE.BMP
WATERBURRY LAKE.TIF

TERRAIN TYPE:

G Level	SAND & GRAVEL, TOPOGRAPHICALLY LEVEL
Gm	SAND & GRAVEL, TOPOG. MEDIUM ROUGHNESS
Gr	SAND & GRAVEL, TOPOGRAPHICALLY ROUGH
D	DRUMLINIZED MORAIN DEPOSITS
Dr	DRUMLINIZED MORAIN, TOPOGRAPHICALLY ROUGHER
H	HUMMOCKY MORAIN DEPOSITS, BOULDERY
W	WET, BOULDERY, ORGANICS 0.3m DEPTHS
S	TREED SWAMP, WATER @ SURFACE, ORGANICS 1.0m-0.5m
M	MUSKEG 1.0m-5.0m, SOME PERMAFROST
C	COMPLEX PATTERN, ORGANICS 3.0m-5.0m, PERMAFROST
R	BEDROCK
D/R	DRIFT OVER BEDROCK, DRIFT 1.0m-2.0m DEPTH
K	KETTLEHOLE, M/K INDICATES MUSKEG FILLED
L	WATER BODIES

0m 100m 200m 300m 400m 500m

DRAWING ISSUE			
5			
4			
3			
2			
1			
NO	DATE	DESCRIPTION	BY

DRAWING REVISIONS			
6			
5			
4			
3			
2			
1			
NO	DATE	DESCRIPTION	BY

PROJECT TITLE

PRE-FEASIBILITY STUDY
MCARTHUR RIVER TO
CIGAR LAKE HAUL ROAD

DRAWING TITLE

ROUTE 1
PHOTOMOSAIC SHEETS

DRAWING LOCATION : C:\projects\2007\McArthur River Cigar Lake Haul Road\Design Haul Road.dwg

PROJECT NO. MR-07-008		FILE NO. CAMECO	
DATE 5/8/2007	SCALE N.T.S.	DWG. NO.	SHEET
DRAWN BDS	CHECKED	4	8OF8

Two past projects are referenced in the estimate of quantities. These projects are similar and are located in northern Saskatchewan. The two projects are list below:

a) McArthur River Mine Site to 20 km South of McArthur River Mine Site for a total distance of 20.32 km

b) Cigar Lake Mine Site to Highway No. 905 for a total length of 51.55 km.

ROUTE 1

CONTRACT ITEMS:

Bid Item No. 2000.03 Clearing and Grubbing

1) Extra clearing
a) 20.0km McArthur River Access
Quantity 20.325 km x 44m = 89.43ha
Final Clearing Quantity = 99.7ha
Extra Clearing = 10.27ha/89.43ha x 100 = +11.5%
b) Cigar Access from HWY #905
Quantity 51.55km x 44.0m = 226.82ha
Final Clearing Quantity = 250.64ha
Extra Clearing = 23.83ha/226.82ha x 100 = +10.5%
Use Extra clearing of 12.0% for R/W Widening, Gravel Pits, etc.

km 70.7 to km 122.60 = 52.6km
Length 52,600m
R/W 44.0m
Quantity = 52,600m x 44.0m = 2,314,400m^2
Quantity = 231.44ha
Extra +12% = 27.77ha (Borrow Pits & Gravel Pits)
Total Quantity = 259.21ha

Total Estimated Quantity @ 260ha

Bid Item No. 2200.01 Waste Excavation

a) 20.0km McArthur River Access

Quantity Waste =	8,821m^3	Length =20.325km
Earth Exc.	1,073,731m^3	
% of Earth Exc. = 0.82%		Waste/km = 444m^3

h) Cigar Access from HWY #905

Quantity Waste	= 46,655m^3	Length = 51.55km
Earth Exc.	1,355,550m^3	
% of Earth Exc. = 3.44%		Waste/km = 905m^3

Use 2% of Estimated Earth Exc. 2,720,000m^3 = 54,400m^3

Total Estimated Quantity = 55,000m^3

Bid Item No. 2200.08 Earth Excavation

Terrain Type	Excavation per km	Total Length	m^3	
G Level	8,500	2.25	19125	Sand & Gravel, topographically level
Gm		0	0	Sand & Gravel, topog.. medium roughness
Gr		0	0	Sand & Gravel, topographically rough
D	50,000	43.52	2176000	Drumlinized morain deposits
Dr	83,000	2.62	217460	Drumlinized morain, topographically rougher
H	21,500	1.02	21930	Hummocky moraine deposits, bouldery
W	34,500	0.97	33465	Wet, bouldery, organics 0.3m depths
S	41,500	0.92	38180	Treed swamp, water @ surface,organics 1.0m - 0.5m
M	60,500	0.98	59290	Muskeg, 1.0m -3.0m, some permafrost
C	80,000	0.15	12000	Complex pattern, organics 3.0m -5.0m,permafrost
R		0	0	Bedrock
D/R		0	0	Drift over bedrock, drift 1.0m- 2.0m depth
K		0	0	Kettlehole, M/K indicates muskeg filled
L	50,000	0.18	9000	Water bodies
Totals		52.61	2586450	

Note : Adjust + 5% = 2715773 m^3

Total Estimated Quantity = 2,720,000 m^3 (51,700 m^3/km)

Bid Item No. 2250.05 Rock Excavation

Based on JDMA terrain analysis there should not be any Rock Excavation

Bid Item No. 2260.01 Removal of overburden

This item is applicable for removal overburden on Aggregate Sources

Estimated @ 10000 m^3

Bid Item No. 2320.01 Disposal of Surplus Rock

a) 20.0km McArthur River Access
Quantity Surplus Rock = 47,527m^3
Earth Exc. = 1,073,731m^3
% Surplus Rock = 4.43%

b) Cigar Access from HWY #905
Quantity Surplus Rock = 46,655m^3
Earth Exc. = 1,355,550m^3
% Surplus Rock = 3.44%
Use 4% of Earth Exc.

Surplus Rock estimated @ 4.0% of Earth Excavation 2,720,000m^3 = 108,000m^3

Bid Item No. 2400.01 Haul on Earth Excavation

a) 20.0km McArthur River Access

Quantity Haul on Earth Excavation = 4,179,959m^3hm

Earth Exc. = 1,073,731m^3

Haul Factor = 3.89

b) Cigar Access from HWY #905

Quantity Haul on Earth Exc. = 5,116,930m^3hm

Earth Exc. = 1,355,550m^3

Haul Factor = 3.77

Use Haul Factor = 4.0

Haul on Earth Exc. Estimated = 4.0 x 2,720,000 = 10,880,000m^3hm

Bid Item No. 2405.20 Hauling Aggregate/4300.01 Traffic Gravel Type 100(2")
4300.02 Apply Traffic Gravel Type 100/4300.11 Traffic Gravel Type 104 (11/2")
4300.12 Apply Traffic Gravel Type 104 (11/2")
4300.30 Traffic Gravel Type 104 in Place in Stockpile

Assume Traffic Gravel available @ km70.0 or km122.6

Ave Haul = 52.6km/2 = 26.3km

	Rate/km m^3/km	(Stabilization)	Length km	Quantity m^3	Ave. Haul km	Haul m^3km
Type 100 (2"0)	600		52.6	31560	26.3	830028
Type 104 (11/2")	300		52.6	15780	26.3	415014
		Totals		**47340**		**1245042**
Type 104 (11/2") Stockpile in Place	300		**52.6**	**15780**		

Bid Item No. 4300.13 Reject Aggregate > 20%

Assume Reject @ 35%

47340m3 + 15780m3 = 63,120m^3

Reject Estimated = 63,160 x (35-20) = 9,474m^3 (10,000m^3)

Bid Item No. 2500.02 Watering on the Road, including Hauling

a) 20.0km McArthur River Access

Quantity Watering on the Road =14,459m^3
Earth Exc. = 1,073,731m^3
% Water = 1.35%

b) Cigar Access from HWY #905

Quantity Watering on the Road = 32,000m^3
Earth Exc. = 1,355,550m^3
% Water = 2.36%
Use 2.0% of Exc. Haul Factor = 4.0

Watering on the Road Estimated = 2.0% x 2,720,000 = 54,400m^3 (Use 55,000m^3)

Bid Item No. 3000.01 Subgrade Prep. & Compaction

Subgrade Width m	Length km	**Area m^2**
8.6	52.6	**452360**

Subgrade Prep. & Compaction Estimated = 452,360m^2

Bid Item No. 5000.01 to 5000.14 Supply & Install Culverts

a) 20.0km McArthur River Access

Culvert costs for Supply & Install were $150,000 at 1996 prices, adjusted to 2005 prices would be $278,115 or $13,684/km.

b) Cigar Access from HWY #905

Culvert costs were $386,610 or $7,500/km.
Use $13,000/km

Supply & Install Culverts Estimated = $13,000.00/km x 52.6km = $683,000

Bid Item No. 6000.01 Hand Placed Riprap

a) 20.0km McArthur River Access

Quantity was 2,452m^3 for 20.325km or 121m^3/km

b) Cigar Access from HWY #905

Quantity was 4,110m^3 for 51.55km or 80.0m^3/km

Use 120m^3/km

Riprap Estimated = 120m^3/km x 52.6km = 6,312m^3 (6,500m^3)

Bid Item No. 6600.02 Granular Backfill

a) 20.0km McArthur River Access

Quantity GBF =3,284m^3
Length = 20.325km
GBF = 160m3/km

b) Cigar Access from HWY #905

Quantity GBF = 1662m^3
Length = 51.55km
GBF = 32m3/km
Use 150m3/km

Granular Backfill Estimated = 150m^3/km x 52.5km = 7,890m^3 (8,000m^3)

Bid Item No. 8700.01 & 8700.02 Mobilization & De-Mobilization

a) 20.0km McArthur River Access

Mob. & De-Mob. = $230,700

b) Cigar Access from HWY #905

Mob. & De-Mob = $1,350,000

Estimated: Mob. = $1,000,000
De-Mob = $1,000,000

SUNDRIES:

1) New Flight, Air Photos, & Digital Terrain Model

LIDAR Survey @ McArthur River
Cost = $87,400
Area = 27km x 4km = 108km^2

Route 1 McArthur to Cigar Lake
52.6km x 2.5km = 131.5km^2

Estimated Costs = 131.5km^2 x $810/km^2 = $106,515 ($120,000)

2) Sask Power Relocations

This is unknown at this time.

Estimate = $100,000

3) Purchase & Install Permanent Road Signs

Sask Highways & Transportation Supplied & Installed Permanent Signs
on the road from Highway #905 to Cigar Lake for $22,000. ($12,000 + $10,000)

Estimated Cost = $30,000

4) Personnel Flights @ Shift Change

Flights to McArthur River @ $175.00 one way.
Flights to Cigar Lake @ $195.00 one way
Use $185.00 one way.

Construction Days:
2,720,000m3 @ 14,000m3/day = 194 Days
Consider additional 25% for downtime & Misc. = 194 x 1.25 = 243Days
Shift Change 30 men per week

Estimated Cost = 30men x 35weeks x ($185.00 x 2) = $399,600 ($400,000)

MATERIALS:

1) Coco Matting: Supply & Install

Cigar Access from HWY #905
Cost @ $409,656
Area = 66,073.6m^2
Length = 51.55km
Cost/m^2 = $6.20/$m^2$
Area /km = 1.282/km Use 1,400m^2/km

Estimate for Coco Matting = 1,400m^2 x 52.6km = 73,640m^2 (74,000m^2)

2) Seeding Right of Way

Width = 44.0m - 8.6m = 35.4m
Length = 52.6km
Area = 186ha (200ha)
Rate @ 1lb/500ft^2 = 1/500 x 43560ft^2/acre x 2.47acre/ha = 215lbs/ha
215lbs/ha x 1Bag/50lbs = 4.3 Bags/ha

Seed : 4.3bags/ha x 200ha = 860 Bags (@ $180/Bag)

OTHER CONTRACT ITEMS:

1) Temporary Construction Camp

Cigar Lake Camp @ $171,000
Mobilization @ $35,000 & De-Mob. @ $35,000
Rate @ $25,250/4wks
Accommodated 30 persons, kitchen, Cook (Cost of food not included)
Cost/person /4wks = $25,250/30 = $841/person/4 wks or $210/wk/pers.

Duration of Camp = 2,720,000m^3/14,00m^3/day = 194 Days
Additional for downtime/misc. =1.25 x 194 = 243 Camp Days

243Days/7 = Approx. 35Weeks

60 Persons x 35Weeks x $210/wk = $441,000 ($450,000)
Mobilization = $105,000
De-Mobilization = $105,000

Estimated Total Cost = $660,000 ($700,000)

2) Seeding Road Right of Way

200ha x $265/ha = $53,000 ($55,000)

3) Surplus Aggregate

Estimate 5,000m^3 x $18.50/m^3 = $92,500

FORCE ACCOUNT (EXTRA WORK):

1) Rehab Borrow Pits = $100,000

2) Environmental Requirements
Cigar Road @ $578,472 ($580,000)

3)Erosion Control
Cigar Road $496,818 ($500,000)

4) Misc. = $100,000

Estimated $1,280,000

COSTS:

1) Pre-Feasibility Study

Initial Scope = $25,000
JDMA = $16,800
Addendum = $15,200
Total = $57,000

2) Feasibility Study

	Rate/hr	Weeks	hrs/wk	Cost
Study Coord.	100	20	40	80000
Advisor	90	2	40	7,200
Civil Design Lead	90	10	40	36,000
Civil Design Support	55	10	40	22,000
AutoCAD	45	20	40	36,000
			Total	$181,200
			Estimated	**$200,000**

Note: This estimate does not include field inspections. Helicopter costs, Aggregate Testing.

3) Environmental Monitoring

$6,200/wk x 35wks = $217,000
Report Generation = $10,200
Total = $250,140

Estimated $260,000

Quantities and Co stimate Sheet

CLUNIE CONSULTING ENGINEERS

Contract No.:	
Type of Work:	Grading
Client:	Cameco Corporation
Prepared By:	Clunie Consulting Engineers
Date:	May 14, 2007

Project Information

Project Number	Estimated Cost
Total	

Location / Section	From km	To km	Length
McArthur River to Cigar Lake	70.00	122.60	52.60
		Total	52.60 km

Project Description: ROUTE 1

Pre-Feasibility Study Estimated Costs for Construction of a Subgrade from km70.0 to Cigar Lake Mine Site at km122.6. for a Total Distance of 52.60km.

Remarks: Major Bid Items in Red

Contract Items

Item No.	Spec. No.	Description	Unit	Quantity	Pre-Tender Price	Pre-Tender Cost	At Award Price	At Award Cost
2000.03	2000	CLEARING AND GRUBBING	ha	260	$6,500.00	$1,690,000.00		
2200.01	2200	WASTE EXCAVATION	m3	55,000	$10.00	$550,000.00		
2200.08	2200	EARTH EXC 100% MAX DENSITY REQD FOR EARTH EMBANKMENTS	m3	2,720,000	$7.00	$19,040,000.00		
2250.05	2250	ROCK EXCAVATION	m3					
2260.01	2260	REMOVAL OF OVERBURDEN INCLUDING HAULING	m3					
2320.01	2320	DISPOSAL OF SURPLUS ROCK	m3	10000	$8.00	$80,000.00		
2400.01	2400	HAUL ON EARTH MATERIAL	m3	108000	$20.00	$2,160,000.00		
2400.02	2400	HAUL ON ROCK EXCAVATION	m3.hm	10,880,000	$0.20	$2,176,000.00		
2405.20	2405	HAULING AGGREGATE	m3.hm					
2500.02	2500	WATERING ON THE ROAD INCLUDING HAULING	m3.km	1245042	$0.80	$996,033.60		
3010.01	3010	SUBGRADE PREPARATION AND COMPACTION FOR GRADING	m3	55000	$10.00	$550,000.00		
4300.01	4300	TRAFFIC GRAVEL TPYE 100 (2")	m2	452360	$1.25	$565,450.00		
4300.02	4300	APPLY TRAFFIC GRAVEL TYPE 100	m3	31560	$19.00	$599,640.00		
4300.11	4300	TRAFFIC GRAVEL TYPE 104 (11/2")	m3	31560	$7.00	$220,920.00		
4300.12	4300	APPLY TRAFFIC GRAVEL TYPE 104	m3	15780	$19.00	$299,820.00		
4300.13	4300	REJECT AGGREGATE > 20%	m3	15780	$7.00	$110,460.00		
4300.30	4300	TRAFFIC GRAVEL TYPE 104 IN PLACE IN STOCKPILE	m3	10000	$5.00	$50,000.00		
5000.01	5000	INSTALLING CSP CULVERTS 600mm	m3	15780	$19.00	$299,820.00		
5000.02	5000	INSTALLING CSP CULVERTS 800mm	m					
5000.03	5000	INSTALLING CSP CULVERTS 1200mm	m					
5000.07	5000	INSTALL CORRUGED STEEL PIPE CULVERTS, 1400 mm DIAMETER	m					
5000.08	5000	INSTALL CORRUGED STEEL PIPE CULVERTS, 1600 mm DIAMETER	m					
5000.10	5000	INSTALL CORRUGED STEEL PIPE CULVERTS, 1800 mm DIAMETER	m					
5000.12	5000	INSTALL CORRUGED STEEL PIPE CULVERTS, 2000 mm DIAMETER	m					
5000.14	5000	INSTALL CORRUGED STEEL PIPE CULVERTS, 3000 mm DIAMETER	m					
6000.01	6000	HAND PLACED RIP-RAP	m					
6600.02	6600	GRANULAR BACKFILL IN PLACE	m3	6500	$125.00	$812,500.00		
8700.01	8700	MOBILIZATION	m3	8000	$7.00	$56,000.00		
8700.02	8700	MOBILIZATION & DEMOBILIZATION	LumpSum	1	$1,000,000.00	$1,000,000.00		
			LumpSum	1	$1,000,000.00	$1,000,000.00		
		Supply & Install Culverts	Lump Sum	1	$683,000	$683,000.00		
		Contract Items Sub-Total				$32,939,643.60		
				Price	Quantity	Cost	Quantity	Cost
		Contract Items Total (For comparing bids for award)				$32,939,643.60		

Sundries

Item	Cost
New Flight & Air Photo on Route #1	$120,000.00
Digital Terrain Model (100m Width)	
Personnel Flights/Shifts	$400,000.00
Bridges	
SaskPower Relocates	$100,000.00
Permanent Signs	$30,000.00
Sundries Total	$650,000.00

Materials

Item	Quantity	Price	Cost
Coco Matting	74000	$6.20	$458,800.00
600 CSP			
600 Coupl.			
800 CSP			
800 Coupl.			
1200 CSP			
1200 Coupl.			
1400 CSP			
1400 Coupl.			
1800 CSP			
1800 Coupl.			
2000 CSP			
2000 Coupl.			
3000 CSP			
3000 Coupl.			
Grass Seed	860	$180.00	$154,800.00
Material Sub-Total			$613,600.00
6% PST			$10,836.00
Freight/Miscellaneous			
Materials Total			$624,436.00

Budget Items

Budget Type	Year: 2007	2008	2009	Total
1. Programming				
2. Functional Design				
3. Detailed Design				
4. Pre-Tender Estimate				
5. At Award Estimate				

	Difference ($)	% Difference
Cont. Items At Award vs. Pre-Tender		

Summary of Estimates

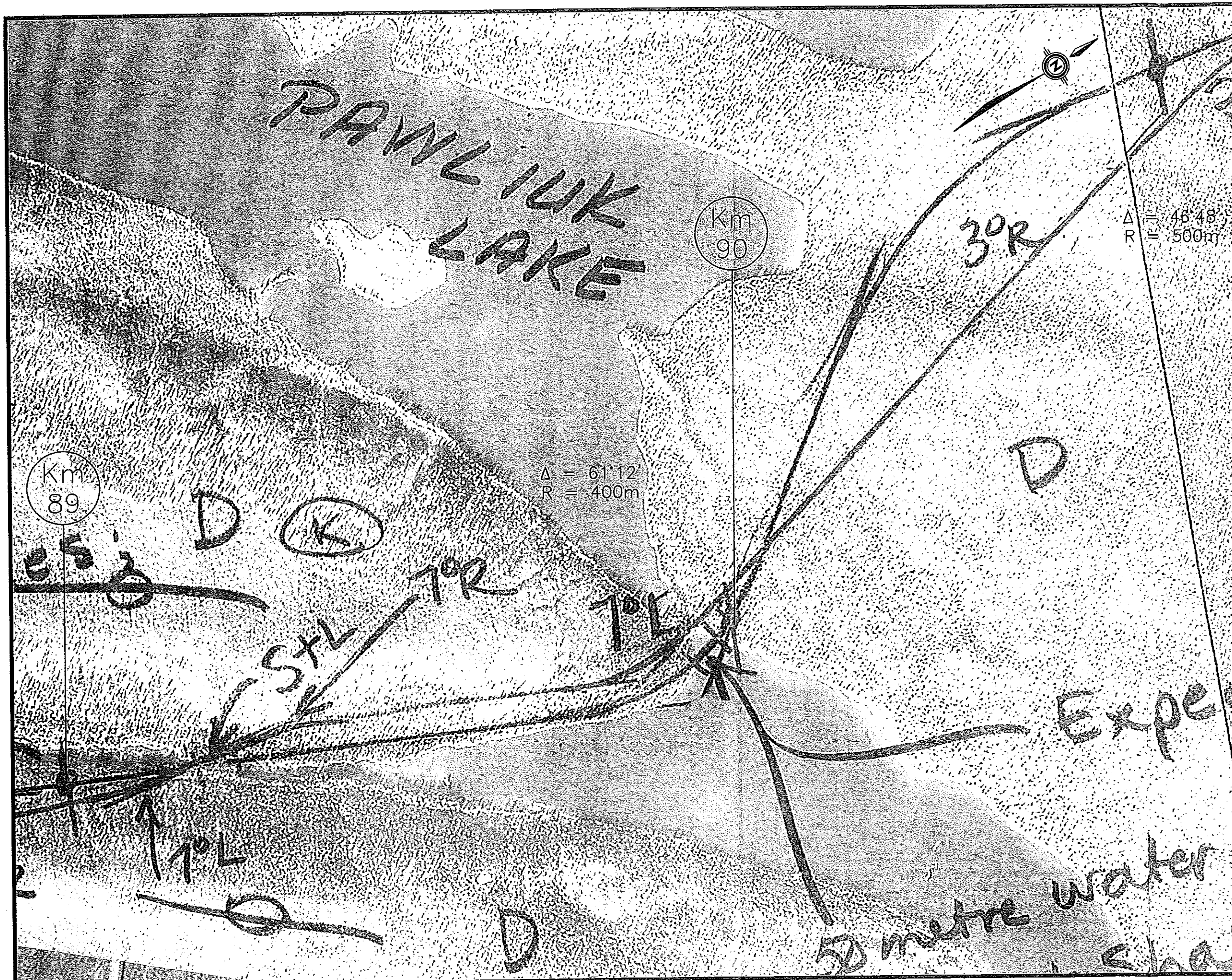
Expenditure Category	Pre-Tender	At Award
Contract Items Sub-Total + OCI	$33,787,144	
Force Account	$1,280,000	
Materials	$624,436	
Sundries	$650,000	
Pre-Feasibilty Study	$57,000	
Feasibility Study	$200,000	
Design Engineering (@ 7% of CI'S + FA)	$2,454,700	
Const. Engineering (@12%)	$4,208,057	
Enviro.Const. Monitoring	$260,000	
Miscellaneous	$478,663	
Total Cost	$44,000,000	

Other Contract Items (OCI)

Item	Cost
Temp. Const. Camp	$700,000.00
Surplus Aggregate	$92,500.00
Seeding R/W	$55,000.00
Other Contract Items Total	$847,500.00

Force Account

Item	Cost
Rehab Borrow Pits	$100,000.00
Environmental Requirements	$580,000.00
Erosion Control Requirements	$500,000.00
Misc.	$100,000.00
Force Account Total	$1,280,000.00



SUB-CONSULTANT

CLUNIE CONSULTING ENGINEERS

4271 5th AVENUE EAST BAG #5800,
PRINCE ALBERT SASKATCHEWAN, CANADA
S6V 7V6
PH: 306-764-4898, FAX:306-764-1037

NOTES:

0m 100m

DRAWING ISSUE

NO	DATE	DESCRIPTION	BY
4			
3			
2			
1			

DRAWING REVISIONS

NO	DATE	DESCRIPTION	BY
6			
5			
4			
3			
2			
1			

PROJECT TITLE

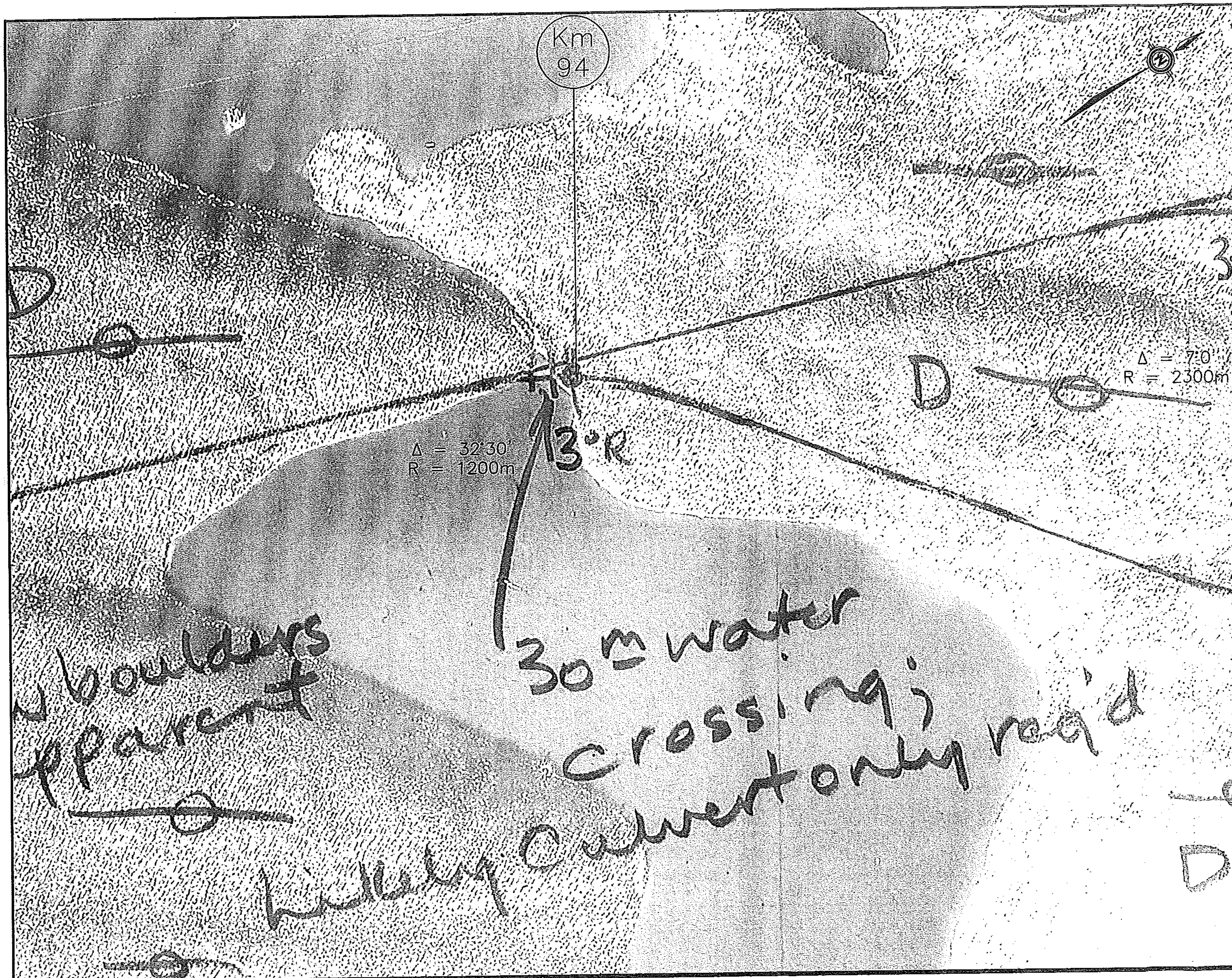
PRE-FEASIBILITY STUDY
MCARTHUR RIVER TO
CIGAR LAKE HAUL ROAD

DRAWING TITLE

ROUTE 1
ENVIRONMENTAL
CONCERN AREAS

DRAWING LOCATION : C:\projects\2007\McArthur River Cigar Lake Haul Road\Design Haul Road.dwg

PROJECT NO.		FILE NO.	
MR-07-008		CAMECO	
DATE 5/10/2007	SCALE ABOVE	DWG. NO.	SHEET
DRAWN BDS	CHECKED	5	1OF5



SUB-CONSULTANT

CLUNIE CONSULTING ENGINEERS

4271 5th AVENUE EAST BAG #5800,
PRINCE ALBERT SASKATCHEWAN, CANADA
S6V 7V6
PH: 306-764-4896, FAX:306-764-1037

NOTES:

0m 100m

DRAWING ISSUE

NO	DATE	DESCRIPTION	BY
4			
3			
2			
1			

DRAWING REVISIONS

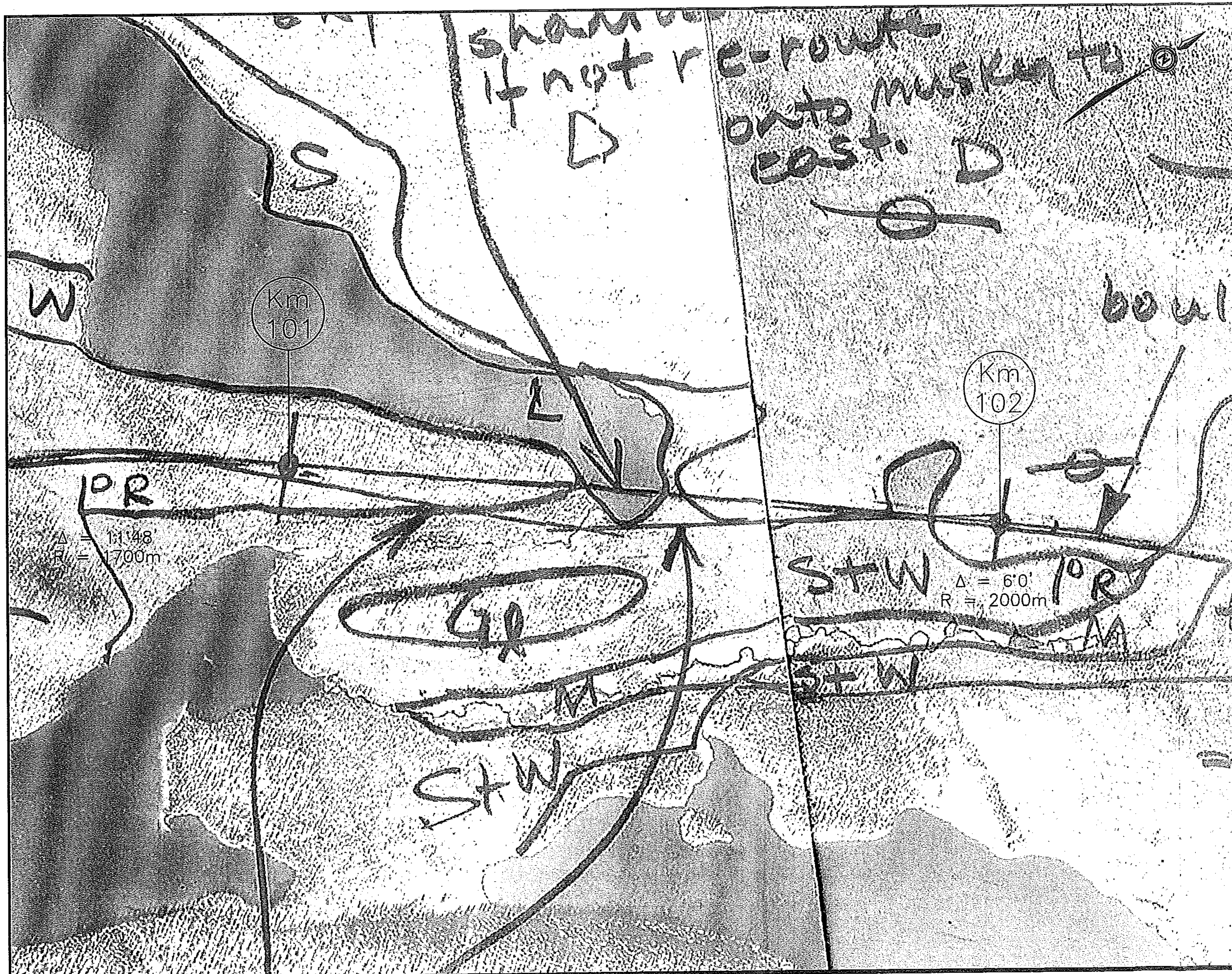
NO	DATE	DESCRIPTION	BY
6			
5			
4			
3			
2			
1			

PROJECT TITLE
PRE-FEASIBILITY STUDY
MCARTHUR RIVER TO
CIGAR LAKE HAUL ROAD

DRAWING TITLE
ROUTE 1
ENVIRONMENTAL
CONCERN AREAS

DRAWING LOCATION : C:\projects\2007\McArthur River Cigar Lake Haul Road\Design Haul Road.dwg

PROJECT NO.		FILE NO.	
MR-07-008		CAMECO	
DATE 5/10/2007	SCALE ABOVE	DWG. NO.	SHEET
DRAWN BDS	CHECKED	5	2OF5



SUB-CONSULTANT

CLUNIE CONSULTING ENGINEERS

4271 5th AVENUE EAST BAG #5800,
PRINCE ALBERT SASKATCHEWAN, CANADA
S6V TV6
PH: 306-764-4896, FAX:306-764-1037

NOTES:

0m 100m

DRAWING ISSUE

NO	DATE	DESCRIPTION	BY
4			
3			
2			
1			

DRAWING REVISIONS

NO	DATE	DESCRIPTION	BY
6			
5			
4			
3			
2			
1			

PROJECT TITLE

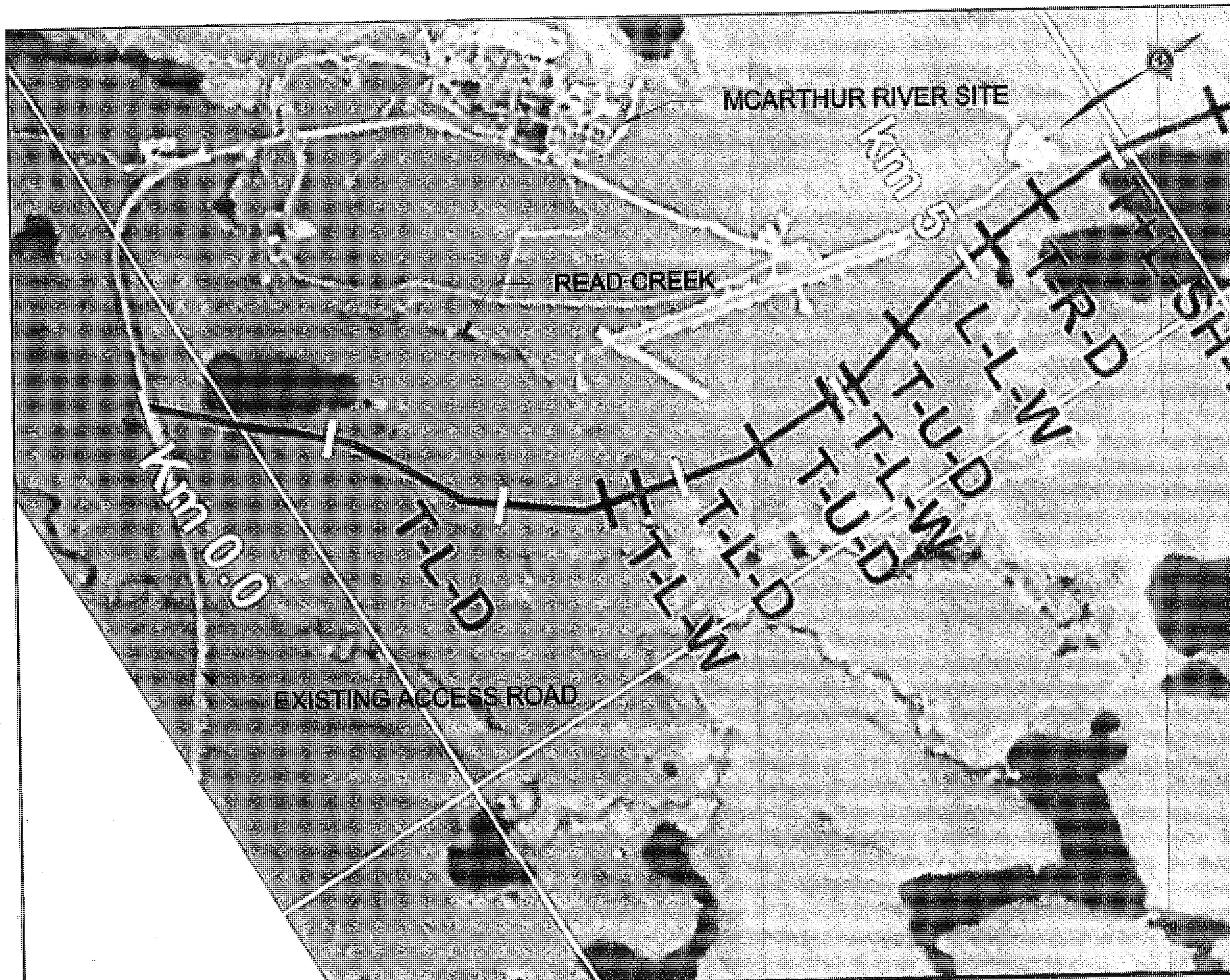
PRE-FEASIBILITY STUDY
MCARTHUR RIVER TO
CIGAR LAKE HAUL ROAD

DRAWING TITLE

ROUTE 1
ENVIRONMENTAL
CONCERN AREAS

DRAWING LOCATION : C:\projects\2007\McArthur River Cigar Lake Haul Road\Design Haul Road.dwg

PROJECT NO.		FILE NO.	
MR-07-008		CAMECO	
DATE 5/10/2007	SCALE ABOVE	DWG. NO.	SHEET
DRAWN BDS	CHECKED	5	3OF5



CLUNIE CONSULTING ENGINEERS

DRAWING ISSUE

NO	DATE	DESCRIPTION	BY
4			
3			
2			
1			

DRAWING REVISIONS

NO	DATE	DESCRIPTION	BY
6			
5			
4			
3			
2			
1			

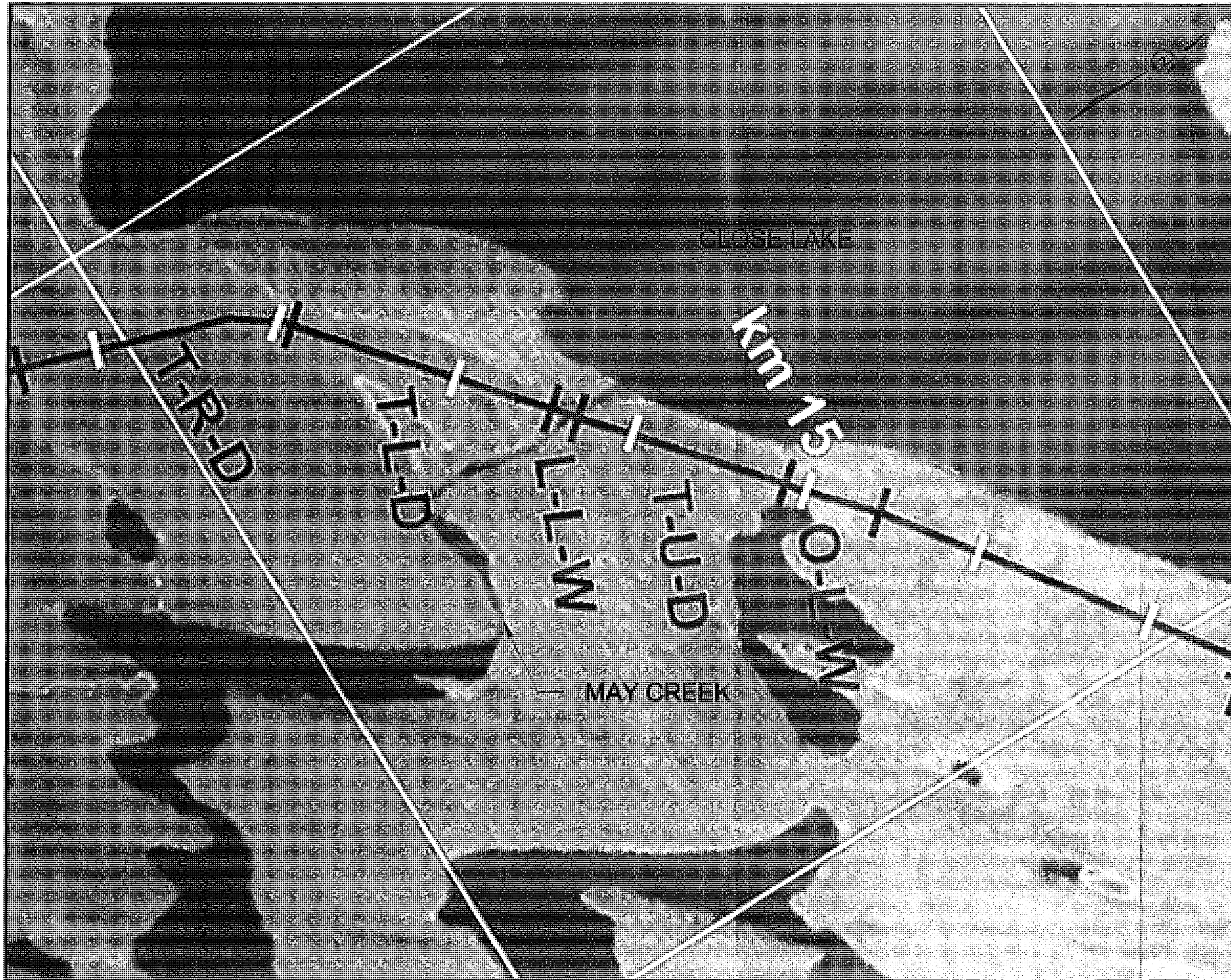
PROJECT TITLE

PRE-FEASIBILITY STUDY
MCARTHUR RIVER TO
CIGAR LAKE HAUL ROAD

DRAWING TITLE

ROUTE 7
ENVIRONMENTAL
CONCERN AREAS

PROJECT NO.	FILE NO.	DWG. NO.	SHEET
		5	4OF5



SUB-CONSULTANT

CLUNIE CONSULTING ENGINEERS

PROJECT TITLE

PRE-FEASIBILITY STUDY MCARTHUR RIVER TO CIGAR LAKE HAUL ROAD

DRAWING TITLE

ROUTE 7 ENVIRONMENTAL CONCERN AREAS

DATE	SCALE	DWG. NO.	SHEET
	NTS	5	5OF5

TERRAIN LEGEND

(mapping 1:60,000 airphotos)

SURFACE MATERIALS AND THEIR FORMATION

T Till. A nonsorted ice-laid fine to medium sand till with very little silt and many boulders, including patches of concentrated surface boulders, termed a "boulder lag." The basal till in ground moraine was deposited directly by glacier ice, and was modified later and locally by wave and current erosion, producing patches of boulder lag.

B Bedrock. Thin (0-2 m) till and/or lacustrine deposits over bedrock. The subscript s stands for sandstone.

G Granular material. Stratified (inter-layered), pockety sand, gravel and boulders. Dominantly fine to medium sand in discontinuous esker-kame-delta trains. The eskers formed in tunnels in stagnant ice. Upon roof collapse over esker tunnels, large ice blocks dropped into channels open to the sky. The ice blocks were buried by further granular material deposition.

P Permafrost-affected peat. Frozen bog plateaus about 1-m high containing sporadic ground ice in lenses and seams. The bog (sphagnum moss, shrubs and forest peat) typically ranges from 1 to 3m deep, and has scattered thermokarst depressions (collapse "scars" from melted ground ice). These depressions are also 1 to 3m deep, but contain fen (forest / shrub / sedge) peat.

O Organics. Muskegs, swamps and marshes. Unfrozen wetlands with the water table at or near ground surface. Variable depth of saturated peat that accumulated in poorly drained depressions. Discontinuous permafrost may be present.

L Mainly lacustrine (waterlaid) silts and sands.

Complex Units

- Lv/B – Lacustrine veneer (0-2m) over bedrock; Lv/T/B_s – lacustrine veneer over till over sandstone bedrock.
- Where two (2) units are used to describe surface materials or drainage the first unit is most dominant. e.g. T, T/B_s – T is dominant. Where topography is rolling (R), W (wet) will be located in the lows or depressions.

TOPOGRAPHY

S.- Smooth topography

R Rolling locally bumpy topography. Moderate to high mounds with steep sideslopes, mostly in areas of thin till over bedrock knobs.

U Undulating terrain.

K Knobs and kettles alongside long and narrow esker ridges. Deep, frequently and closely spaced, kettle holes originate from melted ice blocks in long, discontinuous esker-kame-delta trains.

M Microrelief of up to 2m deep on small thermokarst basins occupying poorly drained level permafrost-affected peatland.

L Level.

DRAINAGE

D Relatively dry ground

W Wet ground

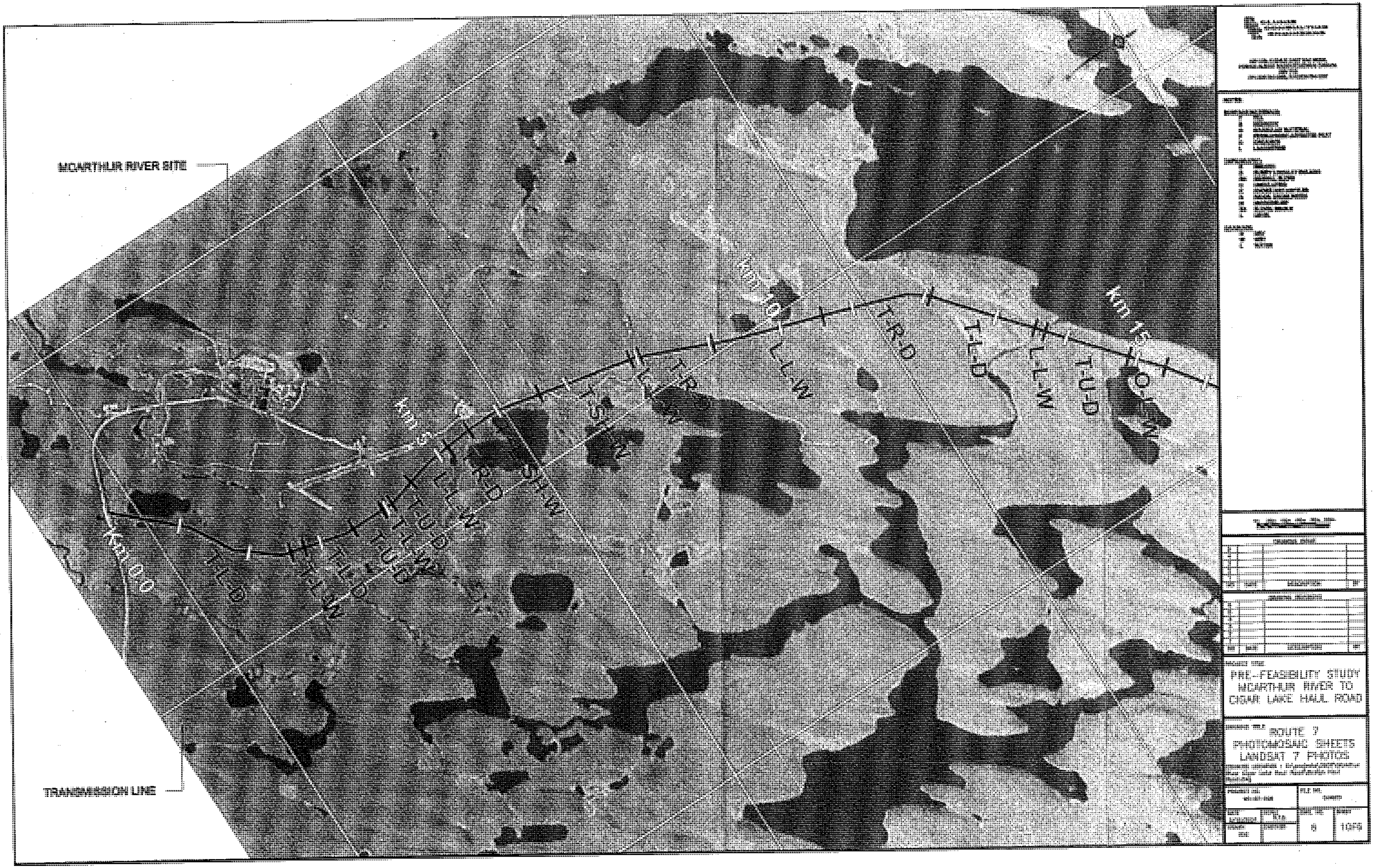
EXAMPLES OF LEGEND USE

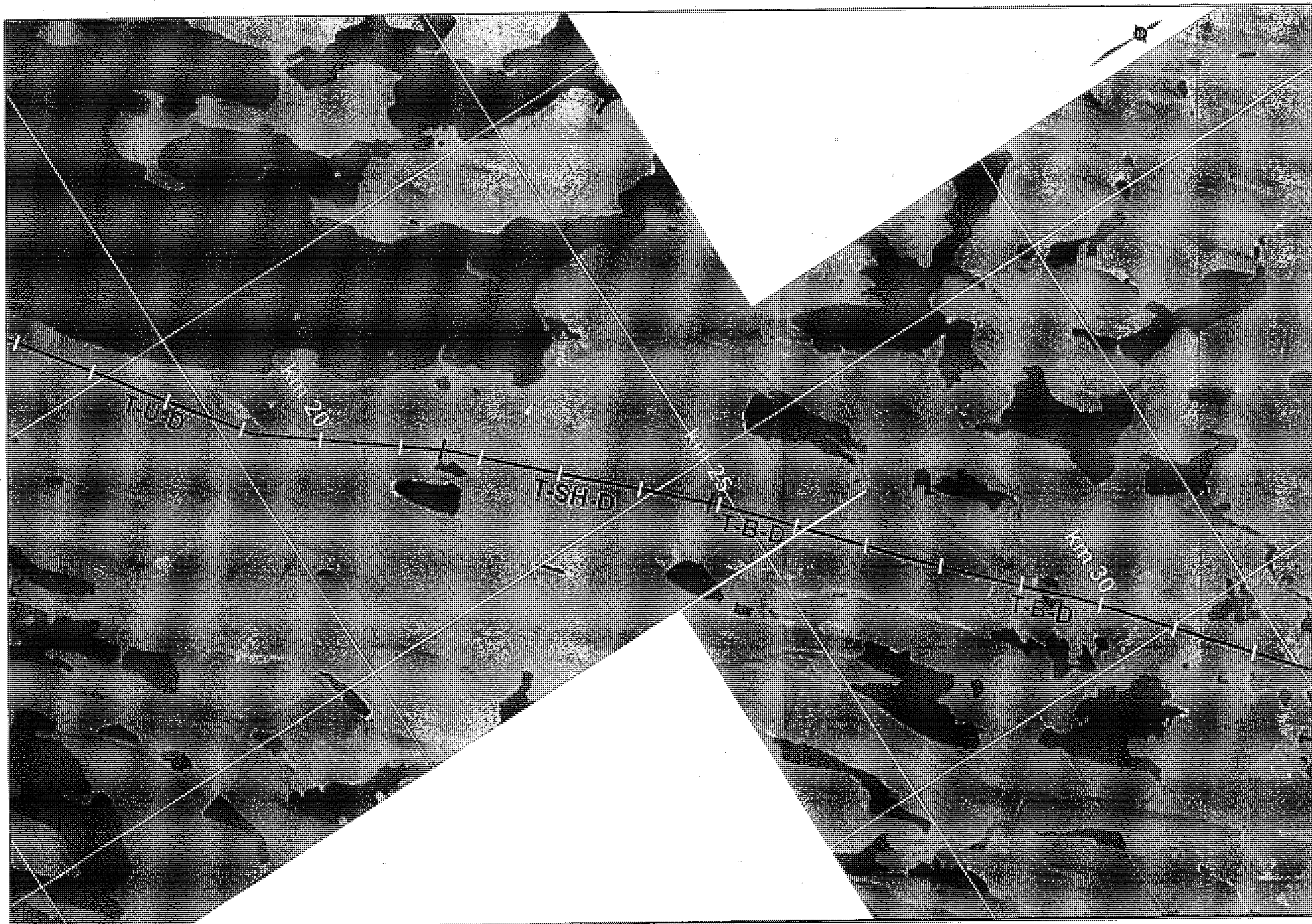
T-S-W reads: Bouldery sandy till (T) below smooth gentle slopes (S) where the surface materials are typically saturated (W).

G-L-D reads: Granular deposits (G) below a level surface (L) that is dry (D).

O, L under MATERIAL reads: O/L (i.e. peat over postglacial lacustrine deposits of silt and fine sand).

1) Units mapped as D will be relatively drier than areas of W or H, but in the northern environment where these units are found, D will still be wetter than similar landform units located in central or southern Saskatchewan mapped as D.


MCARTHUR RIVER SITE
TRANSMISSION LINE
km 0.0
km 5
km 10
km 15
T-L-D
T-R-D
L-L-W
T-U-D
T-S-W
PRE-FEASIBILITY STUDY
MCARTHUR RIVER TO
CIGAR LAKE HAUL ROAD
ROUTE 7
PHOTOMOSAIC SHEETS
LANDSAT 7 PHOTOS
6

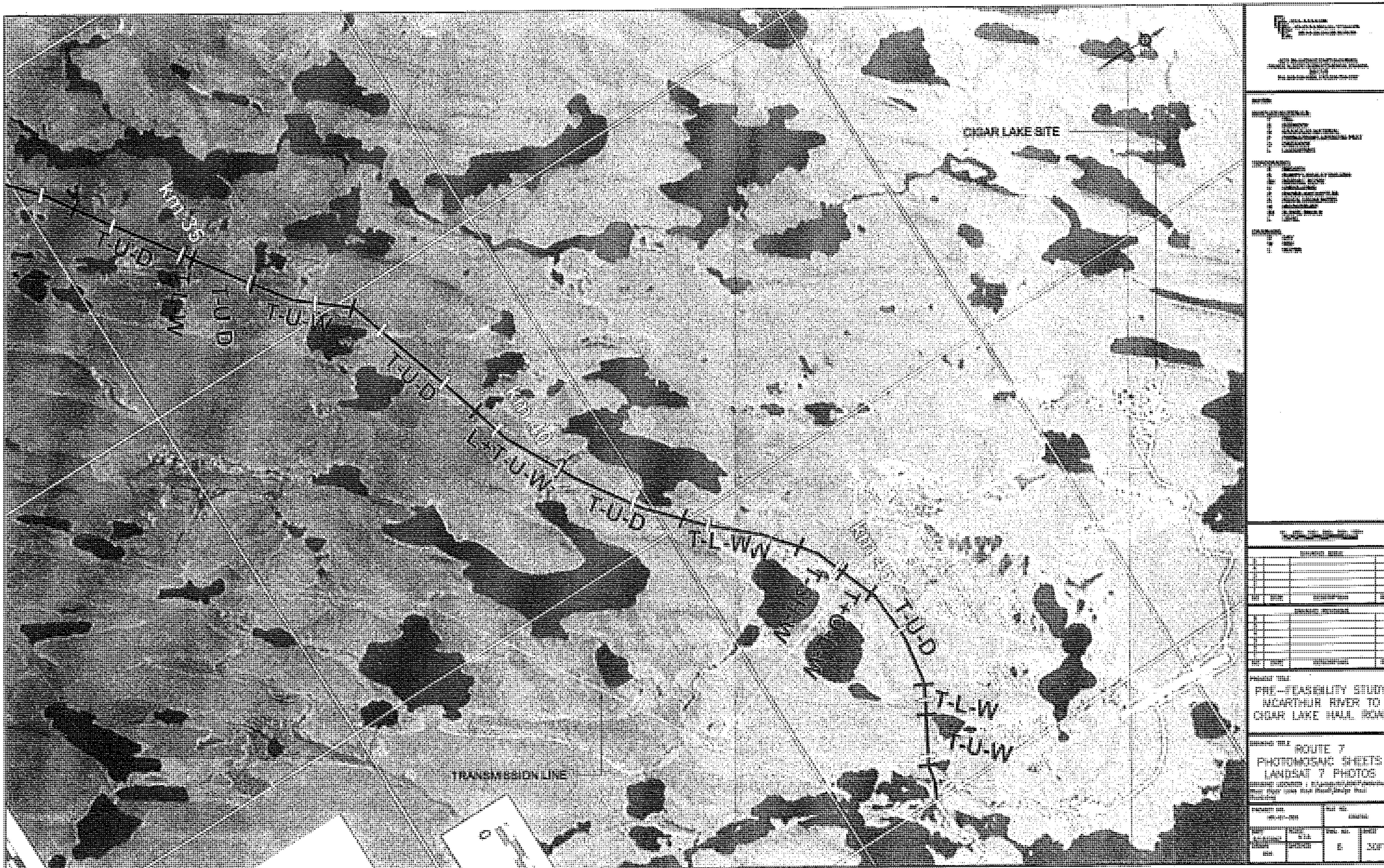


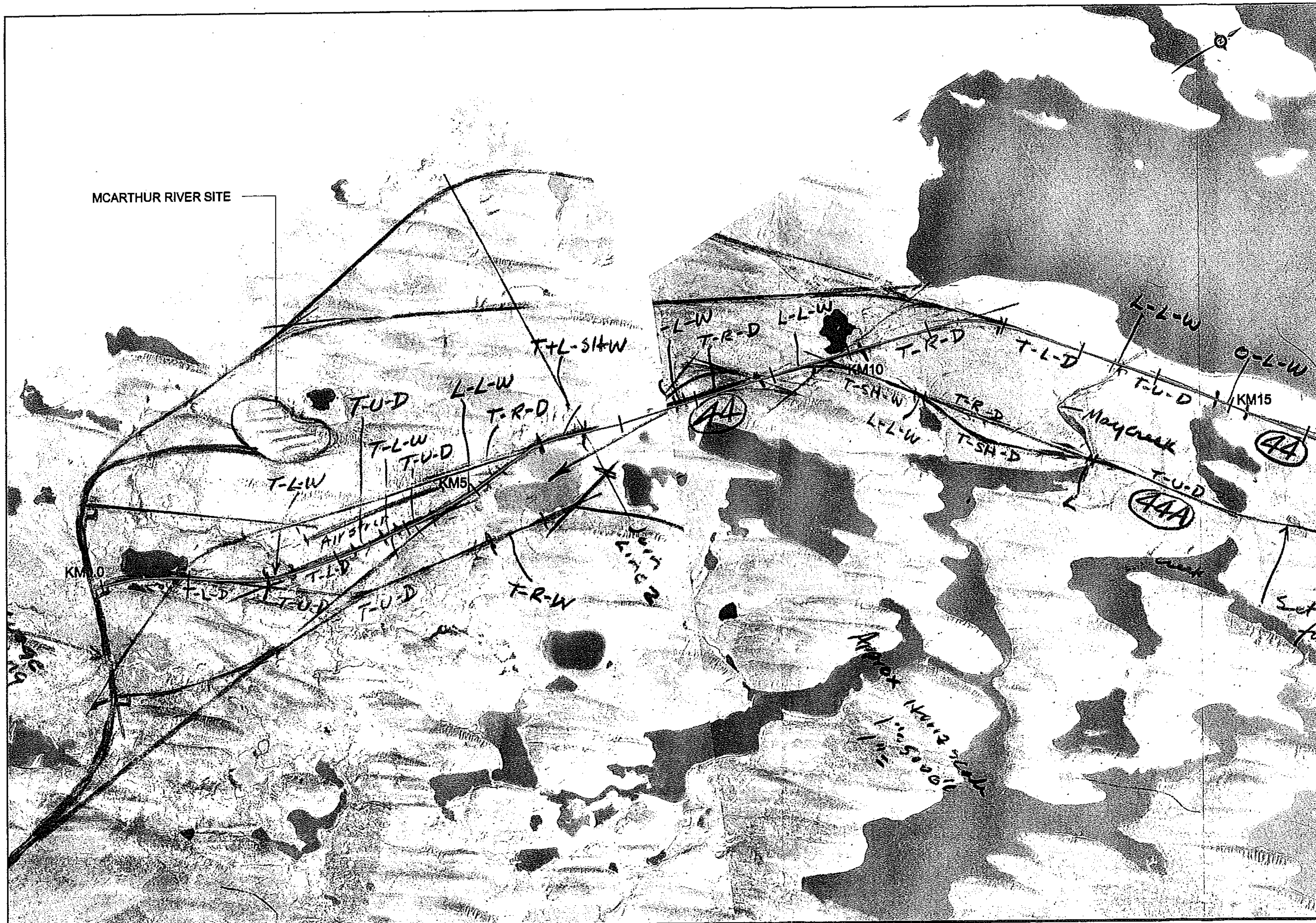
PRE-FEASIBILITY STUDY
MCARTHUR RIVER TO
CIGAR LAKE HAUL ROAD

ROUTE 7
PHOTOMOSAIC SHEETS
LANDSAT 7 PHOTOS

6

20F6


CIGAR LAKE SITE
T-U-D
T-U-D
T-U-W
T-U-D
L-T-U-W
T-U-D
T-L-W
T-U-D
T-L-W
T-U-W
TRANSMISSION LINE
PRE-FEASIBILITY STUDY
MCARTHUR RIVER TO
CIGAR LAKE HAUL ROAD
ROUTE 7
PHOTOMOSAIC SHEETS
LANDSAT 7 PHOTOS
6
3 OF 6



CLUNIE CONSULTING ENGINEERS

4271 5th AVENUE EAST BAG #5300,
PRINCE ALBERT SASKATCHEWAN, CANADA
S6V 7V6
PH: 306-764-4396, FAX:306-764-1037

NOTES:

SURFACE MATERIALS:
- T TILL
- B BEDROCK
- G GRANULAR MATERIAL
- P PERMAFROST-AFFECTED PEAT
- O ORGANICS
- L LACUSTRINE

TOPOGRAPHY:
- S SMOOTH
- B BUMPY LOCALLY ROLLING
- SH SIDEHILL SLOPE
- U UNDULATING
- K KNOBS AND KETTLES
- R RIDGE; DRUMLINIZED
- M MICRORELIEF
- SS SLOPE; SINGLE
- L LEVEL

DRAINAGE:
- D DRY
- W WET
- L WATER

0m 200m 400m 600m 800m 1000m

DRAWING ISSUE

NO	DATE	DESCRIPTION	BY
5			
4			
3			
2			
1			

DRAWING REVISIONS

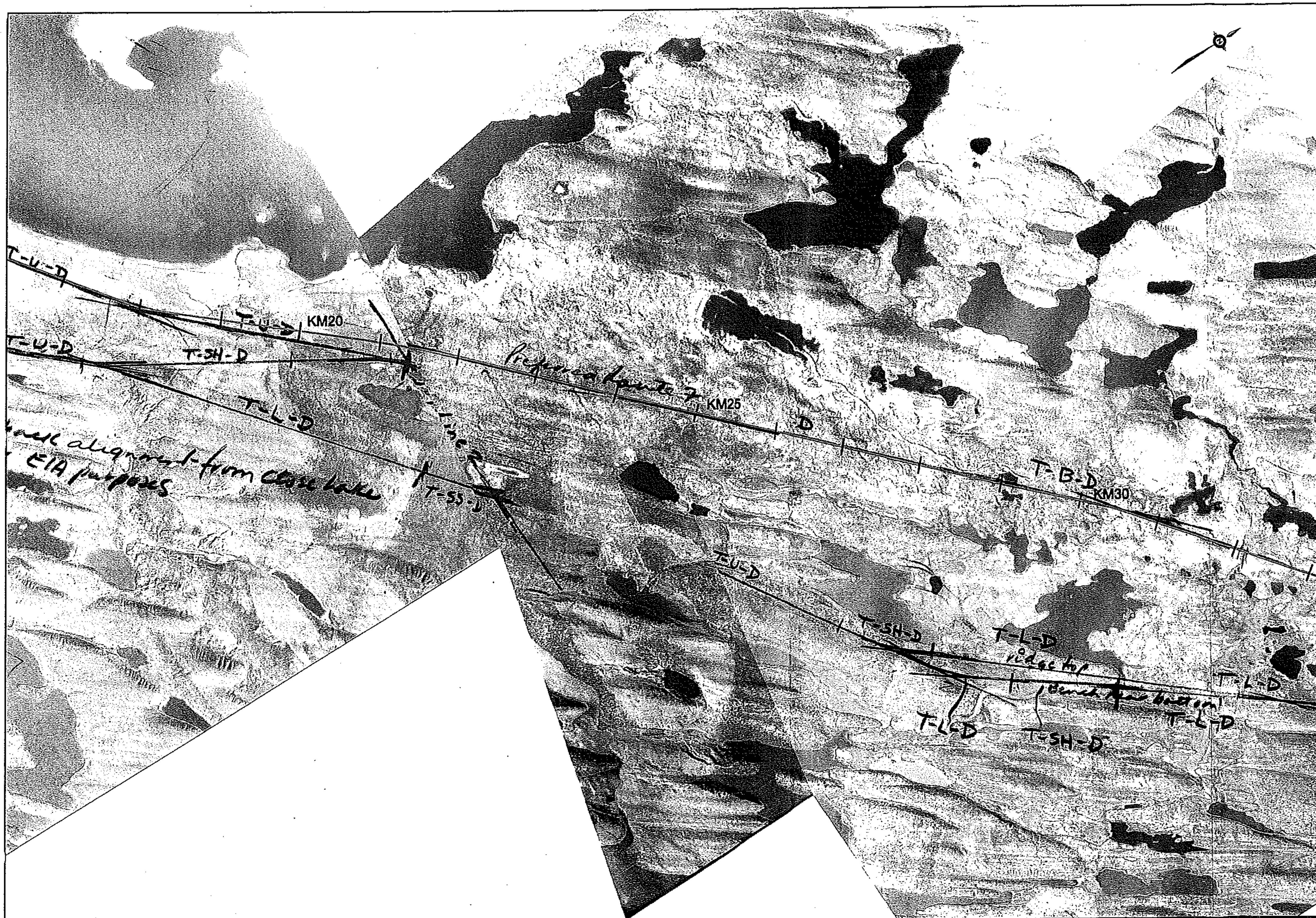
NO	DATE	DESCRIPTION	BY
6			
5			
4			
3			
2			
1			

PROJECT TITLE
PRE-FEASIBILITY STUDY MCARTHUR RIVER TO CIGAR LAKE HAUL ROAD

DRAWING TITLE
ROUTE 7 PHOTOMOSAIC SHEETS 1951 PHOTOS 1:60,000

DRAWING LOCATION : C:\projects\2007\McArthur River Cigar Lake Haul Road\Design Haul Road.dwg

PROJECT NO.		FILE NO.	
MR-07-008		CAMECO	
DATE 5/16/2007	SCALE N.T.S.	DWG. NO.	SHEET
DRAWN BDS	CHECKED	6	4OF6



CLUNIE CONSULTING ENGINEERS

4271 5th AVENUE EAST BAG #5300,
PRINCE ALBERT SASKATCHEWAN, CANADA
S6V 7V6
PH: 306-764-4596, FAX:306-764-1037

NOTES:

SURFACE MATERIALS:
- T TILL
- B BEDROCK
- G GRANULAR MATERIAL
- P PERMAFROST-AFFECTED PEAT
- O ORGANICS
- L LACUSTRINE

TOPOGRAPHY:
- S SMOOTH
- B BUMPY LOCALLY ROLLING
- SH SIDEHILL SLOPE
- U UNDULATING
- K KNOBS AND KETTLES
- R RIDGE; DRUMLINIZED
- M MICRORELIEF
- SS SLOPE; SINGLE
- L LEVEL

DRAINAGE:
- D DRY
- W WET
- L WATER

0m 200m 400m 600m 800m 1000m

DRAWING ISSUE			
5			
4			
3			
2			
1			
NO	DATE	DESCRIPTION	BY

DRAWING REVISIONS			
6			
5			
4			
3			
2			
1			
NO	DATE	DESCRIPTION	BY

PROJECT TITLE
PRE-FEASIBILITY STUDY
MCARTHUR RIVER TO
CIGAR LAKE HAUL ROAD

DRAWING TITLE
ROUTE 7
PHOTOMOSAIC SHEETS
1951 PHOTOS 1:60,000

DRAWING LOCATION : C:\projects\2007\McArthur River Cigar Lake Haul Road\Design Haul Road.dwg

PROJECT NO. MR-07-008		FILE NO. CAMECO	
DATE 5/16/2007	SCALE N.T.S.	DWG. NO. 6	SHEET 5OF6
DRAWN BOS	CHECKED		

CLUNIE CONSULTING ENGINEERS

4271 5th AVENUE EAST BAG #5500,
PRINCE ALBERT SASKATCHEWAN, CANADA
S6V 7V6
PH: 306-764-4596, FAX:306-764-1037

NOTES:

SURFACE MATERIALS:

T	TILL
B	BEDROCK
G	GRANULAR MATERIAL
P	PERMAFROST-AFFECTED PEAT
O	ORGANICS
L	LACUSTRINE

TOPOGRAPHY:

S	SMOOTH
B	BUMPY LOCALLY ROLLING
SH	SIDEHILL SLOPE
U	UNDULATING
K	KNOBS AND KETTLES
R	RIDGE; DRUMLINIZED
M	MICRORELIEF
SS	SLOPE; SINGLE
L	LEVEL

DRAINAGE:

D	DRY
W	WET
L	WATER

0m 200m 400m 600m 800m 1000m

DRAWING ISSUE

NO	DATE	DESCRIPTION	BY
5			
4			
3			
2			
1			

DRAWING REVISIONS

NO	DATE	DESCRIPTION	BY
6			
5			
4			
3			
2			
1			

PROJECT TITLE

PRE-FEASIBILITY STUDY
MCARTHUR RIVER TO
CIGAR LAKE HAUL ROAD

DRAWING TITLE

ROUTE 7
PHOTOMOSAIC SHEETS
1951 PHOTOS 1:60,000

DRAWING LOCATION : C:\projects\2007\McArthur River Cigar Lake Haul Road\Design Haul Road.dwg

PROJECT NO.		FILE NO.	
MR-07-008		CAMECO	
DATE 5/16/2007	SCALE N.T.S.	DWG. NO.	SHEET
DRAWN BDS	CHECKED	6	6OF6

Bid Item No. 2400.01 Haul on Earth Excavation

a) 20.0km McArthur River Access

Quantity Haul on Earth Excavation =4,179,959m^3hm

Earth Exc. = 1,073,731m^3

Haul Factor = 3.89

b) Cigar Access from HWY #905

Quantity Haul on Earth Exc. = 5,116,930m^3hm

Earth Exc. = 1,355,550m^3

Haul Factor = 3.77

Use Haul Factor = 4.0

Haul on Earth Exc. Estimated = 4.0 x 2,110,000 = 8,440,000m^3hm

Bid Item No. 2405.20 Hauling Aggregate/4300.01 Traffic Gravel Type 100(2")
4300.02 Apply Traffic Gravel Type 100/4300.11 Traffic Gravel Type 104 (11/2")
4300.12 Apply Traffic Gravel Type 104 (11/2")
4300.30 Traffic Gravel Type 104 in Place in Stockpile

Assume Traffic Gravel available @ McArthur River Site(km0.0) or Cigar Lake Site(km48.7)

Type 100 (2"0)	Rate/km (Stabilization) m^3/km	km	m^3	km	m^3km
	600	48.7	29220	24.35	711507
Type 104 (11/2")	300	48.7	14610	24.35	355754
	Totals		**43830**		**1067261**
Type 104 (11/2") Stockpile in Place	300	**48.7**	**14610**		

Bid Item No. 4300.13 Reject Aggregate > 20%

Assume Reject @ 35%

43830m^3 + 14610m^3 = 58,440m^3

Reject Estimated = 58,440 x (35-20) = 8,766m^3 (9,000m^3)

Bid Item No. 2500.02 Watering on the Road, including Hauling

a) 20.0km McArthur River Access

Quantity Watering on the Road =14,459m^3

Earth Exc. = 1,073,731m^3

% Water = 1.35%

b) Cigar Access from HWY #905

Quantity Watering on the Road = 32,000m^3

Earth Exc. = 1,355,550m^3

% Water = 2.36%

Use 2.0% of Exc. Haul Factor = 4.0

Watering on the Road Estimated = 2.0% x 2,110 = 42,200m^3 (Use 43,000m^3)

Bid Item No. 3000.01 Subgrade Prep. & Compaction

Subgrade Width m	Length km	**Area m^2**
8.6	48.7	**418820**

Subgrade Prep. & Compaction Estimated = 420,000m^2

Bid Item No. 5000.01 to 5000.14 Supply & Install Culverts

a) 20.0km McArthur River Access

Culvert costs for Supply & Install were $150,000 at 1996 prices, adjusted to 2005 prices would be $278,115 or $13,684/km.

b) Cigar Access from HWY #905

Culvert costs were $386,610 or $7,500/km.

Use $13,000/km

Supply & Install Culverts Estimated = $13,000.00/km x 48.7km = $633,100

Bid Item No. 6000.01 Hand Placed Riprap

a) 20.0km McArthur River Access

Quantity was 2,452m^3 for 20.325km or 121m^3/km

b) Cigar Access from HWY #905

Quantity was 4,110m^3 for 51.55km or 80.0m^3/km

Use 120m^3/km

Riprap Estimated = 120m^3/km x 48.7km = 5,844m^3 (5,900m^3)

Two past projects are referenced in the estimate of quantities. These projects are similar and are located in northern Saskatchewan. The two projects are list below:

a) McArthur River Mine Site to 20 km South of McArthur River Mine Site for a total distance of 20.32 km

b) Cigar Lake Mine Site to Highway No. 905 for a total length of 51.55 km.

ROUTE 7

CONTRACT ITEMS:

Bid Item No. 2000.03 Clearing and Grubbing

1) Extra clearing
a) 20.0km McArthur River Access
Quantity 20.325 km x 44m = 89.43ha
Final Clearing Quantity = 99.7ha
Extra Clearing = 10.27ha/89.43ha x 100 = +11.5%
b) Cigar Access from HWY #905
Quantity 51.55km x 44.0m = 226.82ha
Final Clearing Quantity = 250.64ha
Extra Clearing = 23.83ha/226.82ha x 100 = +10.5%
Use Extra clearing of 12.0% for R/W Widening, Gravel Pits, etc.

km0.0 to km48.7 = 48.7km
Length 48,700m
R/W 44.0m
Quantity = 48,700m x 44.0m = 2,142,800m

Quantity = 214.2ha
Extra +12% = 25.72ha (Borrow Pits & Gravel Pits)
Total Quantity = 239.92ha

Total Estimated Quantity @ 240ha

Bid Item No. 2200.01 Waste Excavation

a) 20.0km McArthur River Access
Quantity Waste = $8,821m^3$ Length =20.325km
Earth Exc. $1,073,731m^3$
% of Earth Exc. = 0.82% Waste/km = $444m^3$
b) Cigar Access from HWY #905
Quantity Waste = $46,655m^3$ Length = 51.55km
Earth Exc. $1,355,550m^3$
% of Earth Exc. = 3.44% Waste/km = $905m^3$

Use 2% of Estimated Earth Exc. 2,110,000 = $42,200m^3$

Total Estimated Quantity = $43,000m^3$

Bid Item No. 2200.08 Earth Excavation

Terrain Type	Excavation per km	Total Length	m^3	
T-L-D	21,500	4.3	92450	Till-Level-Dry
T-U-D	40000	15.84	633600	Till-Undulating-Dry
T-L-W	21500	2.68	57620	Till-Level-Wet
L-L-W	21,500	2.91	62565	Lacustrine-Level-Wet
T-R-D	83,000	2.91	241530	TILL-Ridged/Drumlinized-Dry
T-SH-W	50,000	2.08	104000	Till-Sidehill-Wet
L+T-U-W	40,000	1.47	58800	Lacustrine + Till-Undulating-Wet
T+O-L-W	60,500	0.79	47795	Till+Organics-Level-Wet
T-U-W	40,000	1.16	46400	Till-Undulating-Wet
T+L-SH-W	50,000	0.63	31500	Till+Lacustrine-Sidehill-Wet
T-B-D	40000	7.03	281200	Till-Locally Rolling-Dry
T-SH-D	50000	5.6	280000	Till-Sidehill-Dry
O-L-W	60500	0.49	29645	Organics-Level-Wet
L	50,000	0.81	40500	Water bodies
Totals		48.7	2007605	

Note : Adjust + 5% = 2107985

Total Estimated Quantity = 2,110,000m^3 **($43,326 m^3/km$)**

Bid Item No. 2250.05 Rock Excavation

Based on JDMA terrain analysis there should not be any Rock Excavation

Bid Item No. 2260.01 Removal of overburden

This item is applicable for removal overburden on Aggregate Sources

Estimated @ 10000 m^3

Bid Item No. 2320.01 Disposal of Surplus Rock

a) 20.0km McArthur River Access
Quantity Surplus Rock = 47,527m^3
Earth Exc. = 1,073,731m^3
% Surplus Rock = 4.43%

b) Cigar Access from HWY #905
Quantity Surplus Rock = 46,655m^3
Earth Exc. = 1,355,550m^3
% Surplus Rock = 3.44%
Use 4% of Earth Exc.

Surplus Rock estimated @ 4.0% of Earth Excavation 2,110,000m^3 = 84,400m^3

Bid Item No. 6600.02 Granular Backfill

a) 20.0km McArthur River Access
Quantity GBF =3,284m^3
Length = 20.325km
GBF = 160m3/km

b) Cigar Access from HWY #905
Quantity GBF = 1662m^3
Length = 51.55km
GBF = 32m3/km
Use 150m3/km

Granular Backfill Estimated = 150m^3/km x 48.7km = 7,305m^3 (7,300m^3)

Bid Item No. 8700.01 & 8700.02 Mobilization & De-Mobilization

a) 20.0km McArthur River Access
Mob. & De-Mob. = $230,700

b) Cigar Access from HWY #905
Mob. & De-Mob = $1,350,000

Estimated: Mob. = $1,000,000
De-Mob = $1,000,000

SUNDRIES:

1) New Flight, Air Photos, & Digital Terrain Model

LIDAR Survey @ McArthur River
Cost = $87,400
Area = 27km x 4km = 108km^2

Route 1 McArthur to Cigar Lake
52.6km x 2.5km = 131.5km^2
Estimated Costs = 131.5km^2 x $810/km^2 = $106,515 ($120,000)

2) Sask Power Relocations

This is unknown at this time.
Estimate = $0

3) Purchase & Install Permanent Road Signs

Sask Highways & Transportation Supplied & Installed Permanent Signs
on the road from Highway #905 to Cigar Lake for $22,000. ($12,000 + $10,000)

Estimated Cost = $30,000

4) Personnel Flights @ Shift Change

Flights to McArthur River @ $175.00 one way.
Flights to Cigar Lake @ $195.00 one way
Use $185.00 one way.

Construction Days:

2,110,000m^3 @ 14,000m^3/day = 151 Days
Consider additional 25% for downtime & Misc. = 151 x 1.25 = 189Days
Shift Change 30 men per week

Estimated Cost = 30men x 27weeks x ($185.00 x 2) = $299,700 ($300,000)

MATERIALS:

1) Coco Matting: Supply & Install

Cigar Access from HWY #905
Cost @ $409,656
Area = 66,073.6m^2
Length = 51.55km
Cost/m^2 = $6.20/m^2
Area /km = 1.282/km Use 1,400m^2/km

Estimate for Coco Matting = 1,400m^2 x 48.7km = 68,180m^2 (69,000m^2)

2) Seeding Right of Way

Width = 44.0m - 8.6m = 35.4m
Length = 48.7km
Area = 172ha (180ha)
Rate @ 1lb/500ft^2 = 1/500 x 43560ft^2/acre x 2.47acre/ha = 215lbs/ha
215lbs/ha x 1Bag/50lbs = 4.3 Bags/ha

Seed : 4.3bags/ha x 180ha = 774 Bags (@ $180/Bag)

OTHER CONTRACT ITEMS:

1) Temporary Construction Camp

Cigar Lake Camp @ $171,000
Mobilization @ $35,000 & De-Mob. @ $35,000
Rate @ $25,250/4wks
Accommodated 30 persons, kitchen, Cook (Cost of food not included)
Cost/person /4wks = $25,250/30 = $841/person/4 wks or $210/wk/pers.

Duration of Camp = 2,720,000m^3/14,00m^3/day = 194 Days
Additional for downtime/misc. =1.25 x 194 = 243 Camp Days

189Days/7 = Approx. 27Weeks

60 Persons x 27Weeks x $210/wk = $340,200 ($340,000)
Mobilization = $105,000
De-Mobilization = $105,000

Estimated Total Cost = $550,000 ($550,000)

2) Seeding Road Right of Way

180ha x $265/ha = $47,700 ($48,000)

3) Surplus Aggregate

Estimate 5,000m^3 x $18.50/m^3 = $92,500

FORCE ACCOUNT (EXTRA WORK):

1) Rehab Borrow Pits = $100,000

2) Environmental Requirements
Cigar Road @ $578,472 ($580,000)

3)Erosion Control
Cigar Road$496,818 ($500,000)

4) Misc. = $100,000

Estimated $1,280,000

COSTS:

1) Pre-Feasibility Study

Initial Scope = $25,000
JDMA = $16,800
Addendum = $15,200
Total = $57,000

2) Feasibility Study

	Rate/hr	Weeks	hrs/wk	Cost
Study Coord.	100	20	40	80000
Advisor	90	2	40	7,200
Civil Design Lead	90	10	40	36,000
Civil Design Support	55	10	40	22,000
AutoCAD	45	20	40	36,000
			Total	$181,200
			Estimated	**$200,000**

Note: This estimate does not include field inspections. Helicopter costs, Aggregate Source Testing.

3) Environmental Monitoring

$6,200/wk x 27wks = $167,400
Report Generation = $10,200
Total = $177,600
Estimated $180,000

4) Terrain Mapping & Gravel Search @ Scale 1:10,000 by JDMA

Terrain Mapping = $22,000
Gravel Search = $10,000
Route Mapping = $10,000
Estimated Total = $42,000

CLUNIE CONSULTING ENGINEERS

Quantities and Co stimate Sheet

Contract No.:	
Type of Work:	Grading
Client:	Cameco Corporation
Prepared By:	Clunie Consulting Engineers
Date:	May 14, 2007

Project Information	
Project Number	Estimated Cost
Total	$0.00

Location / Section	From km	To km	Length
McArthur River to Cigar Lake	0.00	48.70	48.70
			0.00
			0.00
			0.00
		Total	48.70 km

Project Description: ROUTE 7

Pre-Feasibility Study Estimated Costs for Construction of a Subgrade from McArthur River to Cigar Lake Mine Site at for a Total Distance of 48.7km.

Remarks: Major Bid Items in Red

Contract Items					Pre-Tender		At Award	
Item No.	Spec. No.	Description	Unit	Quantity	Price	Cost	Price	Cost
2000.03	2000	CLEARING AND GRUBBING	ha	240	$6,500.00	$1,560,000.00		$0.00
2200.01	2200	WASTE EXCAVATION	m3	43,000	$10.00	$430,000.00		$0.00
2200.08	2200	EARTH EXC 100% MAX DENSITY REQD FOR EARTH EMBANKMENTS	m3	2,110,000	$7.00	$14,770,000.00		$0.00
2250.05	2250	ROCK EXCAVATION	m3			$0.00		$0.00
2260.01	2260	REMOVAL OF OVERBURDEN INCLUDING HAULING	m3	10000	$8.00	$80,000.00		$0.00
2320.01	2320	DISPOSAL OF SURPLUS ROCK	m3	84400	$20.00	$1,688,000.00		$0.00
2400.01	2400	HAUL ON EARTH MATERIAL	m3.hm	8,440,000	$0.20	$1,688,000.00		$0.00
2400.02	2400	HAUL ON ROCK EXCAVATION	m3.hm			$0.00		$0.00
2405.20	2405	HAULING AGGREGATE	m3.km	1067261	$0.80	$853,808.80		$0.00
2500.02	2500	WATERING ON THE ROAD INCLUDING HAULING	m3	43000	$10.00	$430,000.00		$0.00
3010.01	3010	SUBGRADE PREPARATION AND COMPACTION FOR GRADING	m2	420000	$1.25	$525,000.00		$0.00
4300.01	4300	TRAFFIC GRAVEL TPYE 100 (2")	m3	29220	$19.00	$555,180.00		$0.00
4300.02	4300	APPLY TRAFFIC GRAVEL TYPE 100	m3	29220	$7.00	$204,540.00		$0.00
4300.11	4300	TRAFFIC GRAVEL TYPE 104 (11/2")	m3	14610	$19.00	$277,590.00		$0.00
4300.12	4300	APPLY TRAFFIC GRAVEL TYPE 104	m3	14610	$7.00	$102,270.00		$0.00
4300.13	4300	REJECT AGGREGATE > 20%	m3	9000	$5.00	$45,000.00		$0.00
4300.30	4300	TRAFFIC GRAVEL TYPE 104 IN PLACE IN STOCKPILE	m3	14610	$19.00	$277,590.00		$0.00
5000.01	5000	INSTALLING CSP CULVERTS 600mm	m			$0.00		$0.00
5000.02	5000	INSTALLING CSP CULVERTS 800mm	m			$0.00		$0.00
5000.03	5000	INSTALLING CSP CULVERTS 1200mm	m			$0.00		$0.00
5000.07	5000	INSTALL CORRUGED STEEL PIPE CULVERTS, 1400 mm DIAMETER	m			$0.00		$0.00
5000.08	5000	INSTALL CORRUGED STEEL PIPE CULVERTS, 1600 mm DIAMETER	m			$0.00		$0.00
5000.10	5000	INSTALL CORRUGED STEEL PIPE CULVERTS, 1800 mm DIAMETER	m			$0.00		$0.00
5000.12	5000	INSTALL CORRUGED STEEL PIPE CULVERTS, 2000 mm DIAMETER	m			$0.00		$0.00
5000.14	5000	INSTALL CORRUGED STEEL PIPE CULVERTS, 3000 mm DIAMETER	m			$0.00		$0.00
6000.01	6000	HAND PLACED RIP-RAP	m3	5900	$125.00	$737,500.00		$0.00
6600.02	6600	GRANULAR BACKFILL IN PLACE	m3	7300	$7.00	$51,100.00		$0.00
8700.01	8700	MOBILIZATION	LumpSum	1	$1,000,000.00	$1,000,000.00		$0.00
8700.02	8700	MOBILIZATION & DEMOBILIZATION	LumpSum	1	$1,000,000.00	$1,000,000.00		$0.00
						$0.00		$0.00
		Supply & Install Culverts	Lump Sum	1	$633,100	$633,100.00		$0.00
						$0.00		$0.00
						$0.00		$0.00
						$0.00		$0.00
						$0.00		$0.00
						$0.00		$0.00
						$0.00		$0.00
						$0.00		$0.00
		Contract Items Sub-Total				$26,908,678.80		$0.00
				Price	Quantity	Cost	Quantity	Cost
						$0.00		$0.00
						$0.00		$0.00
						$0.00		$0.00
		Contract Items Total (For comparing bids for award)				$26,908,678.80		$0.00

Sundries	
Item:	Cost
New Flight & Air Photo on Route #1	$120,000.00
Digital Terrain Model (100m Width)	
Personnel Flights/Shifts	$300,000.00
SaskPower Relocates	
Permanent Signs	$30,000.00
Sundries Total	$450,000.00

Materials			
Item:	Quantity	Price	Cost
Coco Matting	69000	$6.20	$427,800.00
600 CSP			$0.00
600 Coupl.			$0.00
800 CSP			$0.00
800 Coupl.			$0.00
1200 CSP			$0.00
1200 Coupl.			$0.00
1400 CSP			$0.00
1400 Coupl.			$0.00
1800 CSP			$0.00
1800 Coupl.			$0.00
2000 CSP			$0.00
2000 Coupl.			$0.00
3000 CSP			$0.00
3000 Coupl.			$0.00
			$0.00
Grass Seed	774	$180.00	$139,320.00
			$0.00
			$0.00
			$0.00
			$0.00
			$0.00
			$0.00
			$0.00
Material Sub-Total			$567,120.00
6% PST			$9,752.40
Freight/Miscellaneous			
Materials Total			$576,872.40

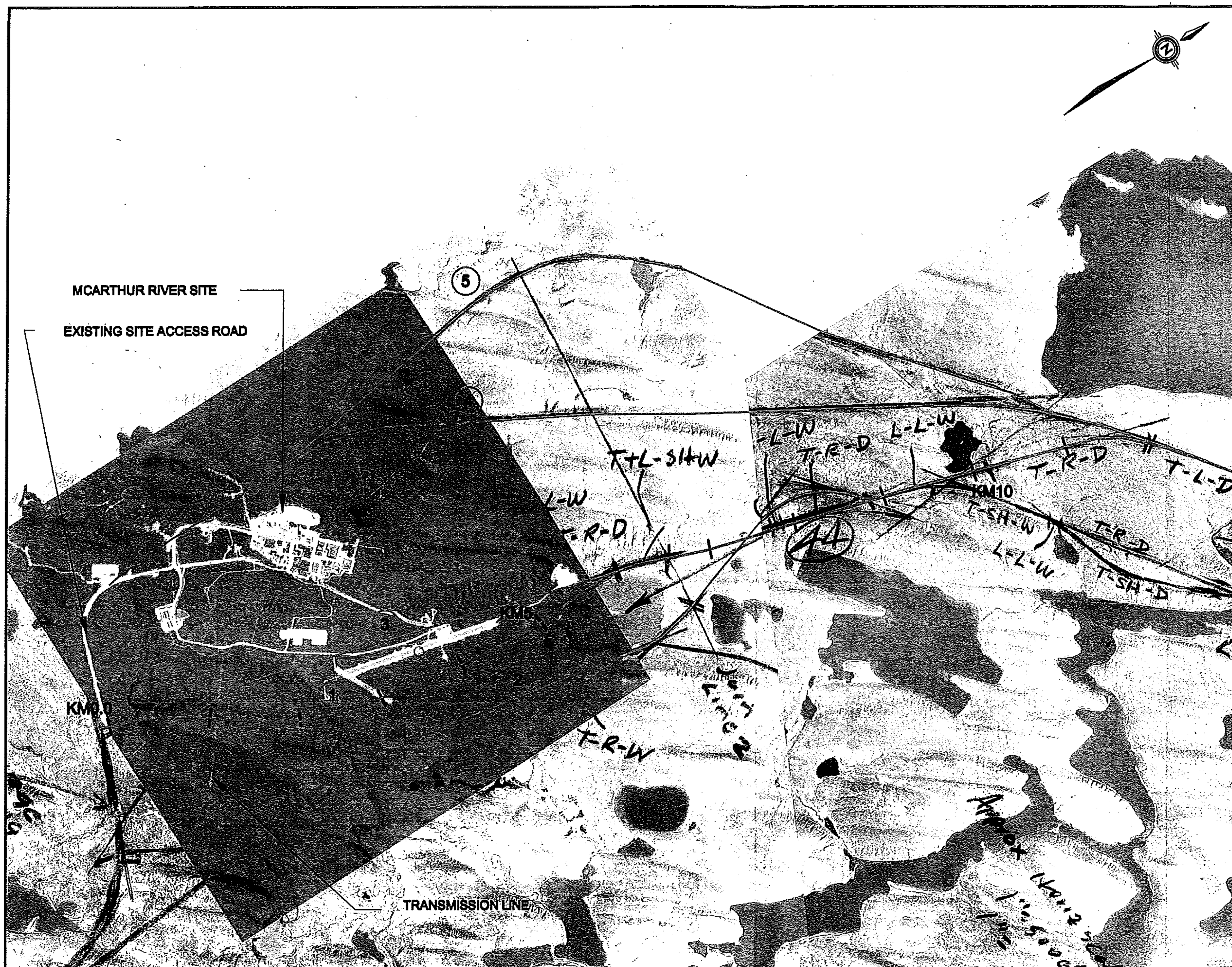
Budget Items	Year			
Budget Type	2007	2008	2009	Total
1. Programming				$0
2. Functional Design				$0
3. Detailed Design				$0
4. Pre-Tender Estimate				$36,500,000
5. At Award Estimate				$0

	Difference ($)	% Difference
Cont. Items At Award vs. Pre-Tender	0.00	0.00

Summary of Estimates		
Expenditure Category	Pre-Tender	At Award
Contract Items Sub-Total + OCI	$27,599,179	
Force Account	$1,280,000	
Materials	$576,872	
Sundries	$450,000	
Pre-Feasibity Study	$57,000	
Feasibility Study	$200,000	
Design Engineering (@ 7% of CI'S + FA)	$2,021,543	
Const. Engineering (@12%)	$3,465,501	
Terrain Mapping & Gravel Search	$42,000	
Enviro.Const. Monitoring	$180,000	
Miscellaneous	$627,905	
Total Cost	$36,500,000	$0

Other Contract Items (OCI)	
Item	Cost
Temp. Const. Camp	$550,000.00
Surplus Aggregate	$92,500.00
Seeding R/W	$48,000.00
Other Contract Items Total	$690,500.00

Force Account	
Item:	Cost
Rehab Borrow Pits	$100,000.00
Environmental Requirements	$580,000.00
Erosion Control Requirements	$500,000.00
Misc.	$100,000.00
Force Account Total	$1,280,000.00



SUB-CONSULTANT

CLUNIE CONSULTING ENGINEERS

4271 5th AVENUE EAST BAG #5800,
PRINCE ALBERT SASKATCHEWAN, CANADA
S6V 7V6
PH: 306-764-4896, FAX:306-764-1037

NOTES:

0m 400m 800m 1200m 1600m 2000m

DRAWING ISSUE			
4			
3			
2			
1			
NO	DATE	DESCRIPTION	BY

DRAWING REVISIONS			
6			
5			
4			
3			
2			
1			
NO	DATE	DESCRIPTION	BY

PROJECT TITLE

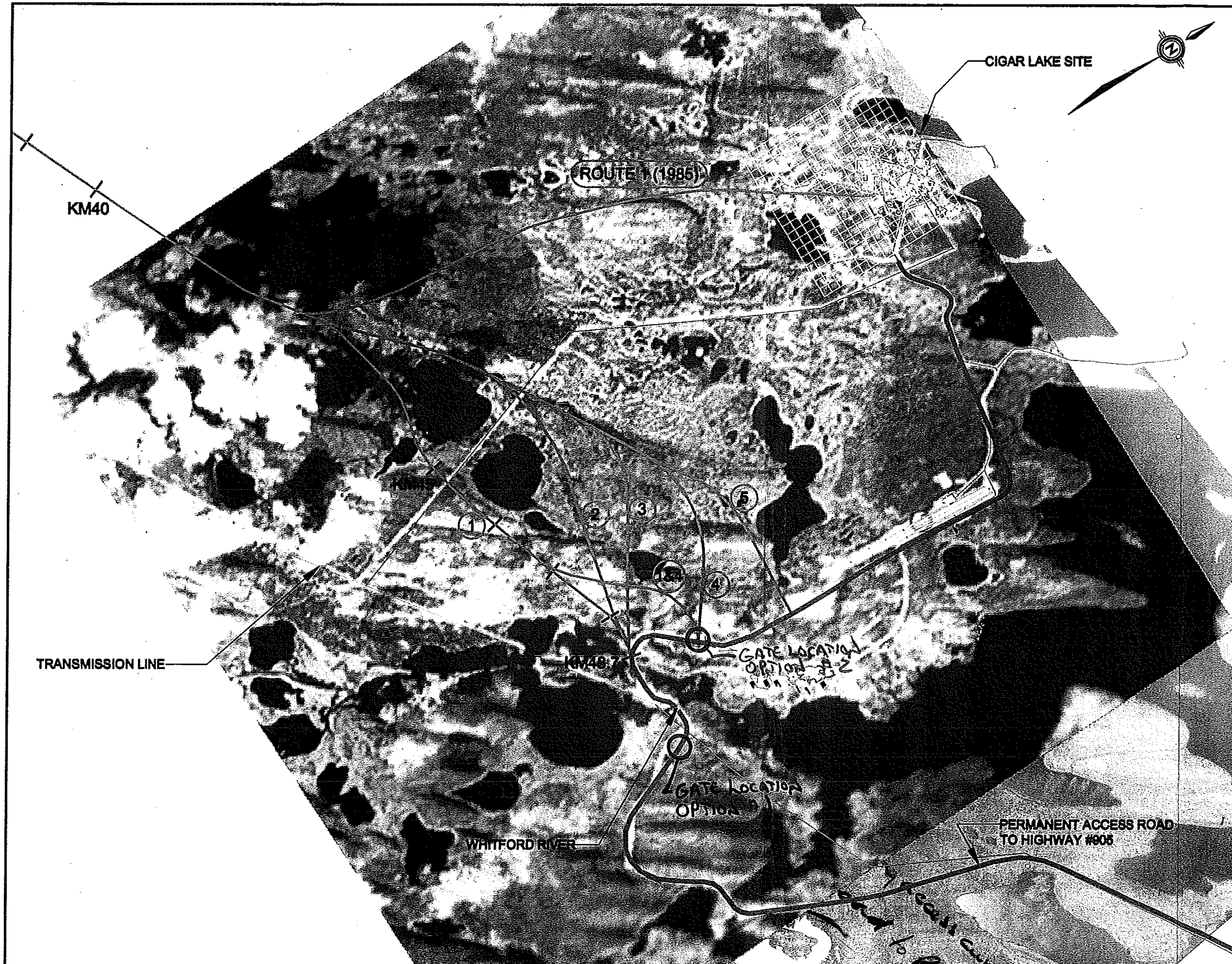
PRE-FEASIBILITY STUDY
MCARTHUR RIVER TO
CIGAR LAKE HAUL ROAD

DRAWING TITLE

MCARTHUR RIVER
ACCESS ALTERNATES

DRAWING LOCATION : C:\projects\2007\McArthur River Cigar Lake Haul Road\Design Haul Road.dwg

PROJECT NO.		FILE NO.	
MR-07-008		CAMECO	
DATE 5/17/2007	SCALE NTS	DWG. NO. 7	SHEET 1OF2
DRAWN BDS	CHECKED		



SUB-CONSULTANT

CLUNIE CONSULTING ENGINEERS

4271 5th AVENUE EAST BAG #5800,
PRINCE ALBERT SASKATCHEWAN, CANADA
S6V 7V6
PH: 306-764-4896, FAX:306-764-1037

NOTES:

0m 400m 800m 1200m 1600m 2000m

DRAWING ISSUE

NO	DATE	DESCRIPTION	BY
4			
3			
2			
1			

DRAWING REVISIONS

NO	DATE	DESCRIPTION	BY
6			
5			
4			
3			
2			
1			

PROJECT TITLE

PRE-FEASIBILITY STUDY
MCARTHUR RIVER TO
CIGAR LAKE HAUL ROAD

DRAWING TITLE

CIGAR LAKE
ACCESS ALTERNATES

DRAWING LOCATION : C:\projects\2007\McArthur River Cigar Lake Haul Road\Design Haul Road.dwg

PROJECT NO.		FILE NO.	
MR-07-008		CAMECO	
DATE 5/17/2007	SCALE NTS	DWG. NO. 7	SHEET 2OF2
DRAWN BDS	CHECKED		

Report

Sask. Ministry of Highways and Infrastructure

Highway No. 914 Detailed Location
Final Report

February 2010

ASSOCIATION OF PROFESSIONAL ENGINEERS
AND GEOSCIENTISTS OF SASKATCHEWAN
CERTIFICATE OF AUTHORIZATION
ASSOCIATED ENGINEERING (SASK.) LTD.
NUMBER
C116
Permission to Consult Held By:

Discipline	Sask. Reg. No.	Signature

ASSOCIATED ENGINEERING
QUALITY MANAGEMENT SIGN-OFF
Signature: ____________________
Date: ____________________

Seal

Executive Summary

Associated Engineering (AE) was commissioned by the Ministry of Highways & Infrastructure (MHI) to complete a detailed location report for an all weather roadway between the Cigar Lake and McArthur Lake mine sites.

Currently two existing Cameco private roads are used to access the mines, McArthur from Highway No. 914, and Cigar Lake from Highway No. 905. Between the mines there is an existing winter trail. This trail, containing overland and ice road portions, has not been used by Cameco in several years.

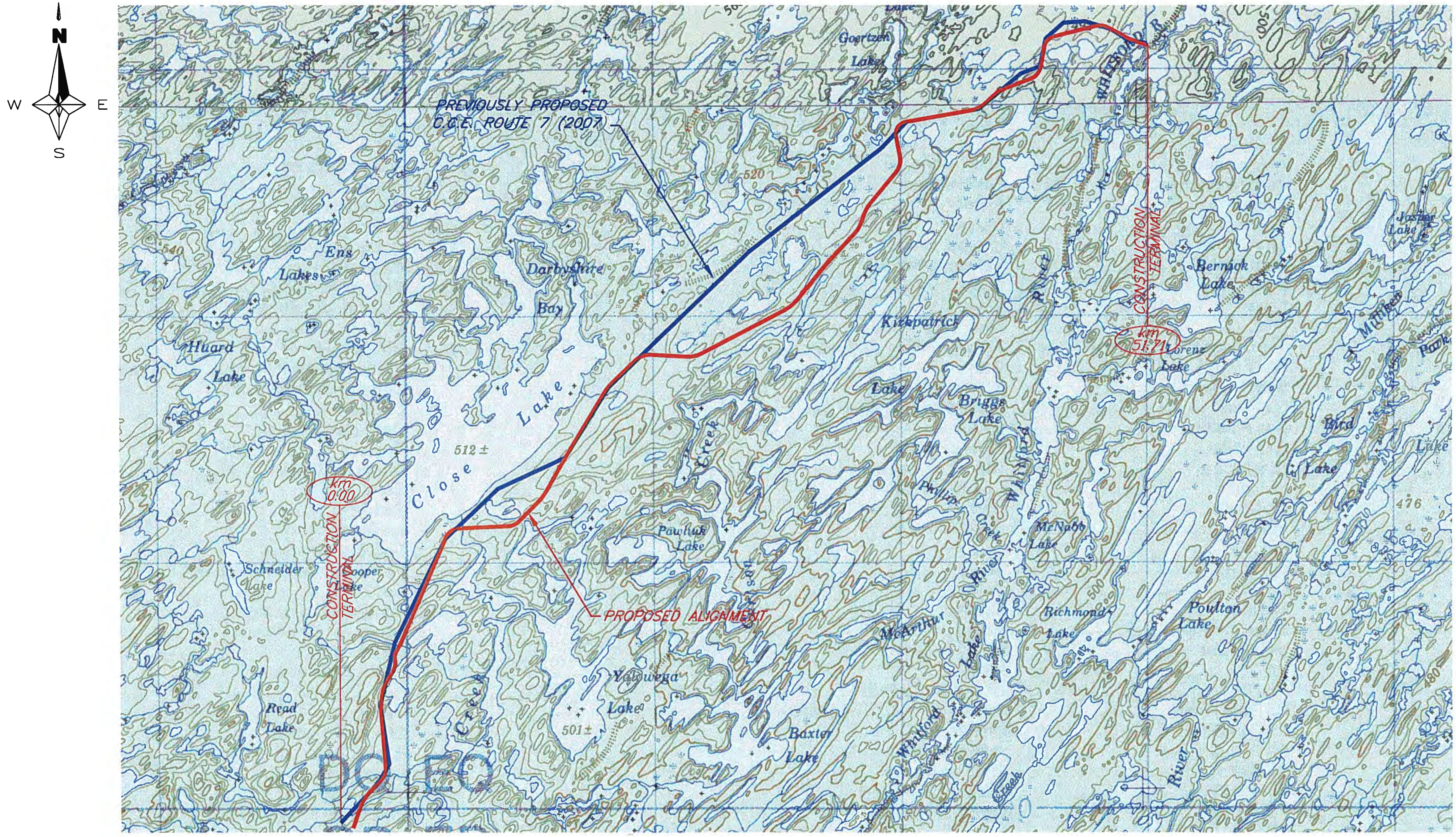
The new proposed roadway is to serve as an all weather connector between the two mine sites, a public highway corridor connecting Highway No. 914 with Highway No. 905, as well as public access to the north. Discussions are currently underway with Cameco and other industry to determine possible partnerships and cost sharing.

The intent of this detailed location study was to refine the work done on previous studies and look closer at the existing recommendations to ensure its feasibility. Air photos, satellite imagery, terrain information, helicopter site investigation and a site visit were used to establish a new recommended route.

The recommended route follows approximately 35% of route 7 proposed in the CCE feasibility study performed in 2007, with the rest being proposed new location as illustrated in Appendix C.

The proposed roadway is 51.7 km in length traversing along a constructible corridor between rock out crops, sloughs, muskegs, rivers and lakes. The recommended route incorporates MHI standards, Environmental and DFO requirements. The west terminus of the roadway is a tie in point with existing Highway 914 approximately 3.6 km east of the McArthur River mine site. The east terminus of the roadway is a tie in with the existing private Cigar Lake access road approximately 8 km south of the Cigar Lake mine site.

The estimated cost of this project in 2010 dollars is $38,570,000 or $683,000/km. This cost includes an additional 4.8 km segment to bypass the Key Lake Mine Site which was not included in this Detailed Location Report. A breakdown of this cost estimate can be found in Appendix F.



Saskatchewan
Ministry of
Highways and
Infrastructure

LOCATION PLAN

HIGHWAY NO 914

km 0.00 TO km 51.71

DRAWN BY	M. WALTERS	DATE	09/11/25	CS	914-04	TAB NO	3-1
DESIGNED BY	J. HORAN	DATE	09/11/25	CONTRACT		SHEET	1 OF 1

Ministry of Highways and Infrastructure
Highway No. 914 Detailed Location Report

Recommended By:	______________________________ Jeff Horan, Associated Engineering (Sask. Ltd)	________ Date
Recommended By:	______________________________ Al Loke, Northern Business Coordinator	________ Date
Recommended By:	______________________________ Doug Neis, Regional Operations & Design Engineer	________ Date
Recommended By:	______________________________ Sukhy Kent, Director Design and Traffic Operations Engineering Standards	________ Date
Recommended By:	______________________________ Ron Gerbrandt, Executive Director Engineering Standards	________ Date
Approved By:	______________________________ Terry Schmidt, ADM Operations Division	________ Date

Table of Contents

1 Project Background

In November 2009 the Ministry of Highways and Infrastructure (MHI) issued Terms of Reference for a detailed location and environmental project submission for the extension of Highway No. 914 from McArthur River Mine Site to Cigar Lake Mine Site, in Northern Saskatchewan. Currently there are private roadways on both ends of the study area that are owned, operated, and maintained by Cameco. Future plans include the construction of this section of roadway to link the two existing sections, construction of a small section of roadway to bypass the Key Lake mine site, then opening the entire section of 914 as a public roadway.

The detailed location report considered the following:

- Avoiding undesirable terrain that would make construction difficult and costly.
- The proximity of accessible granular and borrow sources.
- The proximity to lakes and water bodies.
- The location and number of significant river and stream crossings.

A functional standard was provided by MHI that included a proposed geometric standard as well as ROW width. Helicopter and on site work were also included in the commission to assist in optimizing the proposed route. This on site work was performed in November, 2009.

2 Previous Work Completed

Work completed by others to date is as follows:

- In December 1985 J.D. Mollard & Associates (JDMA) completed a Feasibility Study for the construction of a haul road between the Key Lake and Cigar Lake Mine Sites.
- In 1997 the construction of the road from Key Lake Mine Site to McArthur River Mine Site was completed, following JDMA location recommendations with the exception of the McArthur River Mine Site access.
- In 2007 Clunie Consulting Engineers (CCE) completed a pre-feasibility assessment, conceptual design, and capital cost estimate for the completion of the route between McArthur River and Cigar Lake Mine Sites.

3 Overall Route Description

The McArthur River and Cigar Lake Uranium Mines are situated in north central Saskatchewan, McArthur River at 57°45’47”, 105°03’9” and Cigar Lake at 58°04’07”, 104°32’27”. Sole ground access consists of an undeveloped winter trail that had been used as access between the two sites in the past; this trail is no longer used for any purpose. A new roadway is proposed to serve as an all weather connector between the McArthur River and Cigar Lake mine sites.

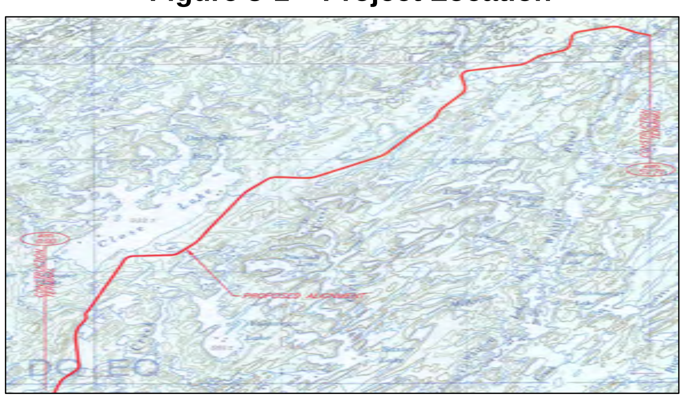
The proposed all weather haul route will connect the two existing private Cameco haul roads. The intent is for the proposed roadway to bypass the existing McArthur River and Cigar Lake sites without entering areas currently considered within the mine site limits. Cameco has indicated that they would permit the Ministry to construct the roadway through sections within their surfacial lease area if required.

A small section of realignment would also be required to bypass the section of Highway No. 914 within the Key Lake mine site area. This location work was not included in this detailed location commission, but a cost base solely on anticipated length is included in the anticipated project cost, as the work will be done concurrently with construction on the McArthur to Cigar segment.

The proposed roadway will act as a more efficient route for truck traffic to access mines operated by Cameco and others in northern Saskatchewan. Negotiations are currently underway between the Ministry and Cameco to open the entire section of Highway No. 914 as a public roadway after construction of the connector is complete.

Figure 3.1 illustrates an overall view of the proposed location of the road.

Figure 3-1 – Project Location



The proposed roadway is 51.71 km in length. The proposed location takes into consideration the recommendations made in the feasibility study, and actual observed conditions noted during on site work.

The initial goal of the location study was to evaluate the route presented in the feasibility study performed in 2007. This route was entered into a GPS unit in the aircraft that allowed a direct flight path along the proposed route. In several areas, the proposed alignment deviates from that proposed in the 2007 feasibility study. Rationale behind the deviations are as follows:

- To ensure current MHI geometric standards are met throughout the route.
- To meet minimum lake setback distances. Several sections in the previously proposed alignment did not meet the minimum 90 m setback distance dictated by Ministry of Environment (MOE).
- To consider the need to avoid several adverse terrain areas found during on site work.

See the key plan illustrated in Appendix A for more detail on the proposed location of the road. Section 5.2 of this report gives more detail on the location of deviations between the proposed alignment and the alignment previously recommended.

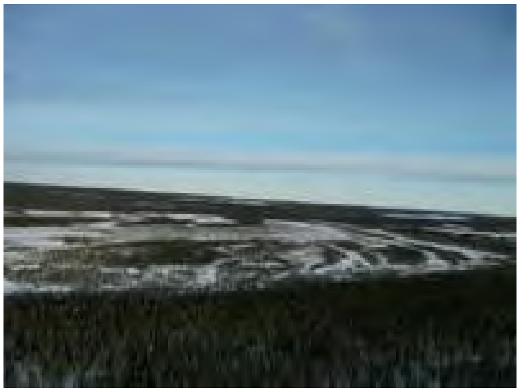
4 Natural Physical Conditions

4.1 TERRAIN CONDITIONS

According to the geologic section of the Atlas of Saskatchewan the dominant soil texture in the area is a mixture of sandy and loamy (loamy sands, sands, gravel, sandy loams and silty clay loams) and the topography is indicated to be rough rock land complete with bedrock exposures. The Soil Complex for the area is dominantly Podzol (light colored forest soil) with significant occurrence of undifferentiated Regosols (weakly developed soils) and Fibrisol (deep moss peat). Podzol soils are said to have a thin, light grey to white A horizon and a bright brown B horizon.

In 2007 Clunie Consulting Engineers undertook a prefeasibility study of the proposed route between McArthur River Mine Site and Cigar Lake Mine Site. A 1:60 000 airphoto analysis was performed to determine material types, landforms, and overall feasibility of construction. They found that the majority of the proposed route contains till or lacustine materials.

The study area is highly drumlinized. Drumlins in this area tend to consist of sandy material, containing silt and boulders. During on site work shovel tests were performed in several areas to determine material types. These tests indicated that predominant material type contained within these large drumlins is silty sand. Observations noted in areas where erosion had occurred along the slopes of these large landforms indicate that this sandy material is quite deep, and will provide a large source of roadway borrow.



Drumlins near km 33.0

Sandy burn area near km 15.5

Low flat areas below drumlin elevations were found to contain thin sand veneers overlying boulders. Low wet areas were found to contain fibrisol, which is suspected to be quite deep in several locations. As no muskeg probing was possible at the time of this initial site work, it is recommended that prior to final alignment selection through these low areas probing and vane shear testing be performed. Use of geotextiles or geogrids may require consideration on a site to site basis in these low areas.

4.2 ENVIRONMENTAL CONDITIONS

Weather conditions and environmental conditions between McArthur River and Cigar Lake Mine sites are typical of what would be found in northern Saskatchewan. Freezing conditions generally prevail for the winter months of October to April. In the last 10 years of weather data, the maximum recorded temperature was 32.6°C and the minimum was -49.7°C. On average, 449 mm of precipitation was recorded per year. Due to the cold winter temperature and small bodies of water located near the sites, creating ice roads would generally not be difficult during winter months.

4.3 EXISTING WINTER TRAIL

During airphoto review, and on-site work, there was an existing trail identified between the two mine sites. This trail consists of a combination of overland sections and ice crossings to create a corridor between the two sites. On site it was determined that the path is discontinuous, and it appears to follow a route of minimal obstruction or resistance.

Existing Trail Adjacent to Lake

Existing Trail Aerial View

In correspondence with Cameco personnel it was indicated that the trail does not experience regular vehicle traffic. Exploration vehicles have used several sections of it in recent years, but not with the intent to travel between the two mine sites. Refer to Appendix C for illustrations of the existing trail relative to the proposed route.

4.4 FUNCTIONAL DESIGN STANDARDS

In the project Terms of Reference a design standard was provided by the Ministry. Details provided are as follows.

- Road top width = 8.0 m
- Design speed = 90 km/h
- Surface type = Gravel
- Maximum vertical gradient = 8%

- Sideslope = 4:1
- Backslope = 3:1
- Ditch bottom = 5.0 m
- Curve radius (minimum) = 375 m
- Right of Way width = 40 m

This functional standard is typical of what the Ministry has proposed on other northern low volume roadway projects. It should be noted that the access road constructed to Cigar Lake Mine Site was constructed with a road top width of 8.6 m. It should also be noted that the Right-of-Way width is slightly narrower than the current acceptable Ministry standards, which may result in issues creating windrowing and disposing of cleared timber within the Right-of-Way limits. It is recommended that a right-of-way width closer to a 46 m minimum be utilized.

5 Horizontal Alignment

Roadway location in northern or remote areas is generally driven by a number of factors. When initial location work is being done on a new roadway in the north, terrain often plays the largest role in determining a feasible location. A goal of meeting proper geometrics is also very important as it is often very costly to return, and attempt to rectify substandard elements after construction is completed. As well there are environmental ramifications to approaching new construction in this manner. In a case where budget is limited it can be argued that it is better to save costs during vertical design, as it is easier to re-grade where proper geometry already exists.

The horizontal alignment and proposed options contained in this detailed location report were established using standards recommended by the MHI Design Manual (DM1). The Transportation Association of Canada (TAC) has also been used as reference material for geometrics and general design principles. While setting the horizontal alignment of this roadway a set of general principles were adhered to. Some examples of these principles were to keep the number of curves to a minimum, maintain consistency in curves radii and spacing, avoid small deflections, avoid back to back curves, avoid "broken back" curves, and coordinate vertical and horizontal alignments.

The Ministry standards considered during the establishment of the alignment are as follows:

1. SP 20200 – This standard was used to define minimum and desirable curve radii for all curves along the route. This standard illustrates the desirable radius for aesthetics, improved safety, consistency, and driver expectation. In general the curves along this alignment adhere to guidelines set out in SP 20200. In general while designing the route minimum curve radii's were avoided and guidelines set out in Bulletin 300-1 were taken into consideration. Where possible the minimum distance between curves defined by this standard was adhered to.

2. Bulletin 300-1 - This bulletin indicates that mid band radii should be used for ∆ angles from 0°-50°, the upper half of the band for ∆ angles from 50°-75°, and the top of the band for ∆ angles from 75°-90°. For the majority of the curves along the alignment these guidelines were adhered to, with exceptions in areas where terrain issues dictated that other radii be used.

3. SP 20210 – This standard was used to define superelevation for all curves along the route.

4. SP 20651 – This standard governs the minimum straight tangent distance that should be provided when intersecting another road type.

During the grading design and construction processes additional information about difficult terrain locations will likely surface. Some of this additional knowledge may place the designer in situations where it is difficult to meet Ministry standards. Should this situation arise, the designer will need to obtain design exceptions for areas that are outside of Ministry standards.

5.1 GROUND PROOFING

The initial intent of ground proofing the alignment was to determine whether the route presented by CCE in the feasibility study would be constructable. From November 18-21, 2009, air and ground work was performed by Jeff Horan (AE) and Ben Berkach (MHI) along the proposed route. A helicopter was used to access the location, determine the best possible route, and to assist in avoiding the need to construct through as many complex terrain areas as possible. During this time on site it was determined that is would be necessary to move several portions of the alignment due to environmental and terrain related issues. Alternate alignments were sought in order to avoid these areas, and the new alignments then verified.

During this on site time, the location of potential borrow sources was considered, and several sources noted. In several locations ground work (walking) was done to determine optimal routes through challenging areas such as the May Creek crossing location.

Silty Sand Material km 15.5

Sandy Till Material km 33.0

This ground work was valuable in providing verification of good sections of the route, as work prior to this was performed only with photos. The on site work also aided in avoiding several costly construction areas, and assisted in determining feasible realignments around others. In several areas shovel tests were performed to verify material types near surface. Items such as stream substrate, vegetation thickness and type, and visible wildlife were also noted during this time.

5.2 ROUTE INVESTIGATION PREVIOUS STUDIES

Several route location investigations and feasibility studies were done for this road prior to this detailed location commission. JD Mollard and Associates, in 1985, as well as Clunie Consulting Engineers (CCE), in 2007, were consulted by Cameco to provide terrain details and a location study for a proposed link between the two mine sites. In 2007 CCE recommended a route, indicated in the prefeasibility study as Route 7. This route served as a basis for a prefeasibility study including detailed costing, which was performed in 2007.

The proposed route differs from CCE Route 7 at several locations. Several items were determined during office work prior to visiting the site, and others while conducting the ground proofing. The following sections detail these areas, and rationale used when recommending an alternate alignment around these portions of the route.

5.2.1 ROUTE 7 (km 0.0 - km 1.5)

There is a small lake located near the tie in point with the existing section of Highway No. 914 near the McArthur River site. At this location the CCE proposed Route 7 is within 20 m of this lake, therefore does not meet Ministry of Environment requirements. A stream crossing, which will likely be deemed as fish bearing was also crossed, making the location quite sensitive due to the proximity with the lake. During on site work it was determined that the section immediately adjacent to the lake contains some areas with cross drainage, which could have led to potential sediment issues, and would have caused necessity to install a significant amount of silt fencing at this location.

To ensure minimum setback from this lake, and to ensure a 90 degree tie in with existing Highway No. 914 an alternate tie in location for the junction is proposed. See Appendix C for details on the proposed alignment in this location.

5.2.2 ROUTE 7 (km 5.0 - km 11.0)

This section of roadway is confined by a small lake on the east and by a very large steep drumlin complex on the west. The CCE proposed Route 7 did not meet the 90 m setback minimum for the small lake. As well, field investigation determined that a large portion of Route 7 involved significant sideslope construction along the edge of a very steep drumlin formation. There is an existing temporary bridge located near km 8. The location of this bridge was chosen in the optimal location to construct the roadway as there is a very steep sidehill to the west, and a large drop off to the east.

Route 7 km 8.0 Area

In order to improve constructability, decrease cost, and meet environmental requirements realignment is proposed here. See plans in Appendix C for proposed geometric details.

5.2.3 ROUTE 7 (km 10.0 – km 19.0)

Similar to the area near CCE Route 7 km 0.0 - 1.5, the proposed location did not meet a 90 m setback from surrounding water bodies. During airphoto interpretation it was determined that this section is located in a long low lying muskeg area.

During the ground proofing it was confirmed that the portion from km 14.8 - km 16.0 was predominantly muskeg. There appears to be very little ground relief between close lake and the lake adjacent to the east. As water levels appear to be higher than what were present at the time airphotos were obtained, the marshy area is currently much larger. As this muskeg area appears to be permanent and deep, construction through this area would have been very costly. Also, there appears to be limited borrow material nearby due to the low lying nature of this section.

Muskeg Adjacent to Close Lake: Route 7 km 15.0

In the interest of cost and constructability, realignment is proposed to bypass these adverse conditions. See plans in Appendix C for plans illustrating the proposed alignment to bypass this section.

5.2.4 ROUTE 7 (km 22.0 – km 36.5)

In the CCE feasibility study this section of the route was described as undulated and low. There were several areas noted that contained washed boulder lags on surface. A location was chosen through a very small specific opening between two small lakes near km 29.5. This small opening will not permit the minimum setback distance dictated by MOE to be met.

Initial on site work verified the indicated terrain type through this section. There were a large number of areas noted where grades were significant, and large earth cuts/fills would be required to meet maximum grade requirements. There are also a number of low lying marshy areas noted located between higher landforms.

The location near CCE Route 7 km 29.5 was flown to determine a possible relocation around these two small water bodies. Water levels are currently higher than what is shown in photos. The two lakes shown on the plan have joined into one larger approximately 500 m long waterbody. As shown, CCE proposed Route 7 would proceed directly through the center of this lake.

The proposed location was designed to bypass the majority of these adverse conditions. The location proposed is on high ground that contains large streamlined drumlins. Several sections of these drumlins were walked, and shovel tests performed to determine material type. In all test locations material was proven to be sand, or silty sand with some small boulders visable near surface. Overall it appears that large portions of roadway in this section could be constructed with conventional ditch cut/fill type techniques.

See plans in Appendix C for details on the proposed alignment through this section.

5.2.5 ROUTE 7 (km 41.5 – km 43.0)

At this location CCE proposed Route 7 did not meet setback requirements where passing near an adjacent lake. During on site work, several items were determined that made a route adjustment beneficial. The proposed CCE location was located in primarily low wet areas with marshy materials noted. Several areas of rugged terrain undulations were found, some containing boulder lags on surface.

The proposed location contains terrain that mitigates the majority of adverse conditions. See plans in Appendix C for plans illustrating the proposed alignment.

5.2.6 ROUTE 7 (km 45.5 - km 46.5)

A topographic analysis was performed prior to on site work. During this office work it was determined that the area through this section is flat, and that there was the possibility of reducing the length of roadway required here.

During on site work it was determined that it would be possible to reduce the overall length of roadway here by altering geometrics, as overall the ground surface is quite flat. There is a large flowing muskeg that must be crossed in order to tie in with the nearby existing Cigar Lake road. Following the location proposed in CCE Route 7 would have necessitated a width of approximately 500 m for this muskeg crossing. A location was chosen near the existing powerline at km 48.4 where the muskeg is approx 150 m wide to cross, and the route altered to fit this crossing location.

Powerline Crossing Location

To reduce the overall length of this section and to assist in avoiding muskeg construction realignment is proposed through this section. See plans in Appendix C for plans illustrating the proposed alignment.

5.3 PROPOSED ALIGNMENT

Previous work on the route had resulted in a deliverable from JD Mollard and Associates and Clunie Consulting Engineers that were based on 1:60 000 airphotos, and suggested an alignment based solely on terrain. The goal of this commission was to evaluate this alignment in the field to determine the viability of that proposed route. In areas where improvements could be suggested based on site specific information, realignments were to be presented.

High resolution satellite imagery was not available at the time of commission. The required imagery was collected from the Saskatchewan Geospatial Imagery Collaborative at flysask.ca. This imagery was downloaded and orthocorrected, at a 1:5000 scale, so that it would be possible to export GPS information as well as view it in the correct location in AutoCad. Setting up the imagery this way also allows the exportation of points from the drawing to GPS units for future groundwork and material testing. Using this system it will also be possible to import an alignment directly into a RTK GPS unit and have the surveyors directly stake out a route, with a much decreased possibility of routing errors. It can also be anticipated that future information obtained by GPS will easily be able to be made into maps, etc for the Ministry of Environment or others.

Contours were obtained from NTS topographic maps and used to create vertical profiles. These profiles provide an overview of the vertical terrain along the route, and have sufficient accuracy to pinpoint areas where terrain may cause construction difficulty. Due to the limitations in accuracy of the contour model, detailed earthwork calculations should not be performed based on them. It was mentioned by Ministry staff that a LiDAR collection is planned for the route based on the alignment recommended in this report; this information would prove more suitable for a detailed vertical profile and earthwork calculations when complete.

Prior to doing on site work coordinates were input into handheld GPS units, and later into the helicopters GPS. Waypoints were created for significant points along the route, which allowed for later optimization of the route in the office. These waypoints used in conjunction with the orthocorrected imagery verify that the alignment proposed in this report is the one determined in the field as optimal.

This preliminary work has allowed for the avoidance of several areas that would have proved difficult and costly to construct through. The UTM coordinates obtained through this detailed horizontal design report can also be used to provide LiDAR suppliers a survey route.

Plans containing all geometric data, and curve information for the proposed route are included in Appendix D for review. A geometric analysis is included in Appendix B. For information purposes a plan comparing the alignment proposed by Clunie Consulting Engineers using airphotos with the current proposed alignment is also included for review in Appendix C. A GPS point file for use during the staking of the project location can be found in Appendix G.

5.4 WATER CROSSINGS

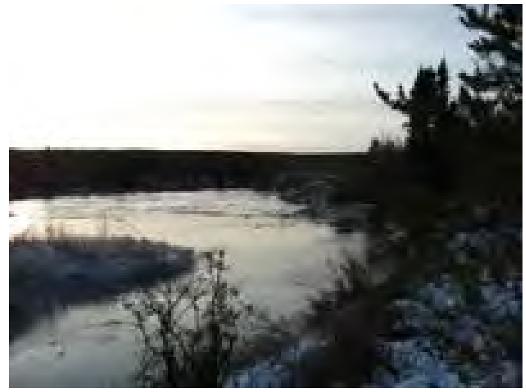
Water crossings play a significant role in choosing the location of any roadway. Large streams and river crossings can represent a large portion of the overall construction cost of a project. During the general route selection by CCE a route was proposed based on airphotos that attempted to minimize construction through swampy and marshy areas, as well as to minimize stream crossings.

During the preparation of this report the overall location was studied more closely in order to determine the most cost efficient route. Locations were chosen for each crossing in an attempt to minimize stream habitat destruction, and to effectively lower construction costs. Along the proposed route there were twelve water crossings identified during airphoto work and on site work. Due to the nature of the terrain there is the likelihood that, during detailed environmental work on site, several other small crossings may show up. This work would be best performed during spring melt. Table 5.1 provides a tabular view of crossings identified during this study.

Table 5-1 – Crossing Locations

Kilometre	Description	Likelihood of Fish Habitat	Proposed Insulation
0+850	Creek Crossing	Yes	Culvert
2+575	River Crossing	Yes	Culvert
7+925	Creek Crossing	No	Culvert
10+800	Creek Crossing	Yes	Culvert
13+600	Creek Crossing	Yes	Bridge
20+700-20+900	Swamp	No	Culvert
23+600	Drainage Run	No	Culvert
27+300	Creek Crossing	Yes	Culvert
31+400	Creek Crossing	No	Culvert
34+300	Creek Crossing	No	Culvert
35+500-35+700	Swamp	No	Culvert
46+800	Creek Crossing	No	Culvert

Crossing near McArthur tie in km 0.85



Crossing near 19.0

Of the twelve crossings only five had visible water flowing during the site visit, with the rest being short marshy areas or muskeg drainage. It is anticipated that culverts will handle drainage requirements for all of the crossings along the route, with the exception of the May Creek crossing discussed in section 5.5.4.

5.5 PROPOSED ROUTE – CHALLENGING CONSTRUCTION AREAS

Several areas were pinpointed along the proposed alignment that will likely prove challenging during construction. These areas are detailed in the following sections.

5.5.1 Area near to McArthur River Airstrip (km 3.0 – km 4.4)

The proposed route comes within 175 m of the existing McArthur River Airstrip, at the closest point. This airstrip is used on a regular basis during shift change and client movement to and from the mine. Cameco may have concerns with the route proximity to the airstrip, depending on the types and volume of roadway traffic. The route passes near the edge of the current Cameco surface lease in this area, but does not enter it at any point. See Appendix D for detail.

5.5.2 Proximity to Lake (km 6.0)

At this location there is a large drumlin located to the west of the route, and a lake to the east. There is a relatively small corridor in which a roadway would fit between these two landforms. Initial steps in determining a location included identifying minimum setbacks from the lake, then altering the alignment in order to create the most constructible configuration possible. An alignment is presented that meets MOE requirements for setback, as well as follows sections of constructible terrain.

Geometrics through this section meet Ministry standards as shown. If realignments are proposed in the field during construction, it will be difficult to modify one element of this section of alignment without causing a substandard geometric condition.

5.5.3 Existing Temporary Bridge Crossing (km 7.9)

There is an existing temporary bridge at this location on the proposed route. Due to the rugged terrain in the surrounding area the existing crossing location is the most desirable point for crossing this creek. During the site visit there was no water flow observed at the crossing. It appears that drainage here comes predominantly from flow down the sideslope of the adjacent drumlin. It is anticipated that large culverts should be acceptable to accommodate flows at this crossing, although further investigation is required to determine the actual depth of water and flow rates at this location.

During construction of the all weather roadway it will be necessary to decommission the existing crossing. The owner should be contacted well in advance to ensure no operational issues arise from the removal of the structure.

5.5.4 May Creek Crossing (km 13.6)

At km 13.6 on the proposed route the roadway crosses May Creek. May Creek connects Close Lake and the Yalowega Lake systems. The creek varies in width from 10 m to approximately 50 m. Due to the size and anticipated flow in this system, any route chosen to cross this creek would require a bridge.

Cost is a major consideration in choosing the location of any large drainage structure. The location illustrated in this report was found in the field to be the optimal location for a bridge crossing the May Creek. Relative to waterbodies nearby, it is 600 m from Close Lake, and 250 m from Yalowega Lake. Office location work and field work identified several options for a crossing. The creek was flown during field review and the site was confirmed to be most desirable for a crossing.

The width observed at the proposed crossing location during on site work was determined to be approximately 10 m. As the water level was low, due to time of year, it is anticipated that the river full flow width will be slightly higher than what was observed during the site visit. As such it is estimated that a bridge span of approximately 10 m to 15 m will be required. The observed stream substrate consists of sand and boulders. Gradient is quite minimal, with placid type flow toward Yalowega Lake observed during the site visit.

May Creek Crossing Aerial

Creek Substrate

Field work will be required at this crossing location to assist in confirming fish assessments and flow conditions. Ministry of Environment and DFO will require submissions prior to undertaking any work at this location. The picture below illustrates the optimal identified crossing location.

May Creel Crossing Location

5.5.5 Route Proximity to Adjacent Lakes

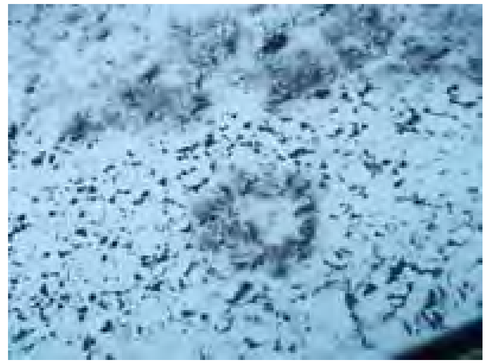
The types of terrain and landforms encountered along the proposed route are typical of what can be expected in this area of northern Saskatchewan. There are several lakes, rivers and/or creek crossings that must be considered along and adjacent to the route. The Ministry of Environment requirement is to maintain a minimum 90 m setback from major water bodies. This setback is met for all 19 lakes, that are within 500 m of the proposed right of way, on the proposed route.

This route also has several areas containing muskeg and swampy sections. While setting the alignment these areas were avoided, or minimized in order to assist in controlling overall construction costs.

5.5.6 Drainage Channel (km 31.5)

A glacial drainage channel was encountered at km 31.5 on the proposed route. This channel was dry during field inspections with rock substrate, indicating a large, rapid movement of water through this area at some point in history. This area is relatively short, and could not be avoided as it joins two large low sections on the boundary of a large streamlined drumlin

Channel near km 31.5



Channel Substrate

As approach gradients were observed to be much steeper than the Ministry 8% maximum, significant cuts will be required at approaches, and likely large fills required through the streambed. The channel will most likely require a large culvert installation due to the width and anticipated fill requirements. Following the LiDAR survey, proposed by the Ministry, it will be possible to obtain detailed quantity calculations for this area.

5.5.7 Powerline Crossing (km 1.2 & km 48.5)

The route crosses the SPC (Saskatchewan Power Corporation) 138Kv transmission line at two locations on the proposed route. The first is the crossing at km 1.2; this line feeds the McArthur River Mine Site. The second conflict is with the line feeding Cigar Lake Mine Site at km 48.5. Both crossings intersect the transmission line at approximately 90˚. The proposed crossing points are not anticipated to cause significant conflict with the SPC line. SPC personnel should be contacted and line movement, if required, will be done prior to route opening to public traffic.

5.6 TIE IN LOCATIONS

5.6.1 Junction with McArthur River Mine Access Road

A location for a tie in point with the existing McArthur River Mine access was determined during office work, and later verified during on site work. The location chosen is situated in a tangent section 90° to the existing access approximately 3.6 km's east of the McArthur River Mine Site. This location appears to provide adequate sight distance in both directions along the McArthur River Mine Access Road.

The proposed location of the junction can be viewed on plans in Appendix D

This proposed tie in junction will necessitate a stop condition when accessing the existing access road to McArthur River Mines Site. A tangent distance of 860 m is provided prior to the stop condition at the McArthur road, which meets Ministry requirements.

One of the major considerations in the location of the tie in with the McArthur Access is the proximity to surrounding lakes. To the east of the proposed route there are water bodies, the required setback was adhered to, which governed the location of the tie in.

McArthur River Tie In Location – Looking toward Mine Site

5.6.2 Junction with Cigar Lake Mine Access Road

The proposed route proceeds overland for 51.71 km and terminates at the Cigar Lake Mine Access road. This junction is located approximately 8.0 km south of the Cigar Lake Mine Site, and approximately 1.0 km south of the Cigar Lake Gate. The new alignment will tie in to the Cigar Lake Road acting as the new through movement. Traffic approaching from the Cigar Lake Mine Site will be forced into a stop condition prior to accessing the new roadway. The remaining Cigar Lake access road will require realignment to intersect the proposed road at 90°.

The area near this tie in location contains several areas of difficult terrain containing steep grades and marshy areas. A location was chosen for the tie in considering these terrain issues as well as the location of the existing Cameco security gate to the north of the proposed tie in.

Cigar Lake Tie In Location

Cigar Lake Tie In looking west

Details on the proposed alignment can be viewed on plans in Appendix D.

6 Public Consultation

The Ministry has consulted with Cameco and Areva personnel to indentify the intent to construct a route connecting the two mine access roads. Cameco personnel have stated that no roadways are to be constructed within their current mine sites. They have also indicated that if necessary they would allow construction of the connector roadway through areas currently within their mine lease boundaries.

Consultation with local residents has not been conducted, due to the low habitants and no communities in the immediate area of the proposed route.

7 Preliminary Cost Estimate

A preliminary cost estimate for the construction of the roadway has been completed and is included in Appendix F. This estimate is based on best available knowledge at the time of this report and it is anticipated that during detailed design further information will be made available that will allow fine tuning of the estimate.

A bypass around the Key Lake mine site will also be constructed as a portion of this contract. At the advice of Ministry staff costs pertaining to its construction are also included in the estimate.

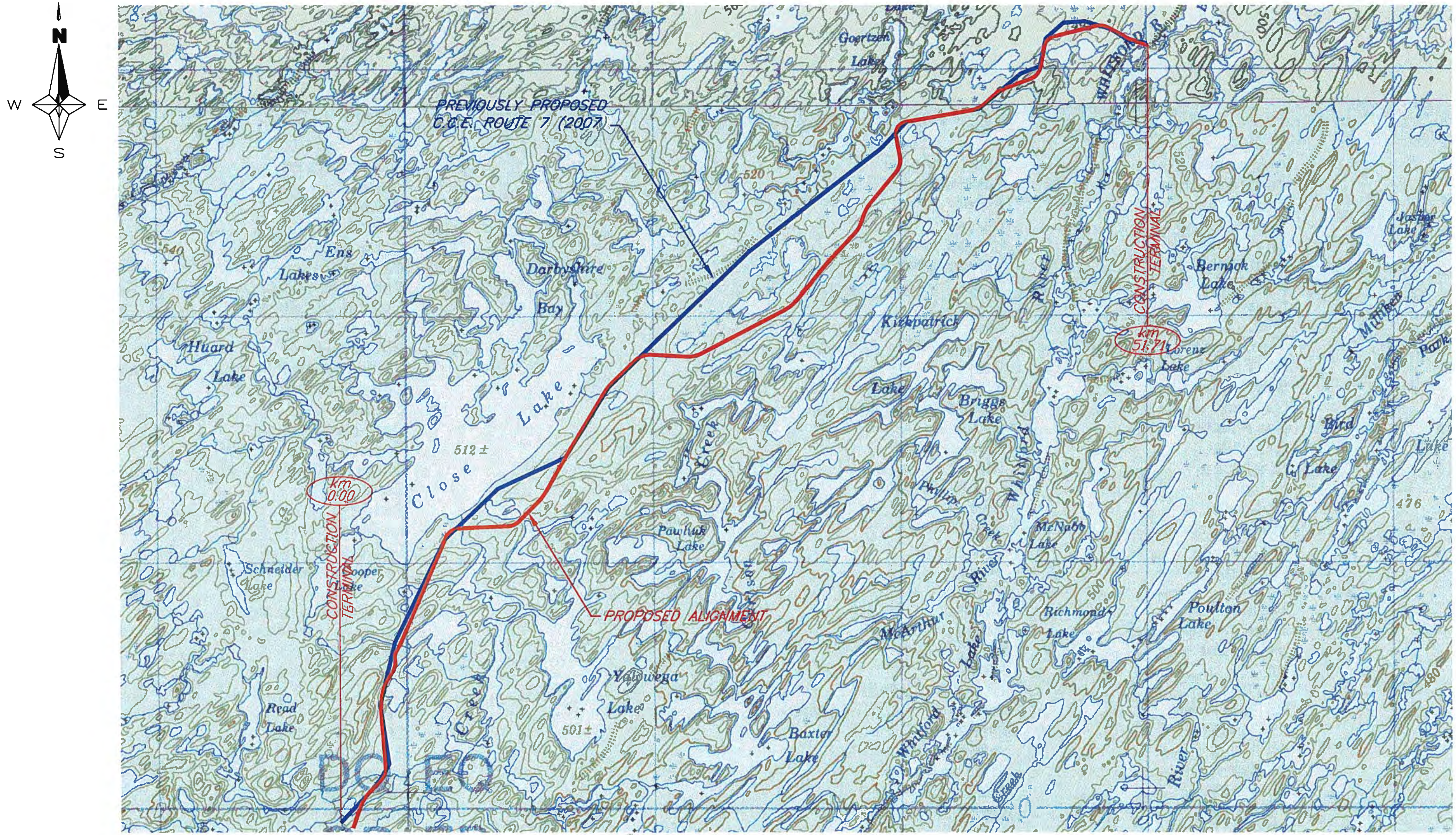
The total estimated project cost in 2010 dollars which includes engineering, materials, and construction is $38,570,000, which works out to $682,000/km.

Note that this estimate has been prepared based on 2010 pricing in the construction industry, and as there will likely be several years prior to commencement overall project costs will need to be revisited prior to work being tendered.

8 Recommendation

This detailed location report provides a safe, efficient, and constructible option to connect the access roads between McArthur River and Cigar Lake Mine Sites. Plans illustrating the location of the proposed roadway are shown in Appendix D. Approval of the detailed location by the ADM, Operations is recommended.

A Appendix A - Location Plan



Saskatchewan Ministry of Highways and Infrastructure	LOCATION PLAN HIGHWAY NO 914 km 0.00 TO km 51.71				
DRAWN BY: M. WALTERS	DATE: 09/11/25	CS: 914-04		TAB NO: 3-1	
DESIGNED BY: J. HORAN	DATE: 09/11/25	CONTRACT:		SHEET: 1 OF 1	

B Appendix B - Geometric Data

Proposed Horizontal Alignment

Curve Data							Distance Between Curves				Curve Radius			
							Existing		Required					
													SP 20200	
No.	Delta	LT	RT	BC	Middle of Curve	EC	Opposite Dir. (m)	Same Dir. (m)	Opposite Dir. (m)	Same Dir. (m)	Design (m)	Minimum (m) SP 20210 e(max)=0.08m/m	Min (m)	Max (m)
1	25 01 02		X	+860.175		1+515.125					1500		1000	2100
							770.50		180					
2	46 01 56	X		2+285.627		2+888.189					750		525	1100
							1053.98			600				
3	2 43 15	X		3+942.170		4+060.894					2500		1800	3500
								1165.84	180					
4	36 52 01		X	5+226.737		6+513.635					2000		1100	2200
							419.68		180					
5	37 22 02	X		6+933.318		7+259.409					500		700	1500
							189.80		180					
6	36 55 38		X	7+449.212		7+690.900					375		700	1500
							183.34		180					
7	7 27 36	X		7+874.243		8+108.609					1800		1800	4200
							4668.57		180					
8	64 04 46		X	12+777.178		13+448.215					600		375	800
							2006.92		180					
9	42 32 58	X		15+455.134		15+900.712					600		600	1300

Deflections

No.	Delta	LT	RT	Points of Intersection Station	Comments

Bridges

No.	Station	Comments

Proposed Horizontal Alignment

Curve Data							Distance Between Curves				Curve Radius			
							Existing		Required					
No.	Delta	LT	RT	BC	Middle of Curve	EC	Opposite Dir. (m)	Same Dir. (m)	Opposite Dir. (m)	Same Dir. (m)	Design (m)	Minimum (m) SP 20210 e(max)=0.08m/m	SP 20200 Min (m)	SP 20200 Max (m)
10	15 09 28	X		16+990.947		17+599.420					2300		1800	3100
							4556.52		180					
11	15 17 29		X	22+155.935		22+769.770					2300		1800	3100
								1281.98		600				
12	46 50 19		X	24+051.753		24+705.742					800		550	1200
							1458.59		180					
13	30 45 27	X		26+164.328		26+808.513					1200		850	1800
								3785.98		600				
14	23 11 17	X		30+594.497		31+242.032					1600		1100	2200
								3587.69		600				
15	23 02 13	X		34+829.720		35+312.203					1200		1100	2200
							420.99		180					
16	20 06 43		X	35+733.191		36+189.517					1300		1300	2600
							1623.37		180					
17	51 09 16	X		37+812.882		38+527.134					800		500	1000
							824.13		180					
18	91 27 18		X	39+351.265		40+149.359					500		350	600

Deflections

No.	Delta	LT	RT	Points of Intersection Station	Comments

Bridges

No.	Station	Comments

Proposed Horizontal Alignment

Curve Data							Distance Between Curves				Curve Radius			
							Existing		Required					
													SP 20200	
No.	Delta	LT	RT	BC	Middle of Curve	EC	Opposite Dir. (m)	Same Dir. (m)	Opposite Dir. (m)	Same Dir. (m)	Design (m)	Minimum (m) SP 20210 e(max)=0.08m/m	Min (m)	Max (m)
19	32 34 22	X		42+854.616		43+423.119					1000		800	1700
							553.01		180					
20	21 57 52		X	43+976.125		44+512.817					1400		1200	2300
							1089.57		180					
21	58 43 50	X		45+602.385		46+217.410					600		425	900
							874.59		180					
22	65 10 26		X	47+092.002		47+660.752					500		375	775
								1723.17		600				
23	42 47 38		X	49+383.918		49+981.433					800		600	1200
							780.78		180					
24	10 40 48	X		50+762.215		51+092.967					1800		1800	3800

Deflections

No.	Delta	LT	RT	Points of Intersection Station	Comments

Bridges

No.	Station	Comments

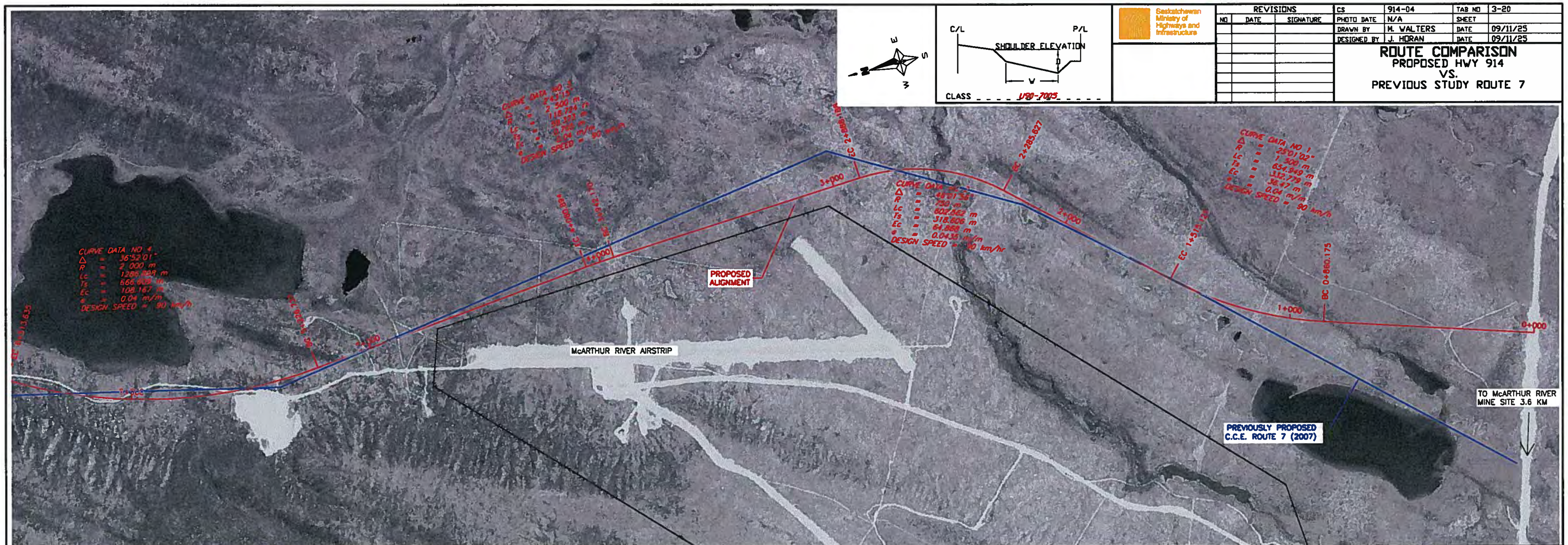
C Appendix C - Route 7 Deviations

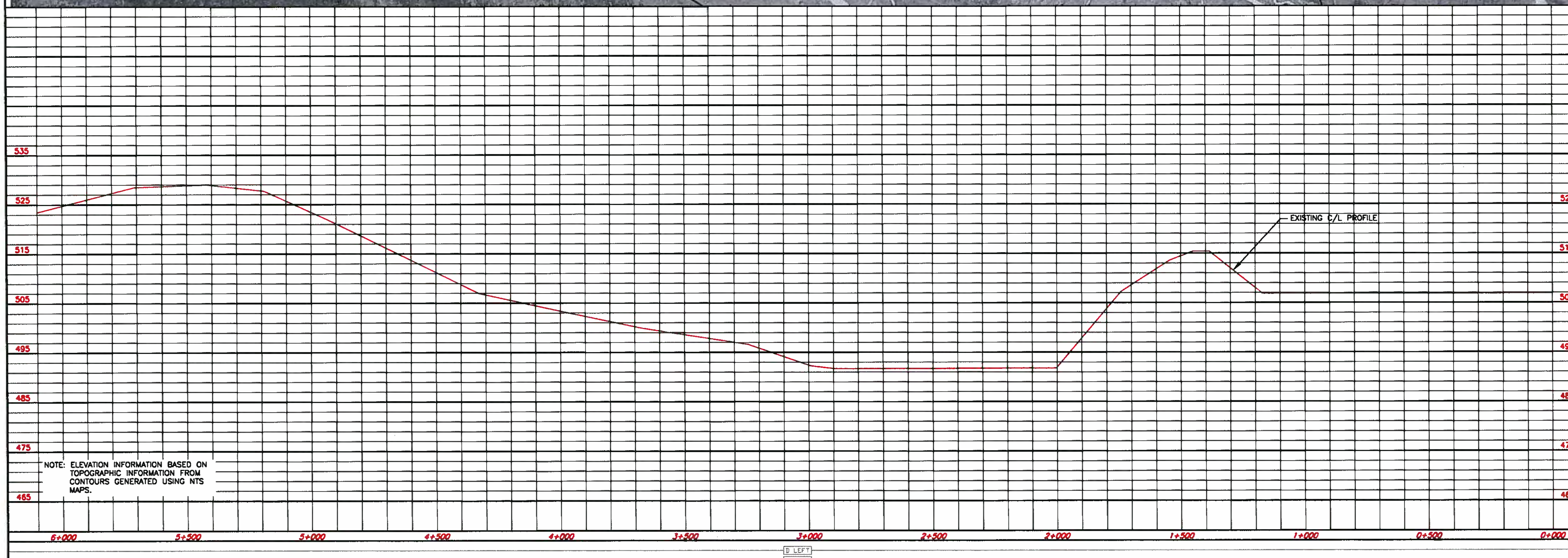
CS	914-04	TAB NO	3-20
PHOTO DATE	N/A	SHEET	
DRAWN BY	M. WALTERS	DATE	09/11/25
DESIGNED BY	J. HORAN	DATE	09/11/25

Saskatchewan Ministry of Highways and Infrastructure

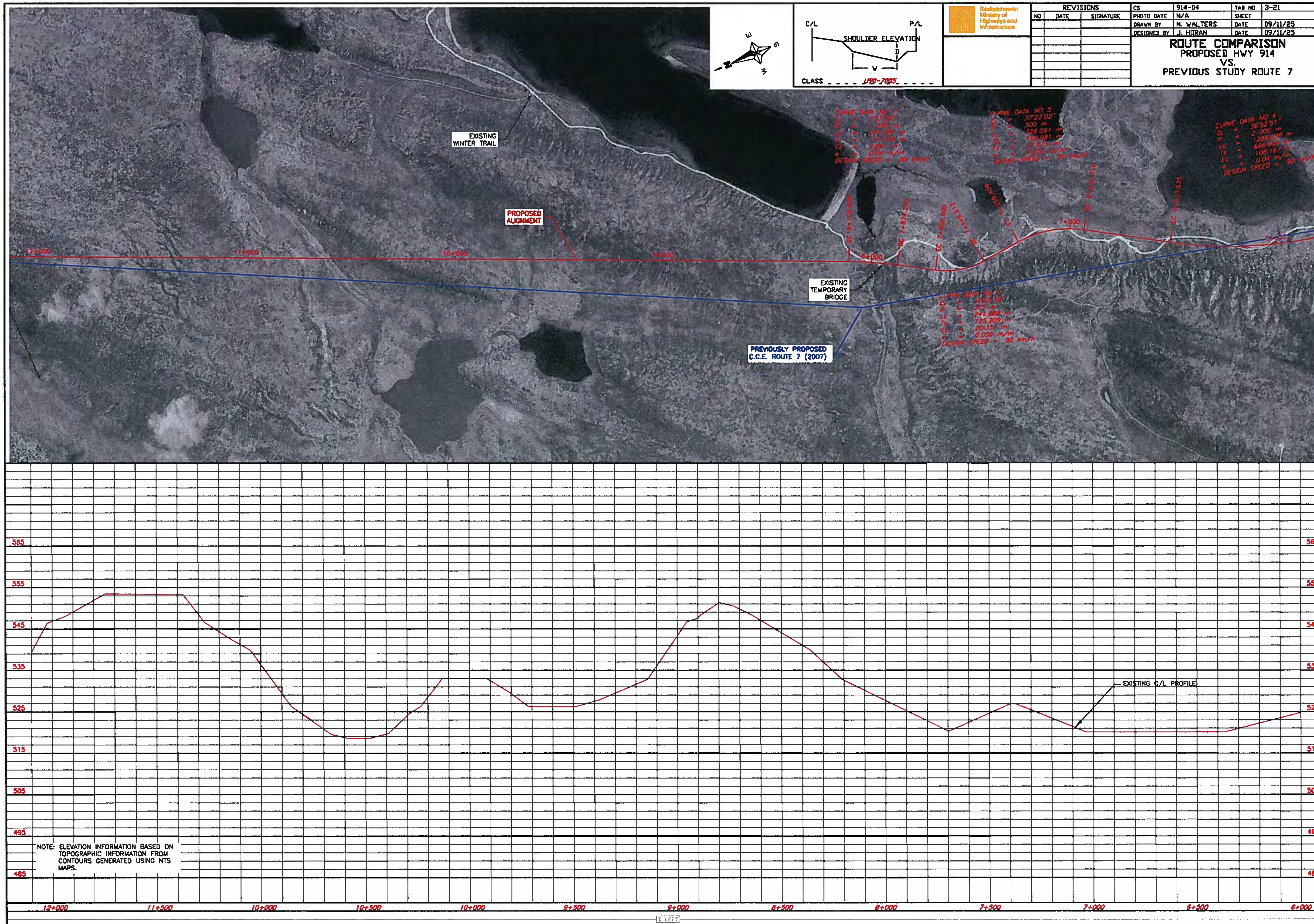
REVISIONS		
NO	DATE	SIGNATURE

ROUTE COMPARISON
PROPOSED HWY 914 VS. PREVIOUS STUDY ROUTE 7

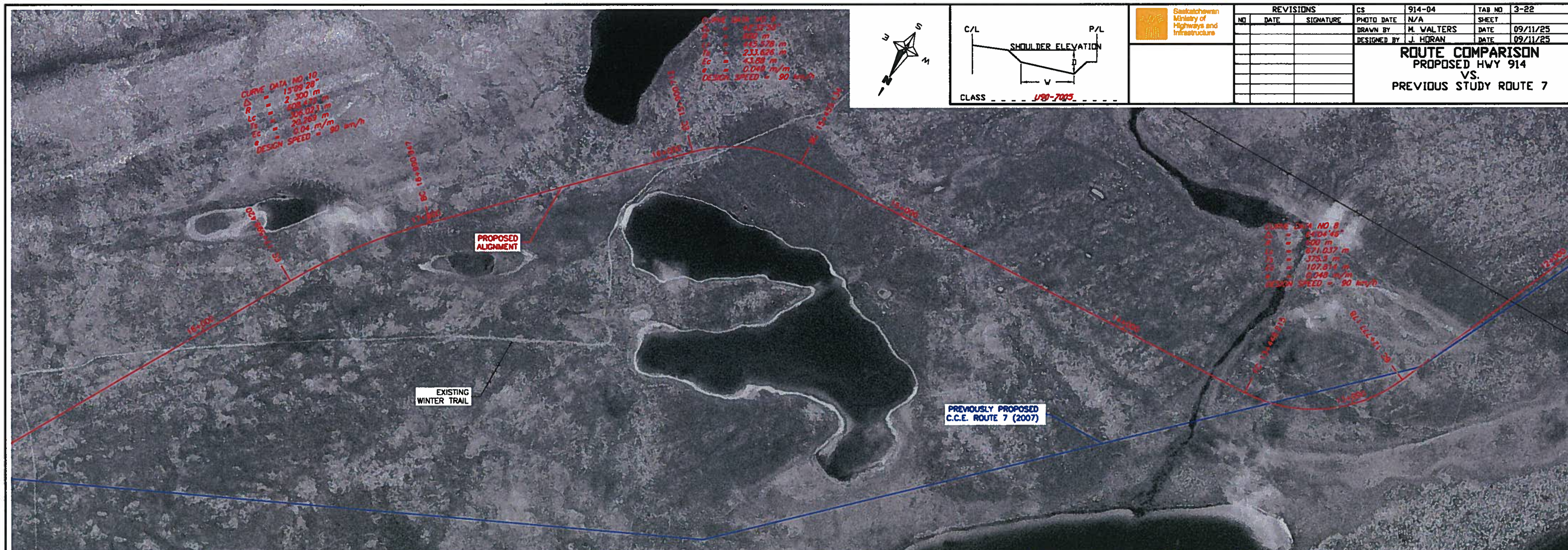




NOTE: ELEVATION INFORMATION BASED ON TOPOGRAPHIC INFORMATION FROM CONTOURS GENERATED USING NTS MAPS.



ROUTE COMPARISON
PROPOSED HWY 914
VS.
PREVIOUS STUDY ROUTE 7
CS 914-04
TAB NO 3-21
PHOTO DATE N/A
SHEET
DRAWN BY M. WALTERS
DATE 09/11/25
DESIGNED BY J. HORAN
DATE 09/11/25
REVISIONS
NO
DATE
SIGNATURE
Saskatchewan Ministry of Highways and Infrastructure
C/L
P/L
SHOULDER ELEVATION
CLASS
EXISTING WINTER TRAIL
PROPOSED ALIGNMENT
EXISTING TEMPORARY BRIDGE
PREVIOUSLY PROPOSED C.C.E. ROUTE 7 (2007)
CURVE DATA NO 5
CURVE DATA NO 4
EXISTING C/L PROFILE
NOTE: ELEVATION INFORMATION BASED ON TOPOGRAPHIC INFORMATION FROM CONTOURS GENERATED USING NTS MAPS.
565
555
545
535
525
515
505
495
485
12+000
11+500
10+000
10+500
10+000
9+500
9+000
8+500
8+000
7+500
7+000
6+500
6+000

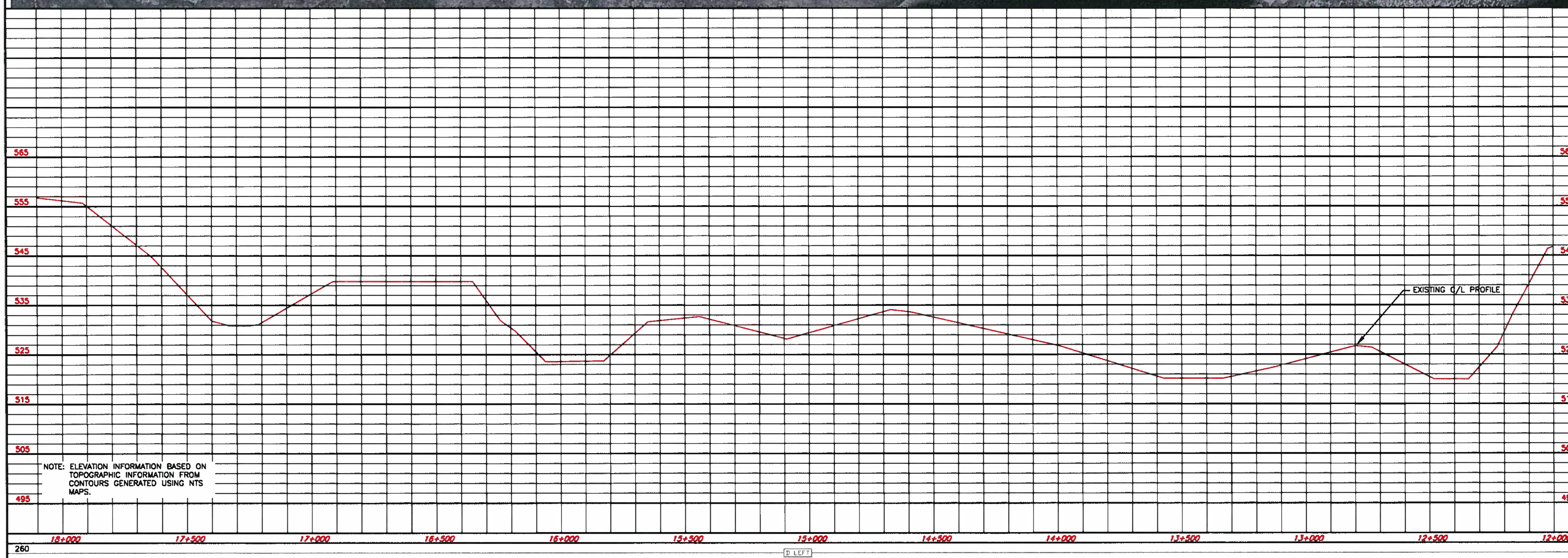


CS	914-04	TAB NO	3-22
PHOTO DATE	N/A	SHEET	
DRAWN BY	M. WALTERS	DATE	09/11/25
DESIGNED BY	J. HORAN	DATE	09/11/25

Saskatchewan Ministry of Highways and Infrastructure

REVISIONS		
NO	DATE	SIGNATURE

ROUTE COMPARISON
PROPOSED HWY 914 VS. PREVIOUS STUDY ROUTE 7



NOTE: ELEVATION INFORMATION BASED ON TOPOGRAPHIC INFORMATION FROM CONTOURS GENERATED USING NTS MAPS.

CS	914-04	TAB NO	3-23
PHOTO DATE	N/A	SHEET	
DRAWN BY	M. WALTERS	DATE	09/11/25
DESIGNED BY	J. HORAN	DATE	09/11/25

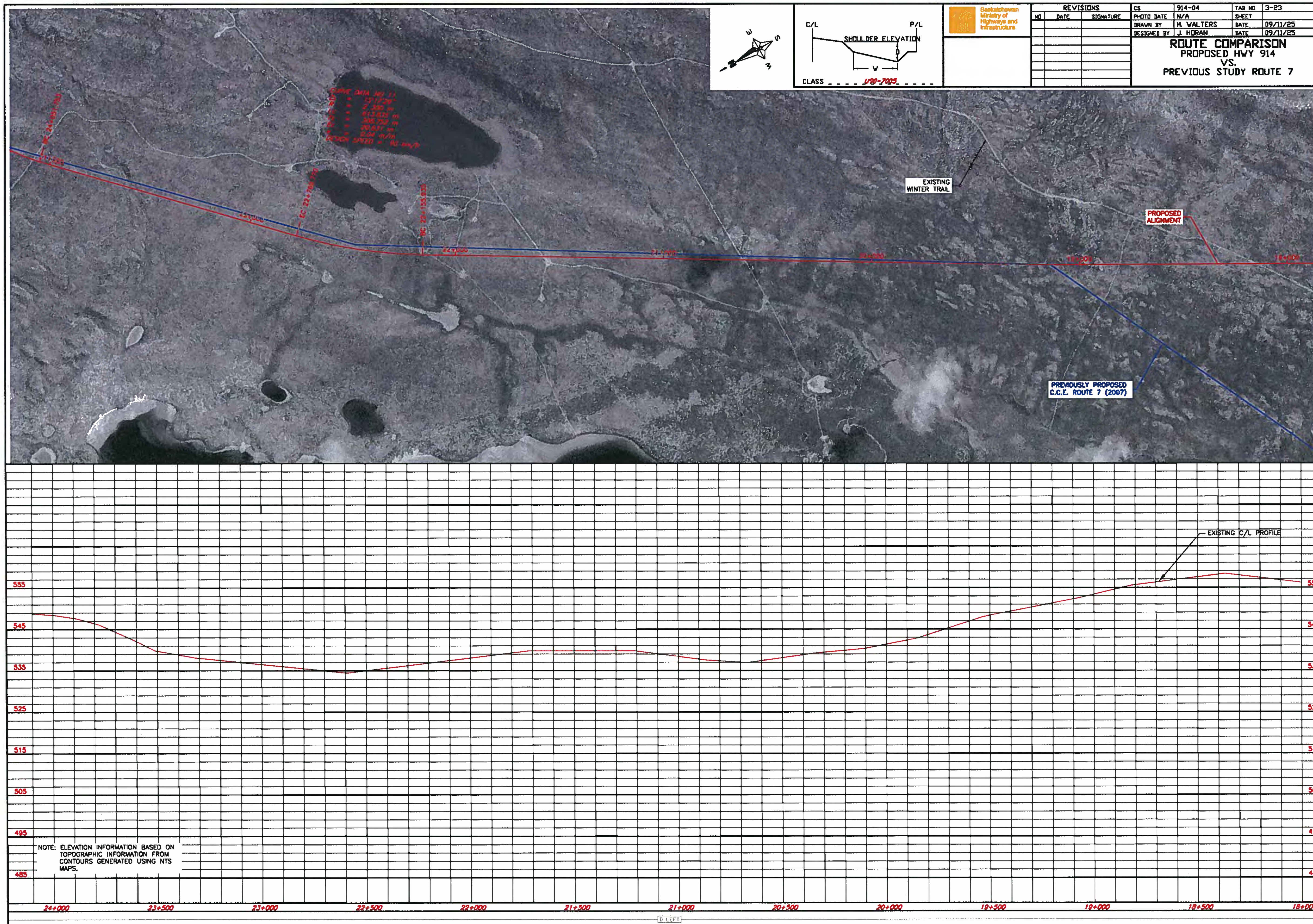
ROUTE COMPARISON
PROPOSED HWY 914 VS. PREVIOUS STUDY ROUTE 7

Saskatchewan Ministry of Highways and Infrastructure

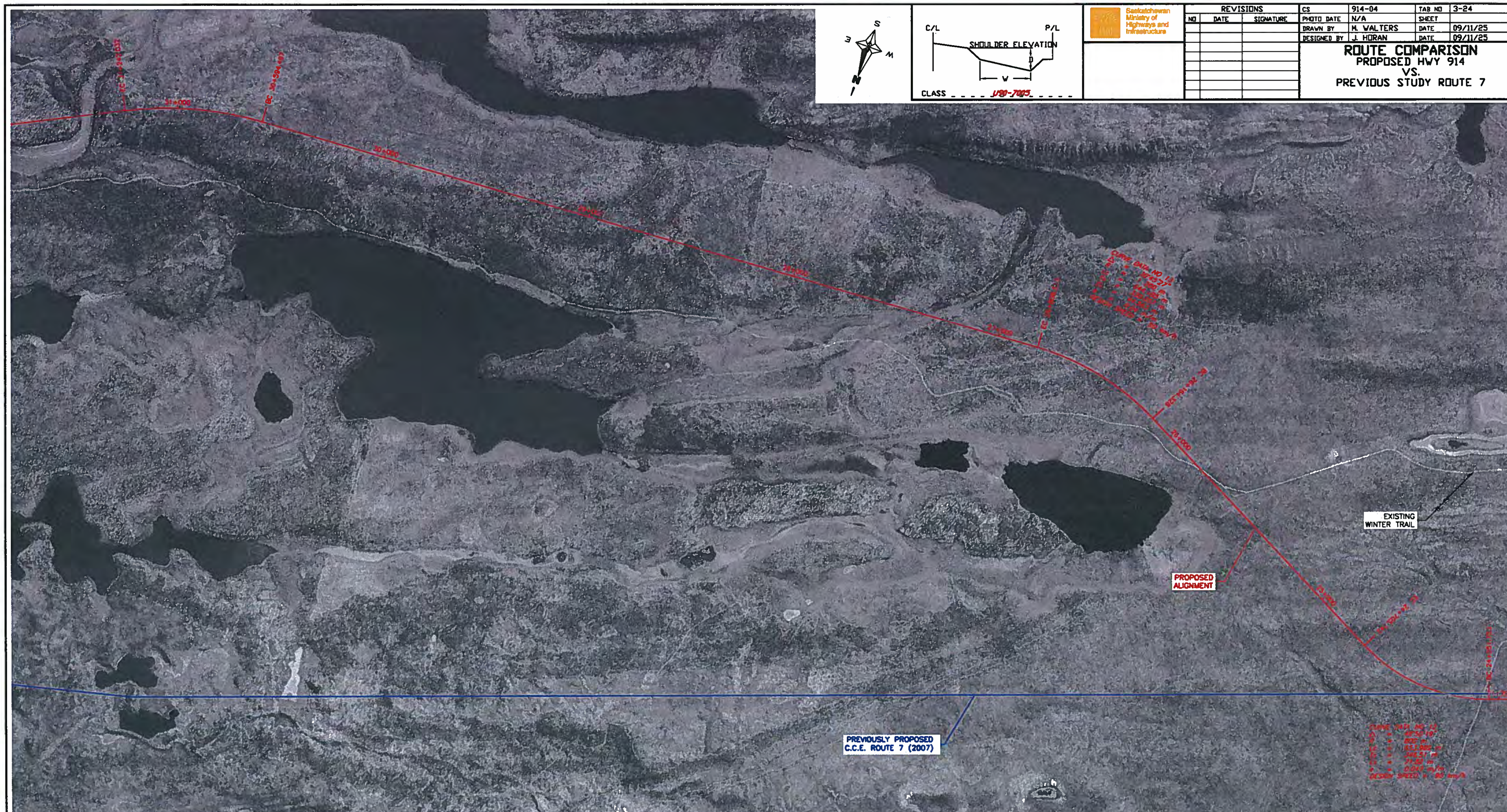
REVISIONS		
NO	DATE	SIGNATURE

C/L P/L SHOULDER ELEVATION D W

CLASS U90-7005



NOTE: ELEVATION INFORMATION BASED ON TOPOGRAPHIC INFORMATION FROM CONTOURS GENERATED USING NTS MAPS.



C/L
P/L
SHOULDER ELEVATION
D
W

CLASS _ _ _ _ _ U80-7005 _ _ _ _ _

Saskatchewan Ministry of Highways and Infrastructure

REVISIONS		
NO	DATE	SIGNATURE

CS	914-04	TAB NO	3-24
PHOTO DATE	N/A	SHEET	
DRAWN BY	M. WALTERS	DATE	09/11/25
DESIGNED BY	J. HORAN	DATE	09/11/25

ROUTE COMPARISON
PROPOSED HWY 914 VS. PREVIOUS STUDY ROUTE 7

30+000 29+500 29+000 28+500 28+000 27+500 27+000 26+500 26+000 25+500 25+000 24+500 24+000

D LEFT
W LEFT

CS	914-04	TAB NO	3-25
PHOTO DATE	N/A	SHEET	
DRAWN BY	M. WALTERS	DATE	09/11/25
DESIGNED BY	J. HORAN	DATE	09/11/25

ROUTE COMPARISON
PROPOSED HWY 914
VS.
PREVIOUS STUDY ROUTE 7

Saskatchewan Ministry of Highways and Infrastructure

REVISIONS

NO	DATE	SIGNATURE

C/L P/L SHOULDER ELEVATION D W

CLASS U90-7005

NOTE: ELEVATION INFORMATION BASED ON TOPOGRAPHIC INFORMATION FROM CONTOURS GENERATED USING NTS MAPS.

36+000 35+500 35+000 34+500 34+000 33+500 33+000 32+500 32+000 31+500 31+000 30+500 30+000

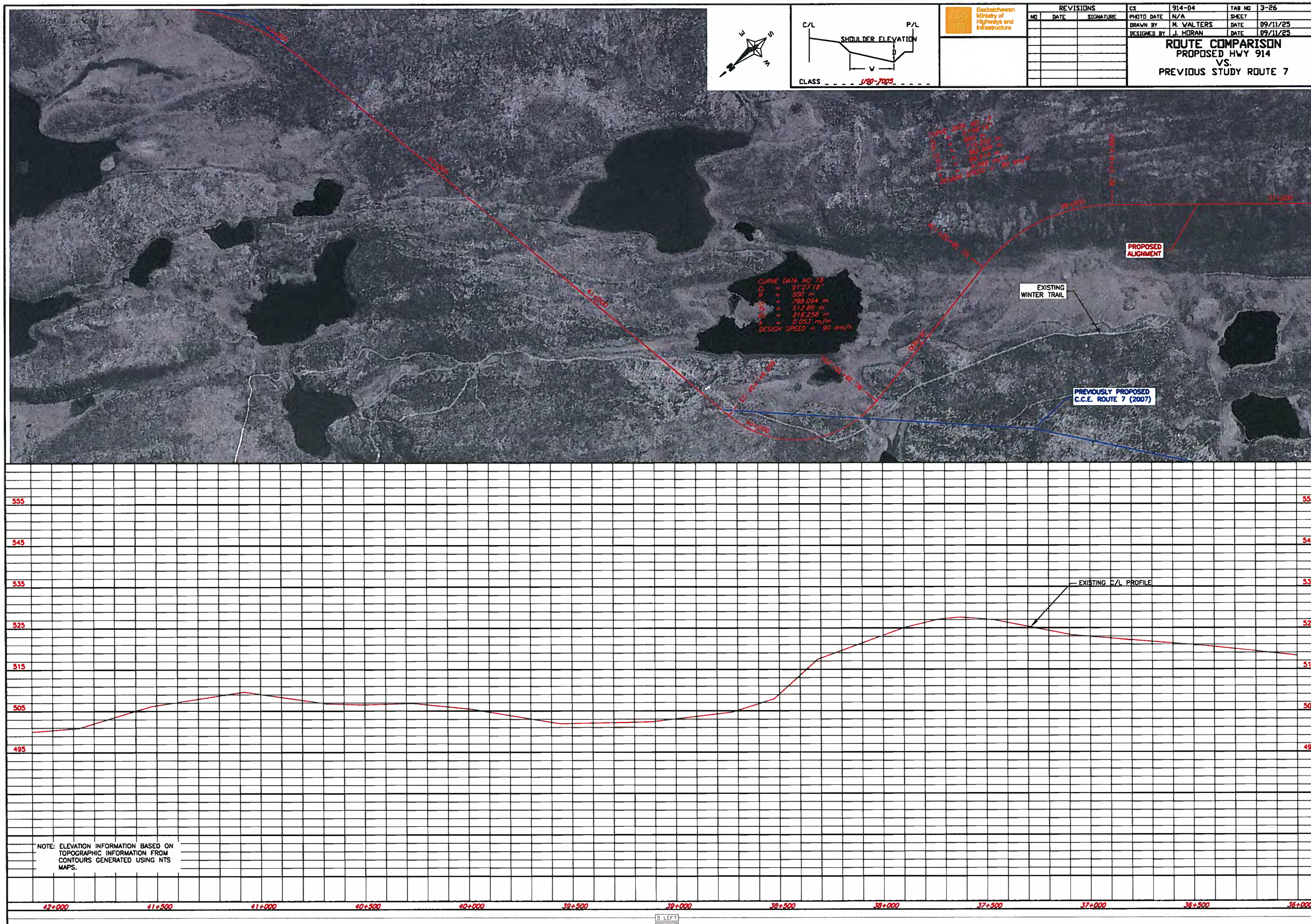
D LEFT
W LEFT

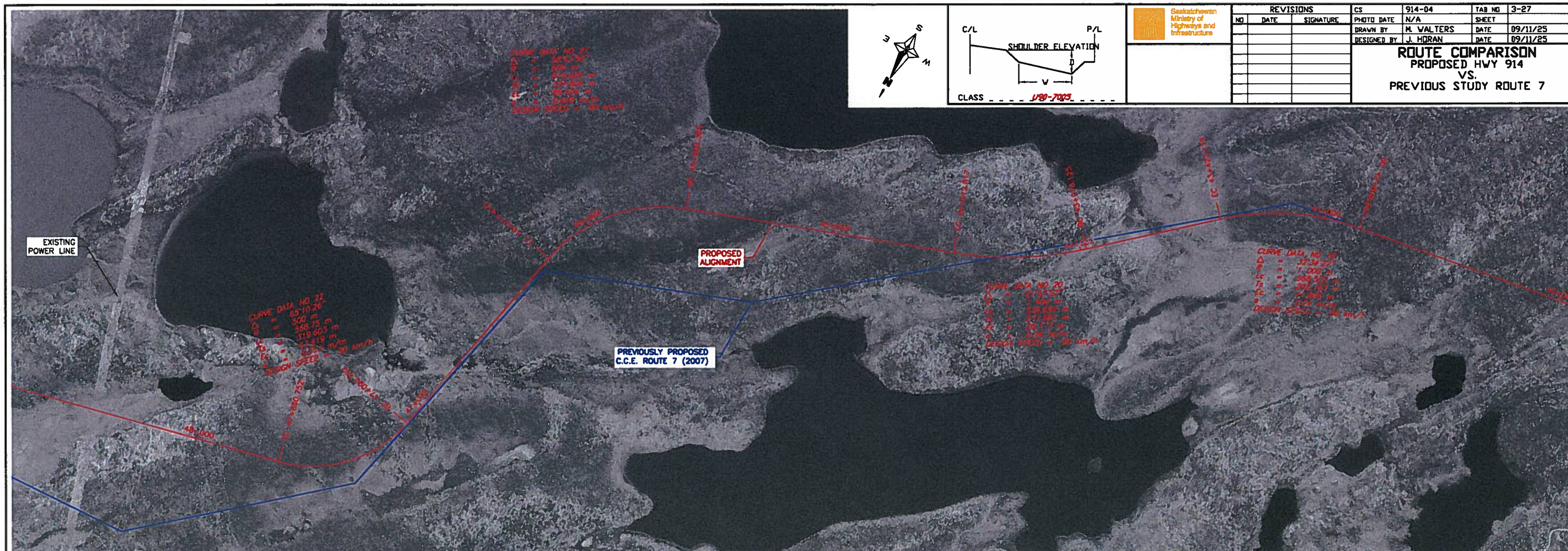
CS	914-04	TAB NO	3-26
PHOTO DATE	N/A	SHEET	
DRAWN BY	M. WALTERS	DATE	09/11/25
DESIGNED BY	J. HORAN	DATE	09/11/25

ROUTE COMPARISON
PROPOSED HWY 914 VS. PREVIOUS STUDY ROUTE 7

Saskatchewan Ministry of Highways and Infrastructure

REVISIONS		
NO	DATE	SIGNATURE





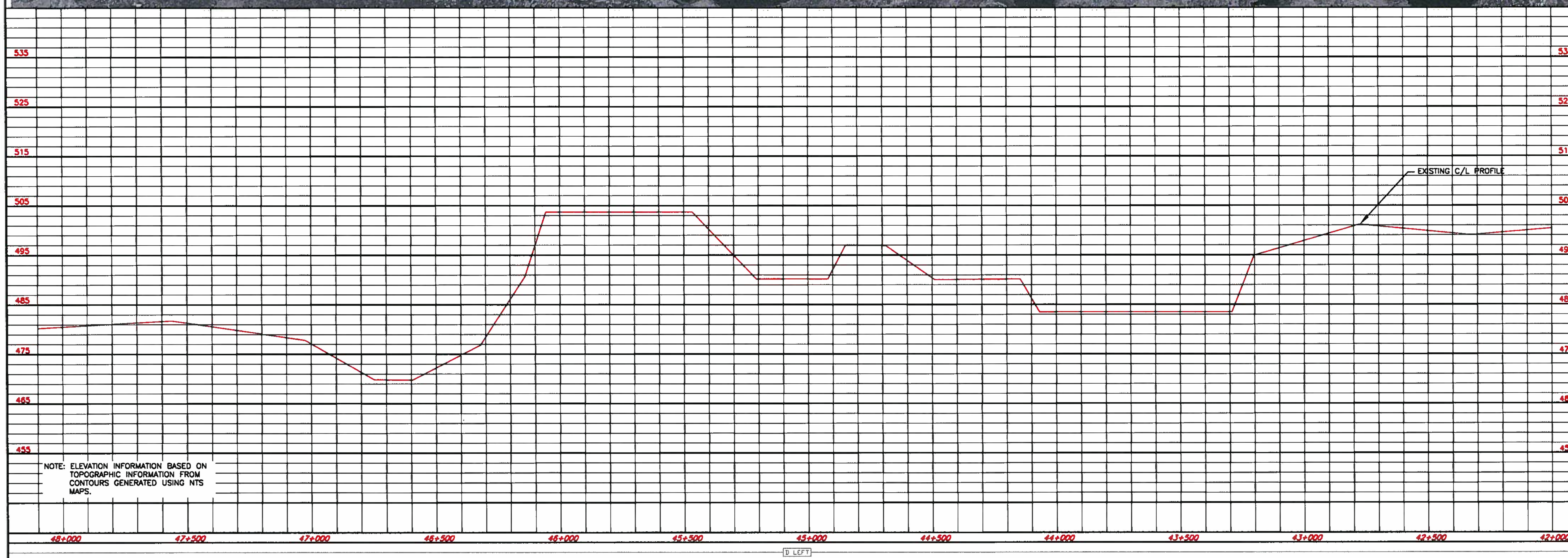
C/L
P/L
SHOULDER ELEVATION
D
W
CLASS U90-7005

Saskatchewan Ministry of Highways and Infrastructure

REVISIONS		
NO	DATE	SIGNATURE

CS	914-04	TAB NO	3-27
PHOTO DATE	N/A	SHEET	
DRAWN BY	M. WALTERS	DATE	09/11/25
DESIGNED BY	J. HORAN	DATE	09/11/25

ROUTE COMPARISON
PROPOSED HWY 914 VS. PREVIOUS STUDY ROUTE 7



CS	914-04	TAB NO	3-28
PHOTO DATE	N/A	SHEET	
DRAWN BY	M. WALTERS	DATE	09/11/25
DESIGNED BY	J. HORAN	DATE	09/11/25

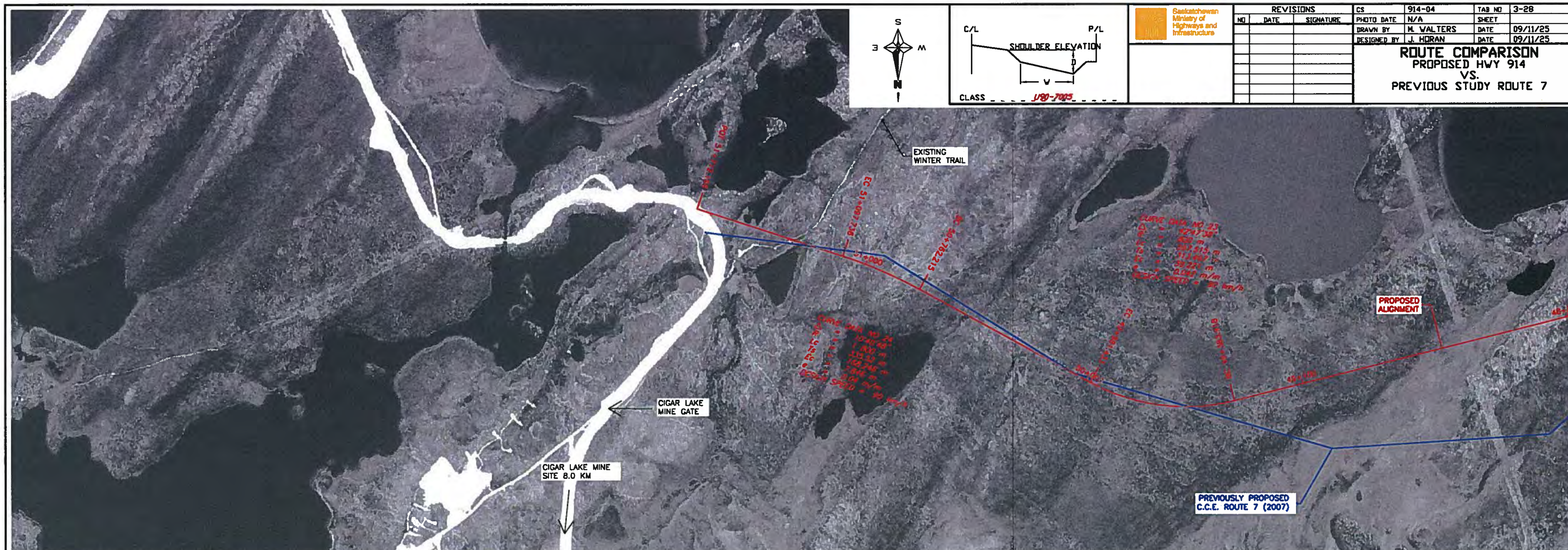
ROUTE COMPARISON
PROPOSED HWY 914
VS.
PREVIOUS STUDY ROUTE 7

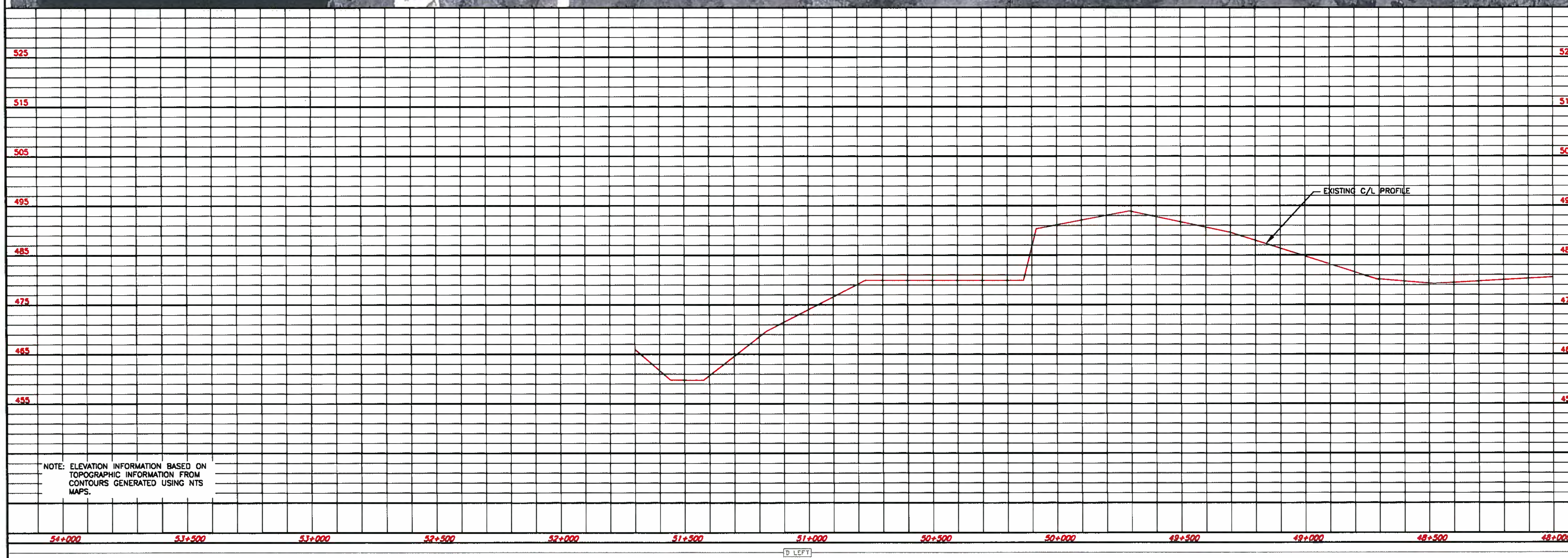
Saskatchewan Ministry of Highways and Infrastructure

REVISIONS		
NO	DATE	SIGNATURE

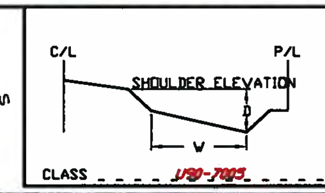
C/L P/L SHOULDER ELEVATION D V

CLASS UBO-7005





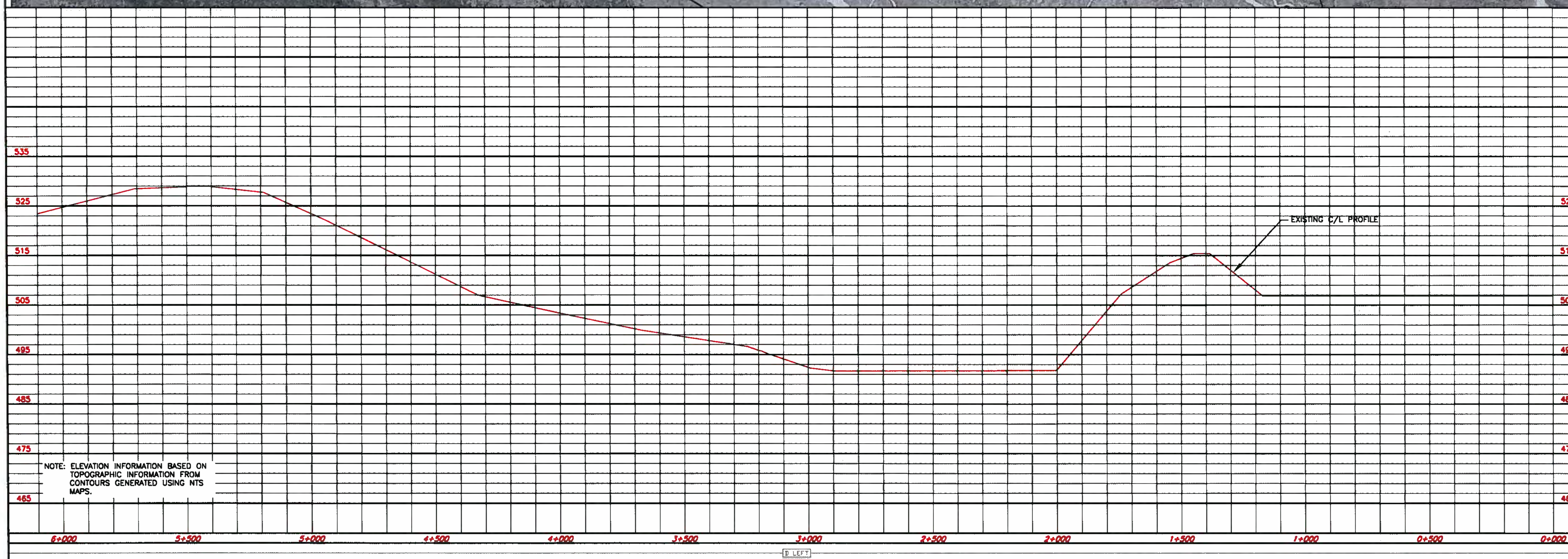
D Appendix D - Proposed Alignment Plans



REVISIONS			CS	914-04	TAB NO 3-1
NO	DATE	SIGNATURE	PHOTO DATE	N/A	SHEET
			DRAWN BY	M. WALTERS	DATE 09/11/25
			DESIGNED BY	J. HORAN	DATE 09/11/25

Saskatchewan Ministry of Highways and Infrastructure

DETAILED LOCATION
HWY 914
McARTHUR RIVER MINE SITE TO CIGAR LAKE MINE SITE



Saskatchewan Ministry of Highways and Infrastructure

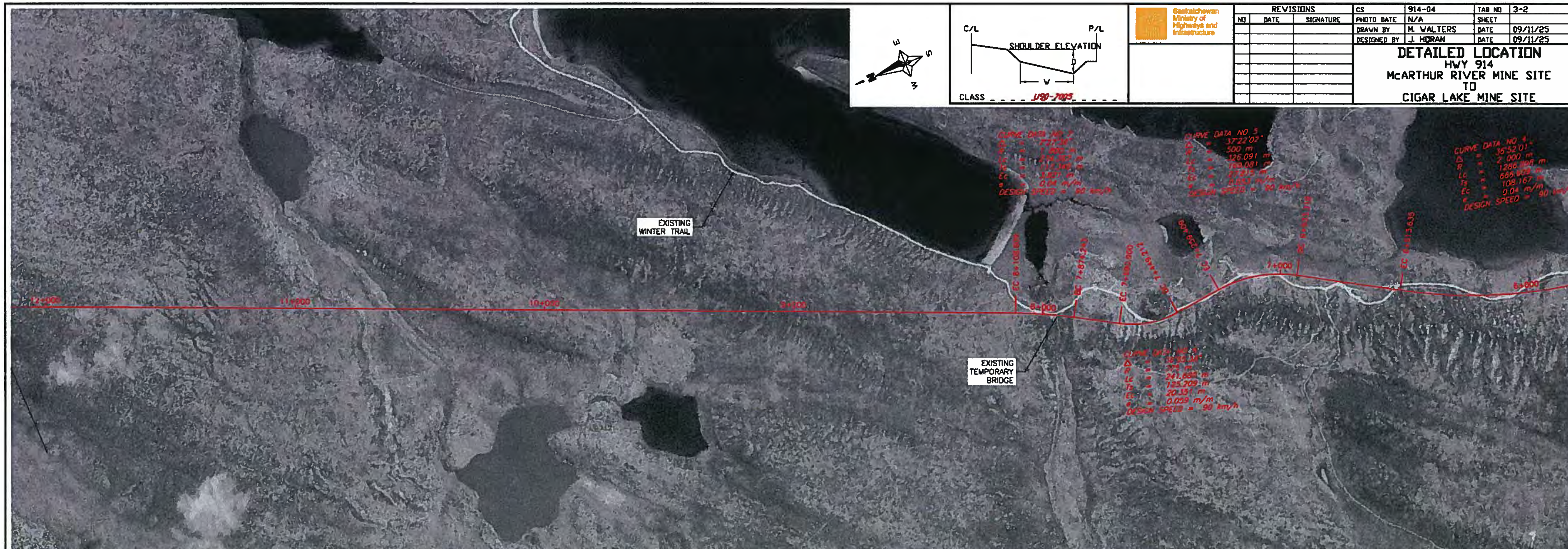
DETAILED LOCATION
HWY 914
McARTHUR RIVER MINE SITE TO CIGAR LAKE MINE SITE

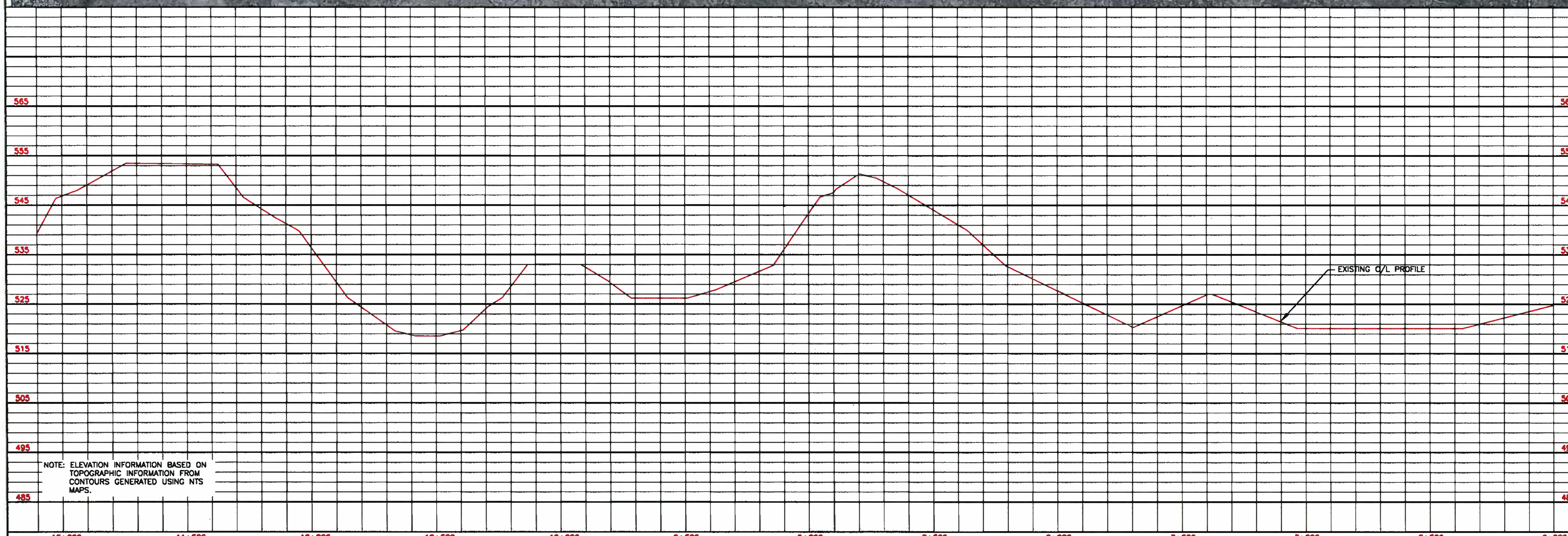
CS	914-04	TAB NO	3-2
PHOTO DATE	N/A	SHEET	
DRAWN BY	M. WALTERS	DATE	09/11/25
DESIGNED BY	J. HORAN	DATE	09/11/25

REVISIONS		
NO	DATE	SIGNATURE

C/L — SHOULDER ELEVATION — P/L — D — W

CLASS U80-7005





CS	914-04	TAB NO	3-3
PHOTO DATE	N/A	SHEET	
DRAWN BY	M. WALTERS	DATE	09/11/25
DESIGNED BY	J. HORAN	DATE	09/11/25

REVISIONS

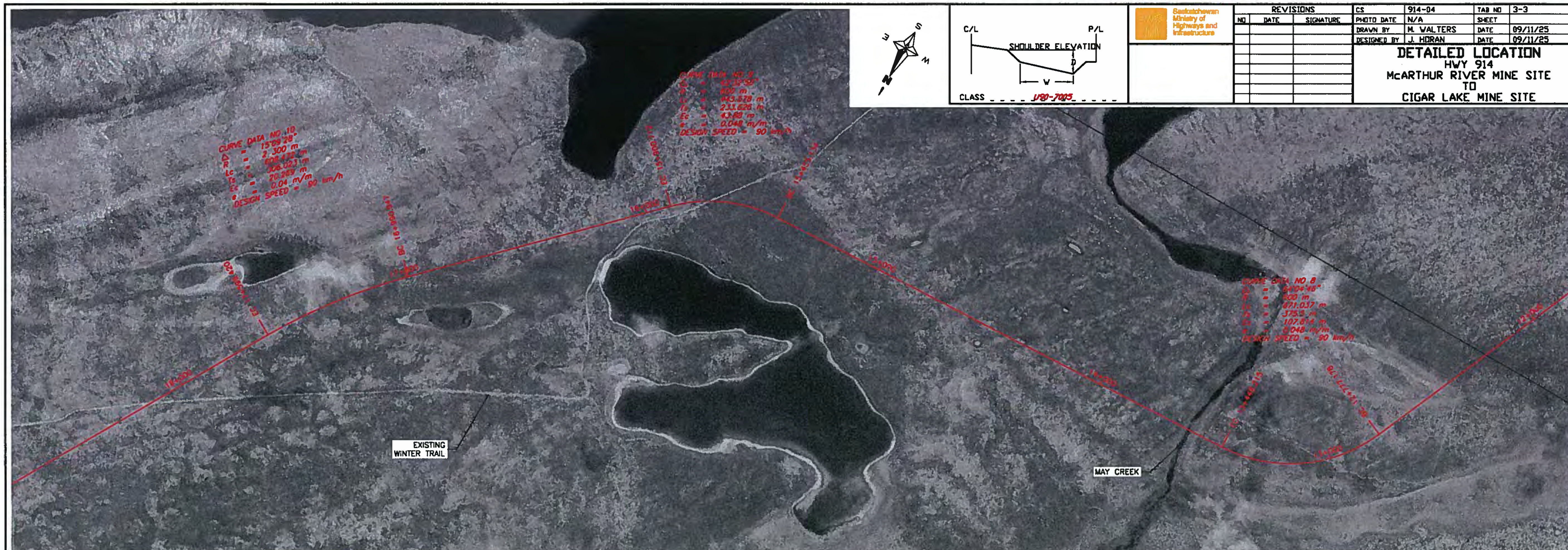
NO	DATE	SIGNATURE

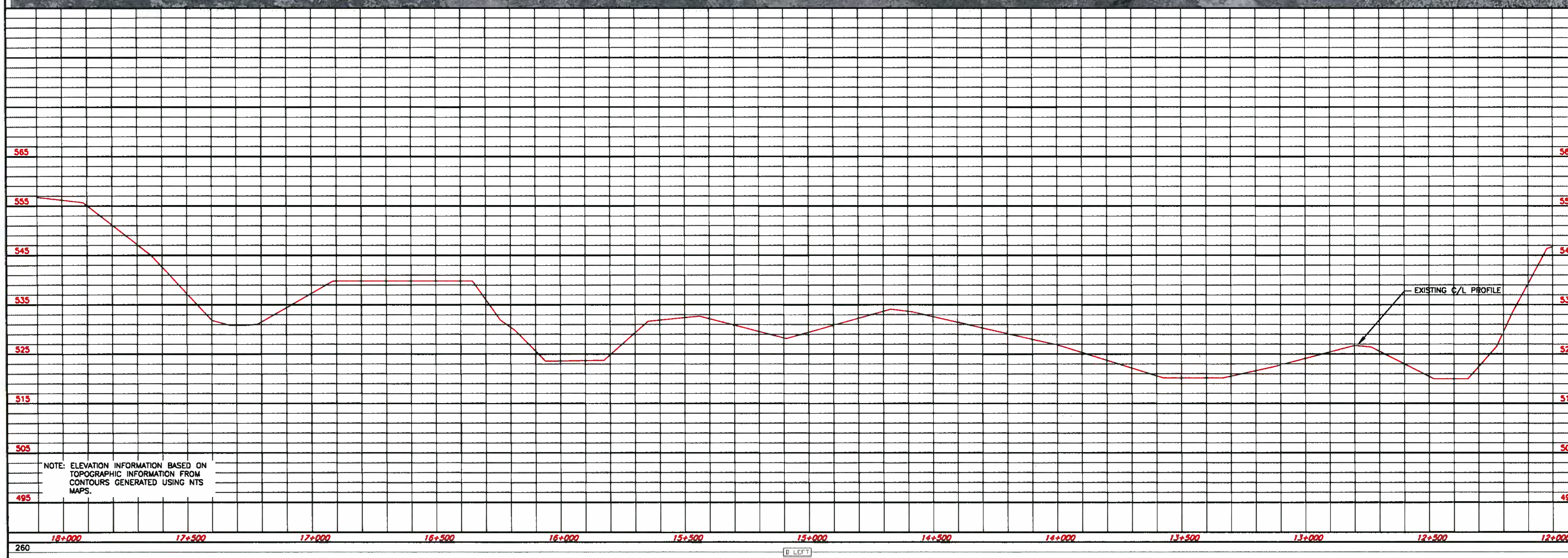
Saskatchewan Ministry of Highways and Infrastructure

DETAILED LOCATION
HWY 914
McARTHUR RIVER MINE SITE
TO
CIGAR LAKE MINE SITE

C/L — P/L — SHOULDER ELEVATION — D — W

CLASS U80-7005





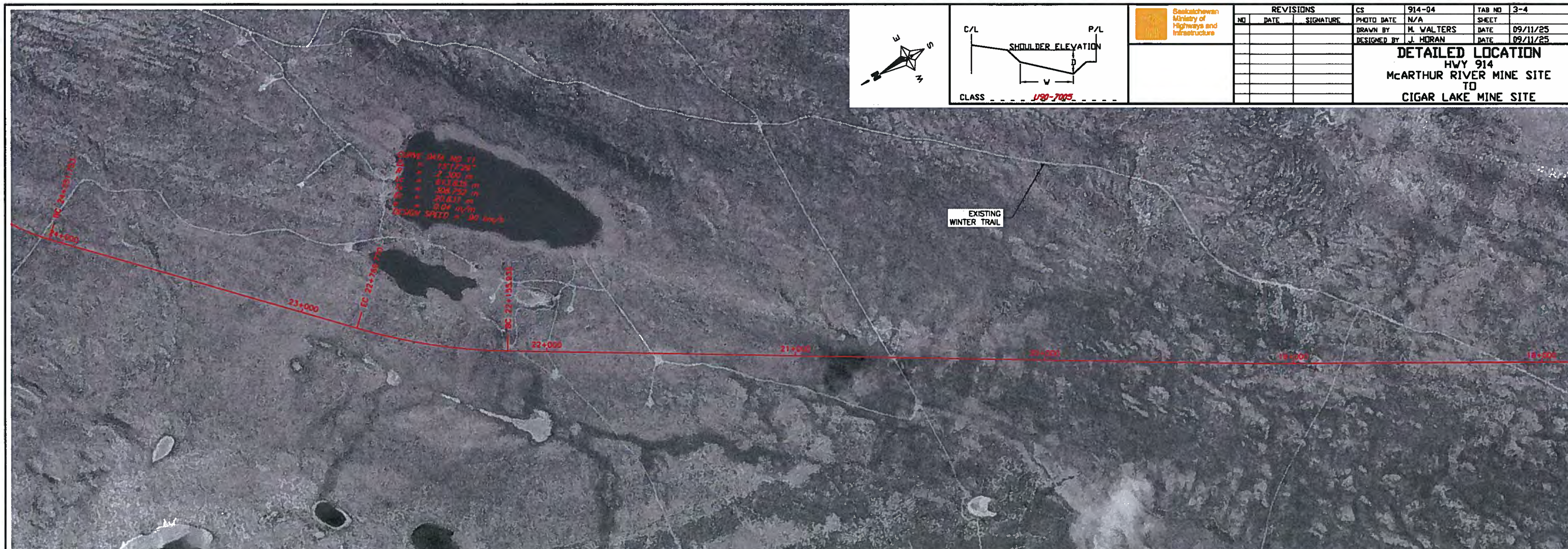
REVISIONS			CS	914-04	TAB NO	3-4
NO	DATE	SIGNATURE	PHOTO DATE	N/A	SHEET	
			DRAWN BY	M. WALTERS	DATE	09/11/25
			DESIGNED BY	J. HORAN	DATE	09/11/25

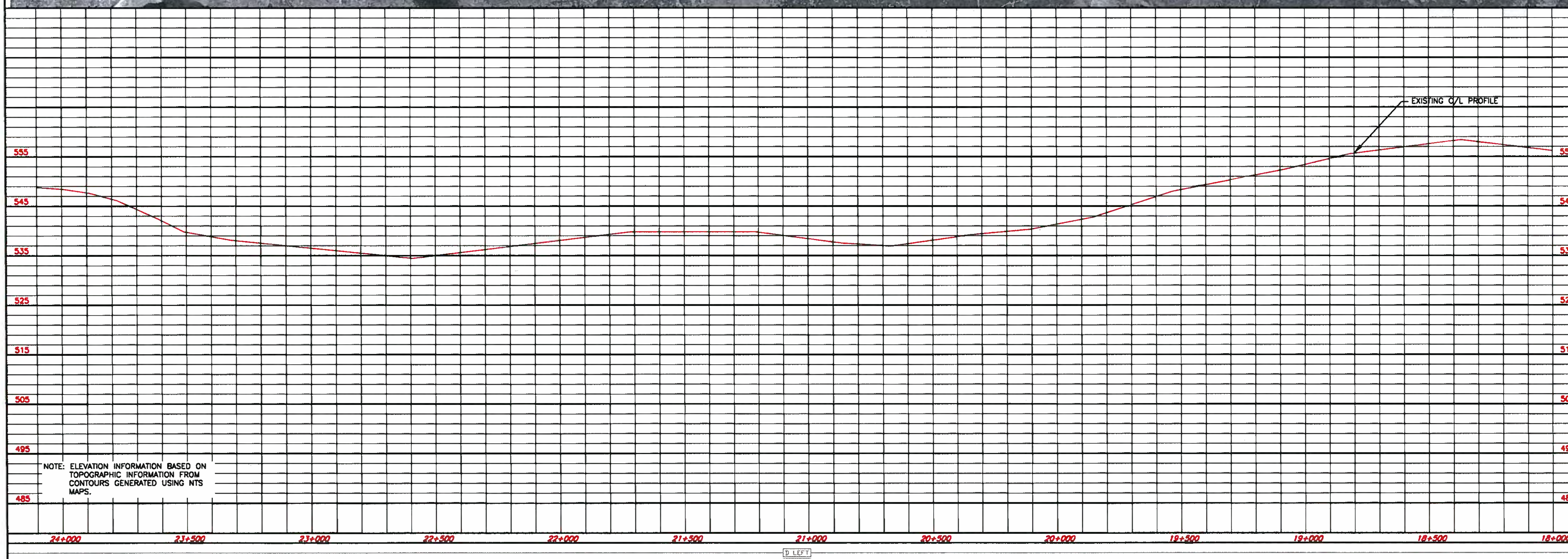
Saskatchewan Ministry of Highways and Infrastructure

DETAILED LOCATION
HWY 914
McARTHUR RIVER MINE SITE TO CIGAR LAKE MINE SITE

C/L P/L SHOULDER ELEVATION D W

CLASS U90-7005



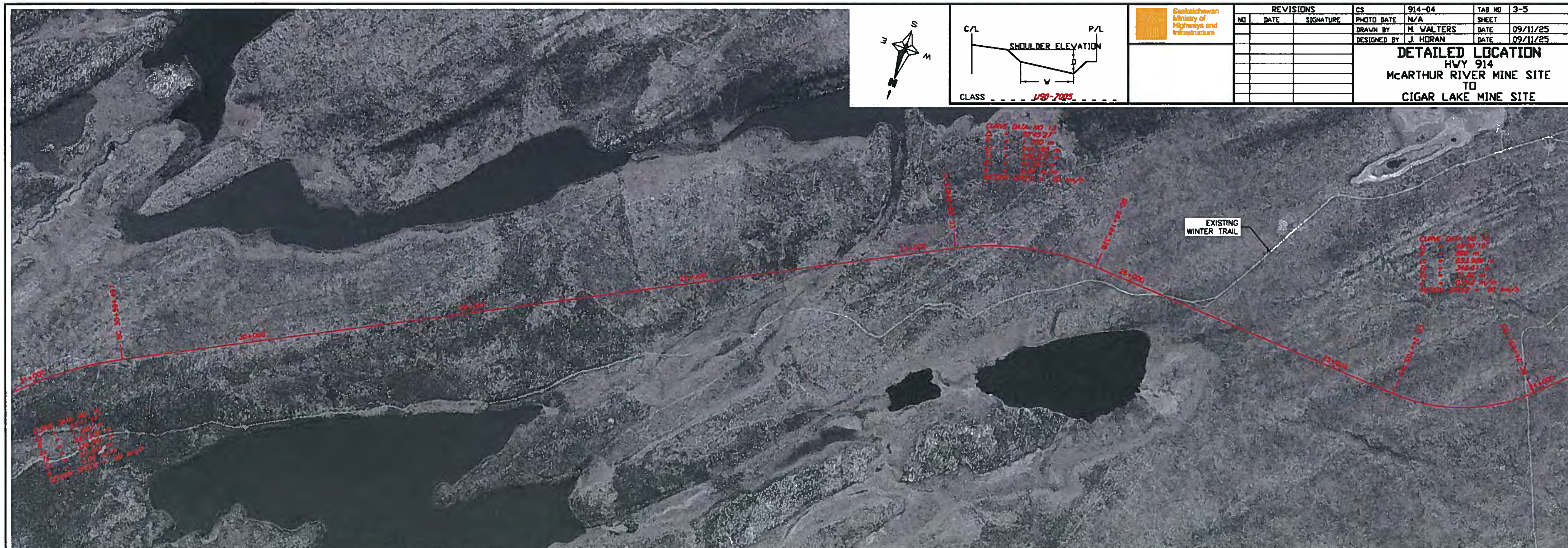


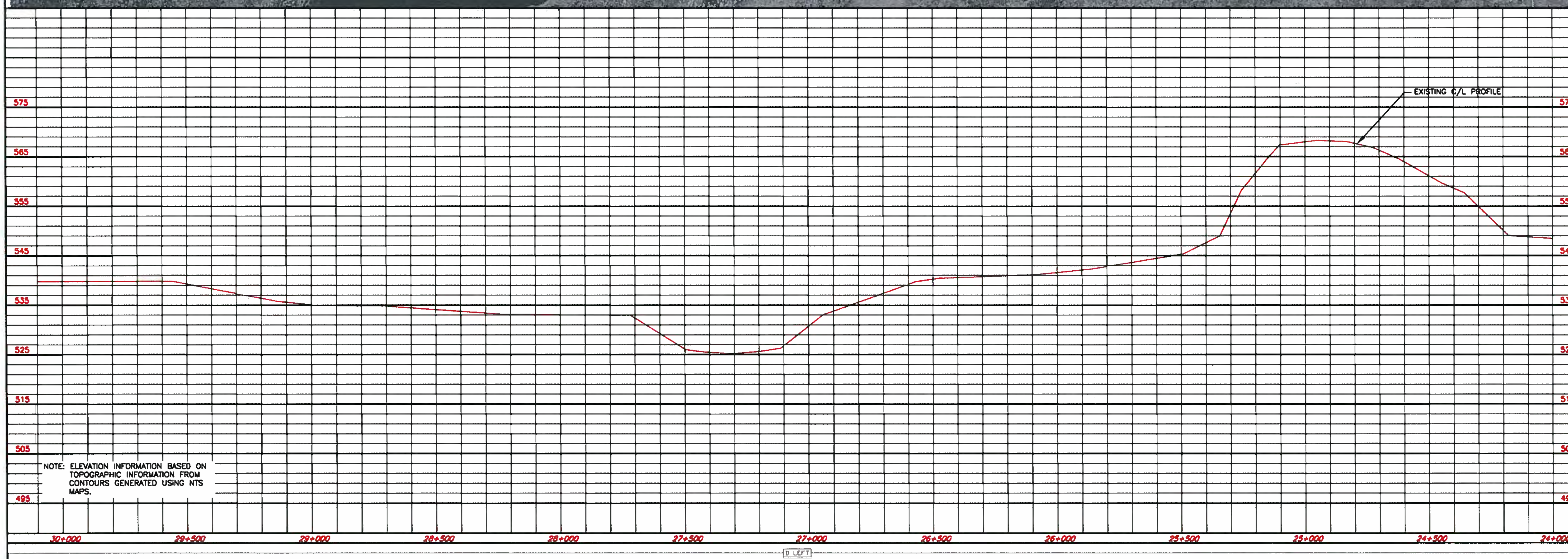
CS	914-04	TAB NO	3-5
PHOTO DATE	N/A	SHEET	
DRAWN BY	M. WALTERS	DATE	09/11/25
DESIGNED BY	J. HORAN	DATE	09/11/25

Saskatchewan Ministry of Highways and Infrastructure

REVISIONS		
NO	DATE	SIGNATURE

DETAILED LOCATION
HWY 914
McARTHUR RIVER MINE SITE TO CIGAR LAKE MINE SITE





NOTE: ELEVATION INFORMATION BASED ON TOPOGRAPHIC INFORMATION FROM CONTOURS GENERATED USING NTS MAPS.

CS	914-04	TAB NO	3-6
PHOTO DATE	N/A	SHEET	
DRAWN BY	M. WALTERS	DATE	09/11/25
DESIGNED BY	J. HORAN	DATE	09/11/25

DETAILED LOCATION
HWY 914
McARTHUR RIVER MINE SITE
TO
CIGAR LAKE MINE SITE

Saskatchewan Ministry of Highways and Infrastructure

REVISIONS

NO	DATE	SIGNATURE

C/L
P/L
SHOULDER ELEVATION
D
W
CLASS UR90-7005

NOTE: ELEVATION INFORMATION BASED ON TOPOGRAPHIC INFORMATION FROM CONTOURS GENERATED USING NTS MAPS.

CS	914-04	TAB NO	3-7
PHOTO DATE	N/A	SHEET	
DRAWN BY	M. WALTERS	DATE	09/11/25
DESIGNED BY	J. HORAN	DATE	09/11/25

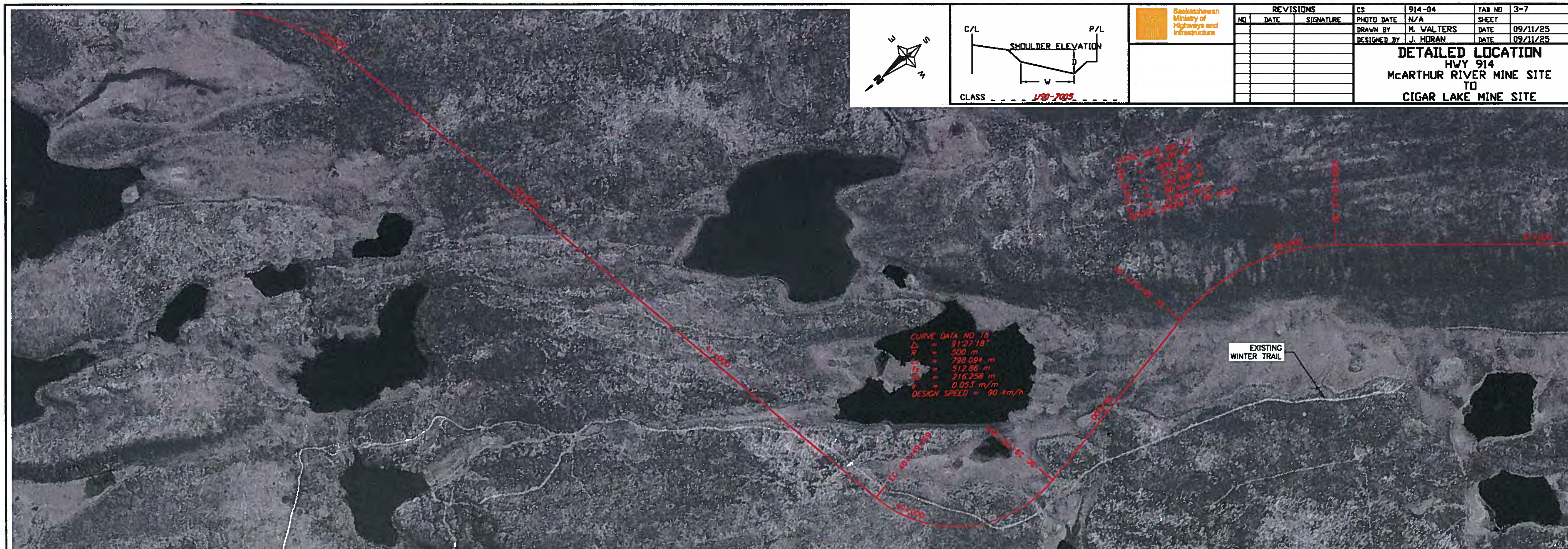
DETAILED LOCATION
HWY 914
McARTHUR RIVER MINE SITE TO CIGAR LAKE MINE SITE

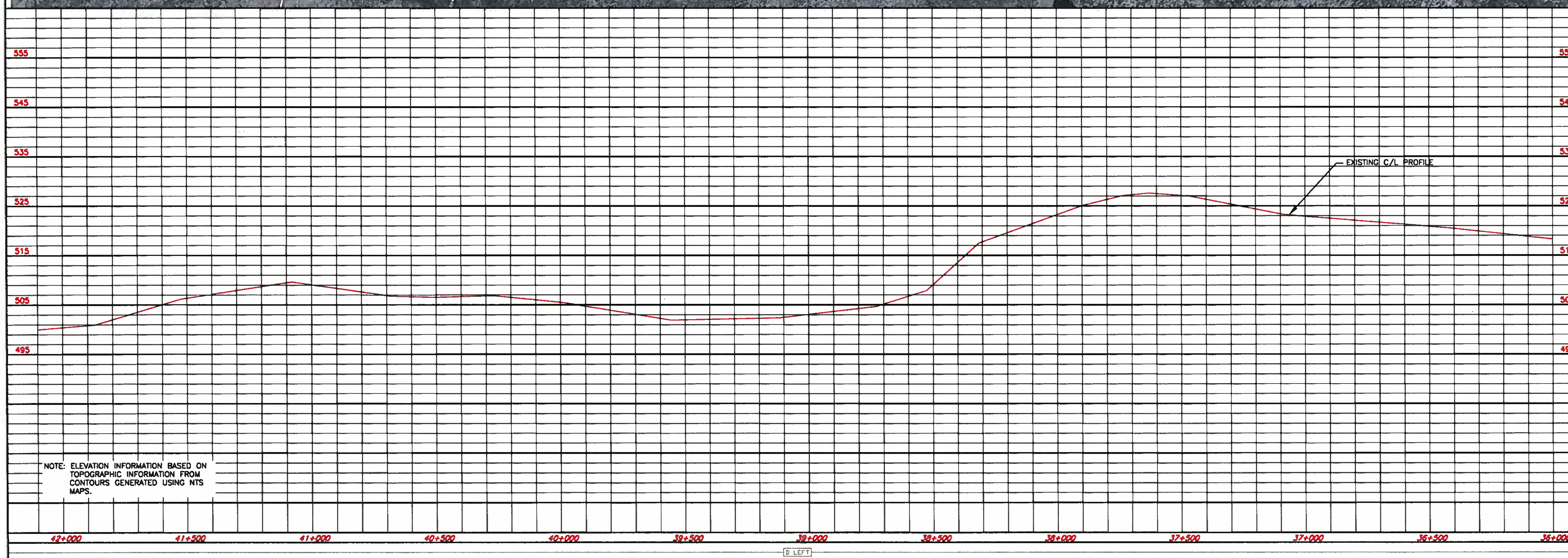
Saskatchewan Ministry of Highways and Infrastructure

REVISIONS		
NO	DATE	SIGNATURE

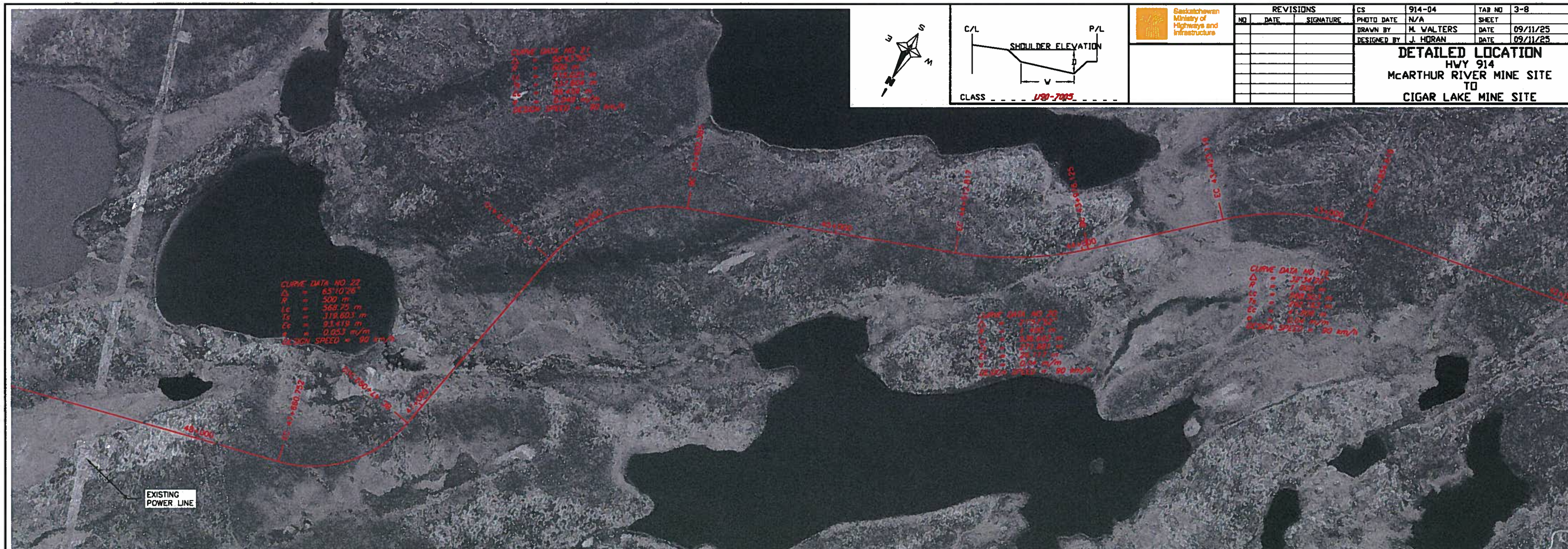
C/L P/L SHOULDER ELEVATION D W

CLASS USO-7005





NOTE: ELEVATION INFORMATION BASED ON TOPOGRAPHIC INFORMATION FROM CONTOURS GENERATED USING NTS MAPS.

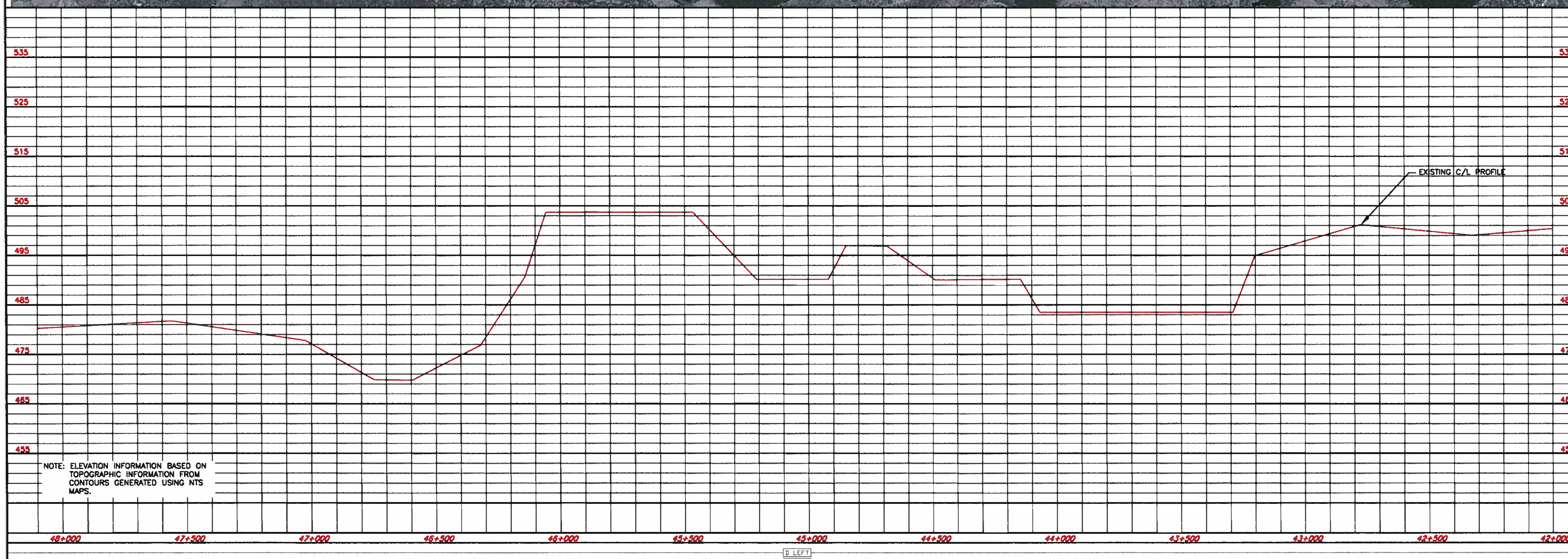


Saskatchewan Ministry of Highways and Infrastructure

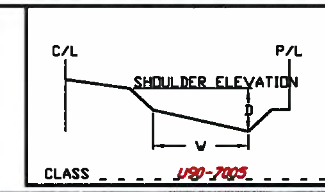
REVISIONS		
NO	DATE	SIGNATURE

CS	914-04	TAB NO	3-8
PHOTO DATE	N/A	SHEET	
DRAWN BY	M. WALTERS	DATE	09/11/25
DESIGNED BY	J. HORAN	DATE	09/11/25

DETAILED LOCATION
HWY 914
McARTHUR RIVER MINE SITE TO CIGAR LAKE MINE SITE



NOTE: ELEVATION INFORMATION BASED ON TOPOGRAPHIC INFORMATION FROM CONTOURS GENERATED USING NTS MAPS.

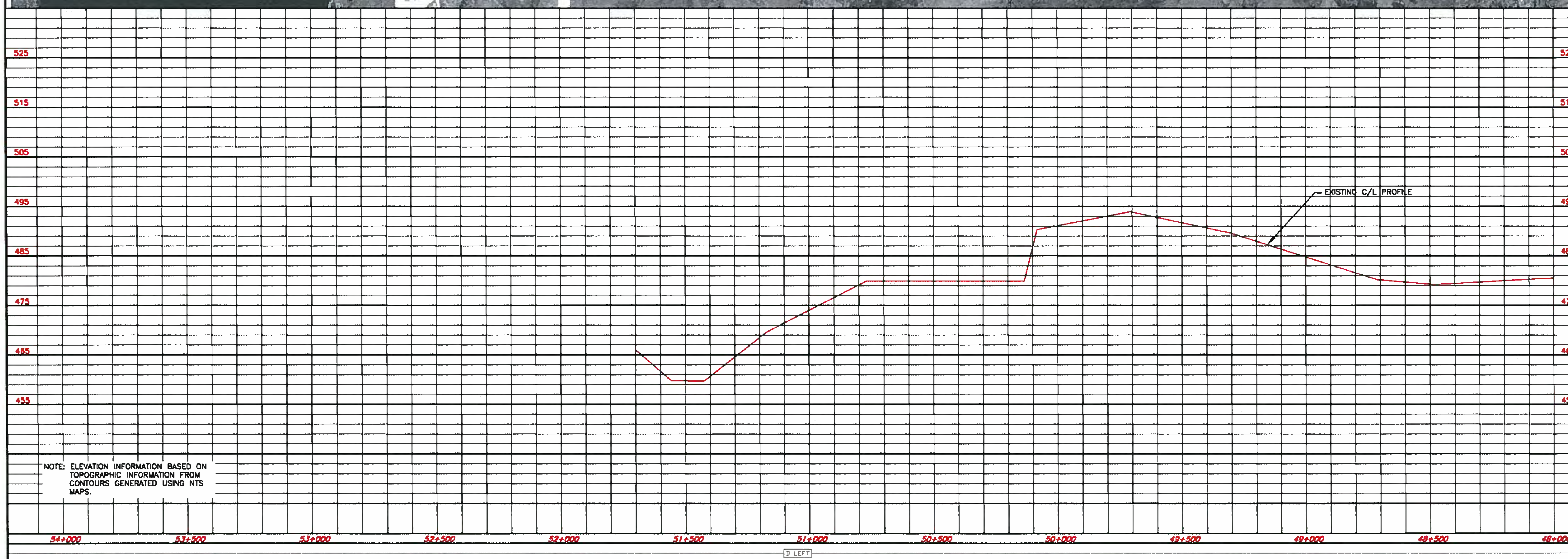


Saskatchewan Ministry of Highways and Infrastructure

REVISIONS		
NO	DATE	SIGNATURE

CS	914-04	TAB NO	3-9
PHOTO DATE	N/A	SHEET	
DRAWN BY	M. WALTERS	DATE	09/11/25
DESIGNED BY	J. HORAN	DATE	09/11/25

DETAILED LOCATION
HWY 914
McARTHUR RIVER MINE SITE
TO
CIGAR LAKE MINE SITE



NOTE: ELEVATION INFORMATION BASED ON TOPOGRAPHIC INFORMATION FROM CONTOURS GENERATED USING NTS MAPS.

E Appendix E - Pictures

May Creek km 13.6

 **May Creek Aerial**	 **May Creek**
 **May Creek**	 **400 m downstream of crossing looking North**
 **Crossing Location**	 **Stream Substrate at Crossing**

Mine Access Road Tie In's

Cigar Lake Tie In

Cigar Lake Tie In Looking West

Cigar Lake Tie In Looking West

McArthur River Near Tie In

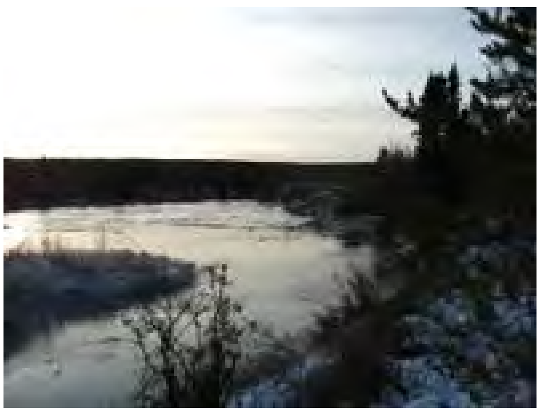
Crossing Near McArthur River Tie In

Side Hill Near McArthur River Tie In

Assorted

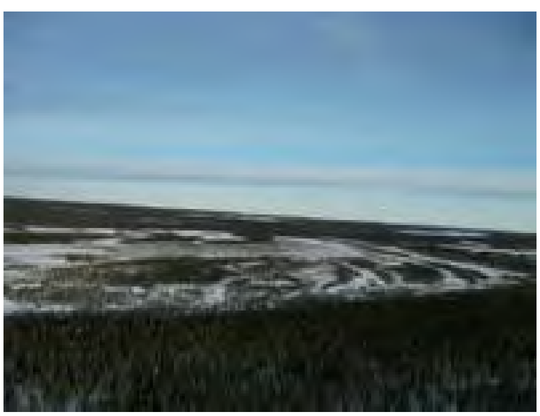
Route 7 km 8 – Large Drumlin on Route

Route 7 km 15 - Large Muskeg Near Close Lake



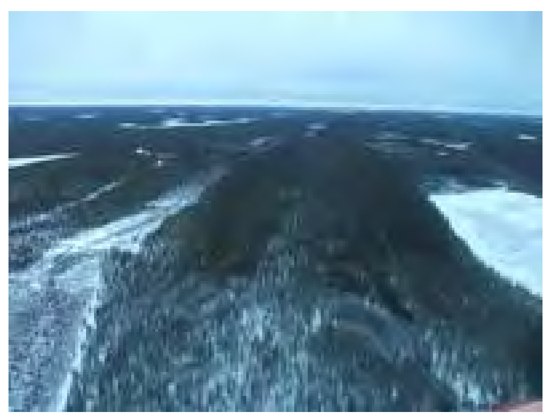
Crossing Near km 19

Between Lakes – Near km 15



Drumlinized Area Near km 33

Aerial View Existing Winter Trail – Near km 16.5

 **Existing Winter Trail Between Lakes – Near km 15.5**	 **Sandy Burn Area between lakes – Near km 15.5**
 **Silty Sand – Near km 15.5**	 **Old Drainage Channel – Near km 31.5**
 **Drainage Channel Substrate – Near km 31.5**	 **Large Drumlin – Near km 32**

Test Hole in Drumlin – Near km 33

Power Line - Near km 48.4

Muskeg Crossing Location – Near km 48.4

F Appendix F - Anticipated Costs

Ministry of Highways and Infrastructure

Quantities and Cost Estimate Sheet

Contract No.:	
Type of Work:	Grading
Region:	Northern
Prepared By:	Patrick Murphy (AE)
Date:	January 25, 2010

Project Information	
Project Number	Estimated Cost
Total	

Control Section	From km	To km	Length
914		51.71	51.71
Key Lake Bypass		4.80	4.80
		Total	56.51 km

Project Description: For the **CONSTRUCTION OF THE SUBGRADE** for an all weather roadway connecting McArthur River mine's private access road to Cigar Lake mine's private access road; and for the **CONSTRUCTION OF THE SUBGRADE** for an all weather roadway bypass near the Key Lake mine site.

Remarks:

Contract Items

Item No.	Spec. No.	Description	Unit	Quantity	Pre-Tender Price	Pre-Tender Cost	At Award Price	At Award Cost
HWY 914								
		CLEARING & GRUBBING	ha	265	$7,500.00	$1,987,500.00		
		SUBGRADE CONSTRUCTION	km	51.7	$400,000.00	$20,684,000.00		
		TRAFFIC GRAVEL TYPE 106	t	20000	$30.00	$600,000.00		
		TRAFFIC GRAVEL TYPE 102	t	35000	$22.00	$770,000.00		
		BRIDGE - MAY CREEK	m	20	$51,000.00	$1,020,000.00		
		INSTALLING CULVERTS GROUP B	m	4000	$120.00	$480,000.00		
		INSTALLING CULVERTS GROUP C	m	1000	$200.00	$200,000.00		
		INSTALL SILT FENCE	m	17000	$15.00	$255,000.00		
		INSTALL EROSION CONTROL BLANKET	m2	40000	$10.00	$400,000.00		
		SEEDING RIGHT OF WAY	ha	200	$525.00	$105,000.00		
		MOBILIZATION	LumpSum	1	$1,000,000.00	$1,000,000.00		
KEY LAKE MINE BYPASS								
		CLEARING & GRUBBING	ha	25	$7,500.00	$187,500.00		
		SUBGRADE CONSTRUCTION	km	4.8	$400,000.00	$1,920,000.00		
		TRAFFIC GRAVEL TYPE 106	t	2000	$26.00	$52,000.00		
		TRAFFIC GRAVEL TYPE 102	t	3500	$26.00	$91,000.00		
		INSTALLING CULVERTS GROUP B	m	100	$120.00	$12,000.00		
		INSTALLING CULVERTS GROUP C	m	100	$200.00	$20,000.00		
		INSTALL SILT FENCE	m	1500	$15.00	$22,500.00		
		INSTALL EROSION CONTROL BLANKET	m2	3000	$15.00	$45,000.00		
		SEEDING RIGHT OF WAY	ha	20	$450.00	$9,000.00		
		MOBILIZATION	LumpSum	1	$500,000.00	$500,000.00		
		Contract Items Sub-Total				**$30,360,500.00**		
				Price	Quantity	Cost	Quantity	Cost
		Contract Items Total (For comparing bids for award)				**$30,360,500.00**		

Sundries

Item	Cost
Sundries Total	

Materials

Item	Quantity	Price	Cost
Group B Culvert	4100	$150.00	$615,000.00
Group C Culvert	1100	$215.00	$236,500.00
Silt Fence	560	$27.00	$15,120.00
Grass Seed (kg)	6600	$8.00	$52,800.00
Erosion Matting	43000	$1.00	$43,000.00
Material Sub-Total			$962,420.00
5% PST			$48,121.00
Materials Total			**$1,010,541.00**

Budget Items

Budget Type	Year: Prev. Years	2009	2010	Total
1. Internal Budget Target				
2. Pre-Tender Estimate				
3. At Award Budget				

Pre-tender Total Added Project Cost	

	Difference ($)	% Difference
Cont. Items At Award vs. Pre-Tender		

Summary of Estimates

Expenditure Category	Pre-Tender	At Award
Contract Items (Sub-Total(not inc. Site Occ.) + OCI)	$30,360,500	
Force Account	$350,000	
Materials	$1,010,541	
Sundries		
Con. Engineering (20%)	$6,072,100	
Des. Engineering	$100,000	
Testing Services	$75,000	
Environmental Impact Statement	$400,000	
Helicopter Services	$200,000	
ROW Surveys		
General Services	$1,859	
Total Cost	**$38,570,000**	

Other Contract Items (OCI)

Item	Cost
B/F/B (5% of Base @ $3.50/t)	
B/F/B Haul (Assume 20 km)	
Reject	
Surplus Aggregate	
Dust Abatement	
Performance Bonus	
Completion Bonus	
RSN Bonus	
Other Contract Items Total	

Force Account

Item	Cost
General	$350,000.00
Force Account Total	**$350,000.00**

G Appendix G - Alignment Points for GPS Use

Appendix G

```
>>>> Describe Chains <<<< [Thu Jan 21 15:52:19 2010]
********************************************************************************
CHAIN L200A1
List         FLEX2032,C ,CURV28,C ,CURV1,C ,CURV3,C ,CURV4,C ,CURV5,C ,CURV6
List         ,C ,CURV29,C ,CURV8,C ,CURV9,C ,CURV10,FLEX2019,C ,CURV11,C ,CURV12
List         ,C ,CURV13,C ,CURV14,FLEX2014,C ,CURV15,C ,CURV16,C ,CURV17,C
List          ,CURV18,C ,CURV20,C ,CURV21,C ,CURV23,C ,CURV24,C ,CURV25,PNT23
List         ,C ,CURV27,FLEX2000
Description
Layer        1
Feature      GEOM
********************************************************************************
FLEX2032 N  6399458.874 E   497754.248 Z 99999.999      STA   0+000.000
        Distance      860.175 m   Azimuth  18°06'54"
CURVE CURV28
        BC N  6400276.414 E   498021.699        STA   0+860.175
        CC N  6399810.023 E   499447.350
        PI N  6400592.698 E   498125.169        STA   1+192.954
                TAN 332.779 m
                DB    18°06'54"
                DA    43°07'56"
                LChord  Distance      649.759 m   Azimuth  30°37'25"
                External Distance 36.470 m
                Middle Ordinate 35.605 m
                Radius 1500.000 m
                DEG     1°09'51"
                DELTA    25°01'02"
                LENGTH 654.949 m
        EC N  6400835.552 E   498352.685        STA   1+515.125
CURVE CURV28
        Distance      770.502 m   Azimuth  43°07'56"
CURVE CURV1
        BC N  6401397.846 E   498879.466        STA   2+285.627
        CC N  6401910.610 E   498332.134
        PI N  6401630.357 E   499097.293        STA   2+604.233
                TAN 318.606 m
                DB    43°07'56"
                DA   357°06'00"
                LChord  Distance      586.486 m   Azimuth  20°06'58"
                External Distance 64.868 m
                Middle Ordinate 59.704 m
                Radius 750.000 m
                DEG     2°19'43"
                DELTA   -46°01'56"
                LENGTH 602.562 m
        EC N  6401948.555 E   499081.173        STA   2+888.188
CURVE CURV1
        Distance     1053.982 m   Azimuth  357°06'00"
CURVE CURV3
        BC N  6403001.187 E   499027.850        STA   3+942.170
        CC N  6402874.705 E   496531.051
        PI N  6403060.484 E   499024.846        STA   4+001.543
                TAN 59.373 m
                DB   357°06'00"
                DA   354°22'45"
                LChord  Distance      118.713 m   Azimuth  355°44'22"
                External Distance 0.705 m
                Middle Ordinate 0.705 m
                Radius 2500.000 m
                DEG     0°41'55"
                DELTA    -2°43'15"
```

```
            LENGTH 118.724 m
        EC N  6403119.571 E   499019.030        STA   4+060.894
CURVE CURV3
        Distance     1165.843 m   Azimuth  354°22'45"
CURVE CURV4
        BC N  6404279.809 E   498904.840        STA   5+226.737
        CC N  6404475.702 E   500895.223
        PI N  6404943.212 E   498839.548        STA   5+893.346
            TAN 666.609 m
            DB   354°22'45"
            DA    31°14'46"
            LChord  Distance     1264.812 m   Azimuth  12°48'45"
            External Distance 108.167 m
            Middle Ordinate 102.617 m
            Radius 2000.000 m
            DEG     0°52'23"
            DELTA    36°52'01"
            LENGTH 1286.898 m
        EC N  6405513.129 E   499185.327        STA   6+513.635
CURVE CURV4
        Distance      419.683 m   Azimuth  31°14'46"
CURVE CURV5
        BC N  6405871.936 E   499403.022        STA   6+933.318
        CC N  6406131.293 E   498975.548
        PI N  6406016.492 E   499490.727        STA   7+102.400
            TAN 169.081 m
            DB    31°14'46"
            DA   353°52'43"
            LChord  Distance      320.342 m   Azimuth  12°33'45"
            External Distance 27.815 m
            Middle Ordinate 26.349 m
            Radius 500.000 m
            DEG     3°29'34"
            DELTA   -37°22'02"
            LENGTH 326.091 m
        EC N  6406184.609 E   499472.697        STA   7+259.409
CURVE CURV5
        Distance      189.803 m   Azimuth  353°52'43"
CURVE CURV6
        BC N  6406373.329 E   499452.458        STA   7+449.212
        CC N  6406413.317 E   499825.320
        PI N  6406497.824 E   499439.107        STA   7+574.420
            TAN 125.209 m
            DB   353°52'43"
            DA    30°48'22"
            LChord  Distance      237.527 m   Azimuth  12°20'33"
            External Distance 20.351 m
            Middle Ordinate 19.303 m
            Radius 375.000 m
            DEG     4°39'25"
            DELTA    36°55'38"
            LENGTH 241.688 m
        EC N  6406605.367 E   499503.230        STA   7+690.900
CURVE CURV6
        Distance      183.343 m   Azimuth  30°48'22"
CURVE CURV29
        BC N  6406762.841 E   499597.126        STA   7+874.243
        CC N  6407684.681 E   498051.095
        PI N  6406863.633 E   499657.224        STA   7+991.592
            TAN 117.349 m
            DB    30°48'22"
            DA    23°20'45"
            LChord  Distance      234.201 m   Azimuth  27°04'33"
```

```
              External Distance 3.821 m
              Middle Ordinate 3.813 m
              Radius 1800.000 m
              DEG     0°58'13"
              DELTA    -7°27'36"
              LENGTH 234.367 m
        EC N  6406971.374 E   499703.728        STA   8+108.609
CURVE CURV29
        Distance     4668.568 m   Azimuth  23°20'45"
CURVE CURV8
        BC N  6411257.723 E   501553.793        STA  12+777.178
        CC N  6411019.955 E   502104.671
        PI N  6411602.480 E   501702.597        STA  13+152.677
              TAN 375.500 m
              DB    23°20'45"
              DA    87°25'31"
              LChord  Distance      636.608 m   Azimuth  55°23'08"
              External Distance 107.814 m
              Middle Ordinate 91.391 m
              Radius 600.000 m
              DEG     2°54'38"
              DELTA    64°04'46"
              LENGTH 671.037 m
        EC N  6411619.349 E   502077.717        STA  13+448.215
CURVE CURV8
        Distance     2006.919 m   Azimuth  87°25'31"
CURVE CURV9
        BC N  6411709.505 E   504082.610        STA  15+455.134
        CC N  6412308.899 E   504055.656
        PI N  6411720.000 E   504316.000        STA  15+688.760
              TAN 233.626 m
              DB    87°25'31"
              DA    44°52'33"
              LChord  Distance      435.409 m   Azimuth  66°09'02"
              External Distance 43.880 m
              Middle Ordinate 40.889 m
              Radius 600.000 m
              DEG     2°54'38"
              DELTA   -42°32'58"
              LENGTH 445.578 m
        EC N  6411885.556 E   504480.840        STA  15+900.712
CURVE CURV9
        Distance     1090.236 m   Azimuth  44°52'33"
CURVE CURV10
        BC N  6412658.140 E   505250.079        STA  16+990.947
        CC N  6414280.954 E   503620.209
        PI N  6412875.000 E   505466.000        STA  17+296.971
              TAN 306.023 m
              DB    44°52'33"
              DA    29°43'05"
              LChord  Distance      606.700 m   Azimuth  37°17'49"
              External Distance 20.269 m
              Middle Ordinate 20.092 m
              Radius 2300.000 m
              DEG     0°45'33"
              DELTA   -15°09'28"
              LENGTH 608.472 m
        EC N  6413140.774 E   505617.705        STA  17+599.420
CURVE CURV10
        Distance     1539.738 m   Azimuth  29°43'05"
FLEX2019 N  6414478.000 E   506381.000 Z 99999.999      STA  19+139.158
        Distance     3016.777 m   Azimuth  30°59'04"
CURVE CURV11
```

```
        BC N  6417064.304 E   507934.053        STA  22+155.935
        CC N  6415880.252 E   509905.859
        PI N  6417329.000 E   508093.000        STA  22+464.687
                TAN 308.752 m
                DB    30°59'04"
                DA    46°16'33"
                LChord  Distance      612.015 m   Azimuth  38°37'48"
                External Distance 20.631 m
                Middle Ordinate 20.448 m
                Radius 2300.000 m
                DEG     0°45'33"
                DELTA    15°17'29"
                LENGTH 613.835 m
        EC N  6417542.406 E   508316.128        STA  22+769.770
CURVE CURV11
        Distance     1281.983 m   Azimuth  46°16'33"
CURVE CURV12
        BC N  6418428.496 E   509242.586        STA  24+051.753
        CC N  6417850.356 E   509795.536
        PI N  6418668.000 E   509493.000        STA  24+398.263
                TAN 346.510 m
                DB    46°16'33"
                DA    93°06'52"
                LChord  Distance      635.930 m   Azimuth  69°41'42"
                External Distance 71.820 m
                Middle Ordinate 65.903 m
                Radius 800.000 m
                DEG     2°10'59"
                DELTA    46°50'19"
                LENGTH 653.989 m
        EC N  6418649.175 E   509838.998        STA  24+705.742
CURVE CURV12
        Distance     1458.586 m   Azimuth  93°06'52"
CURVE CURV13
        BC N  6418569.932 E   511295.430        STA  26+164.328
        CC N  6419768.159 E   511360.625
        PI N  6418552.000 E   511625.000        STA  26+494.385
                TAN 330.057 m
                DB    93°06'52"
                DA    62°21'24"
                LChord  Distance      636.478 m   Azimuth  77°44'08"
                External Distance 44.563 m
                Middle Ordinate 42.968 m
                Radius 1200.000 m
                DEG     1°27'19"
                DELTA   -30°45'27"
                LENGTH 644.185 m
        EC N  6418705.135 E   511917.382        STA  26+808.513
CURVE CURV13
        Distance     3785.983 m   Azimuth  62°21'24"
CURVE CURV14
        BC N  6420461.699 E   515271.209        STA  30+594.497
        CC N  6421879.064 E   514528.865
        PI N  6420614.000 E   515562.000        STA  30+922.757
                TAN 328.261 m
                DB    62°21'24"
                DA    39°10'07"
                LChord  Distance      643.125 m   Azimuth  50°45'46"
                External Distance 33.326 m
                Middle Ordinate 32.646 m
                Radius 1600.000 m
                DEG     1°05'29"
                DELTA   -23°11'17"
```

```
            LENGTH 647.536 m
        EC N  6420868.497 E   515769.331        STA  31+242.032
CURVE CURV14
        Distance     1940.565 m   Azimuth  39°10'07"
FLEX2014 N  6422373.000 E   516995.000 Z 99999.999      STA  33+182.597
        Distance     1647.122 m   Azimuth  42°39'54"
CURVE CURV15
        BC N  6423584.179 E   518111.270        STA  34+829.720
        CC N  6424397.430 E   517228.874
        PI N  6423764.000 E   518277.000        STA  35+074.265
            TAN 244.545 m
            DB    42°39'54"
            DA    19°37'41"
            LChord  Distance      479.240 m   Azimuth  31°08'47"
            External Distance 24.664 m
            Middle Ordinate 24.167 m
            Radius 1200.000 m
            DEG     1°27'19"
            DELTA   -23°02'13"
            LENGTH 482.483 m
        EC N  6423994.335 E   518359.146        STA  35+312.203
CURVE CURV15
        Distance      420.988 m   Azimuth  19°37'41"
CURVE CURV16
        BC N  6424390.861 E   518500.561        STA  35+733.191
        CC N  6423954.175 E   519725.022
        PI N  6424608.000 E   518578.000        STA  35+963.726
            TAN 230.535 m
            DB    19°37'41"
            DA    39°44'24"
            LChord  Distance      453.987 m   Azimuth  29°41'02"
            External Distance 20.283 m
            Middle Ordinate 19.971 m
            Radius 1300.000 m
            DEG     1°20'36"
            DELTA    20°06'43"
            LENGTH 456.326 m
        EC N  6424785.271 E   518725.382        STA  36+189.517
CURVE CURV16
        Distance     1623.365 m   Azimuth  39°44'24"
CURVE CURV17
        BC N  6426033.563 E   519763.207        STA  37+812.882
        CC N  6426545.007 E   519148.044
        PI N  6426328.000 E   520008.000        STA  38+195.787
            TAN 382.906 m
            DB    39°44'24"
            DA   348°35'08"
            LChord  Distance      690.765 m   Azimuth  14°09'46"
            External Distance 86.914 m
            Middle Ordinate 78.397 m
            Radius 800.000 m
            DEG     2°10'59"
            DELTA   -51°09'16"
            LENGTH 714.252 m
        EC N  6426703.332 E   519932.220        STA  38+527.134
CURVE CURV17
        Distance      824.131 m   Azimuth  348°35'08"
CURVE CURV18
        BC N  6427511.163 E   519769.120        STA  39+351.265
        CC N  6427610.116 E   520259.230
        PI N  6428013.879 E   519667.621        STA  39+864.125
            TAN 512.860 m
            DB   348°35'08"
```

```
                DA    80°02'25"
                LChord  Distance      716.027 m   Azimuth  34°18'46"
                External Distance 216.258 m
                Middle Ordinate 150.964 m
                Radius 500.000 m
                DEG     3°29'34"
                DELTA    91°27'18"
                LENGTH 798.094 m
        EC N  6428102.581 E   520172.752        STA  40+149.359
CURVE CURV18
        Distance     2705.257 m   Azimuth  80°02'25"
CURVE CURV20
        BC N  6428570.469 E   522837.240        STA  42+854.616
        CC N  6429555.399 E   522664.285
        PI N  6428621.000 E   523125.000        STA  43+146.779
                TAN 292.163 m
                DB    80°02'25"
                DA    47°28'03"
                LChord  Distance      560.878 m   Azimuth  63°45'14"
                External Distance 41.806 m
                Middle Ordinate 40.128 m
                Radius 1000.000 m
                DEG     1°44'47"
                DELTA   -32°34'22"
                LENGTH 568.503 m
        EC N  6428818.505 E   523340.293        STA  43+423.119
CURVE CURV20
        Distance      553.006 m   Azimuth  47°28'03"
CURVE CURV21
        BC N  6429192.341 E   523747.800        STA  43+976.125
        CC N  6428160.690 E   524694.212
        PI N  6429376.000 E   523948.000        STA  44+247.806
                TAN 271.681 m
                DB    47°28'03"
                DA    69°25'55"
                LChord  Distance      533.412 m   Azimuth  58°26'59"
                External Distance 26.117 m
                Middle Ordinate 25.639 m
                Radius 1400.000 m
                DEG     1°14'51"
                DELTA    21°57'52"
                LENGTH 536.692 m
        EC N  6429471.447 E   524202.363        STA  44+512.817
CURVE CURV21
        Distance     1089.569 m   Azimuth  69°25'55"
CURVE CURV23
        BC N  6429854.235 E   525222.477        STA  45+602.385
        CC N  6430415.988 E   525011.685
        PI N  6429972.842 E   525538.561        STA  45+939.989
                TAN 337.604 m
                DB    69°25'55"
                DA    10°42'05"
                LChord  Distance      588.451 m   Azimuth  40°03'60"
                External Distance 88.459 m
                Middle Ordinate 77.093 m
                Radius 600.000 m
                DEG     2°54'38"
                DELTA   -58°43'50"
                LENGTH 615.025 m
        EC N  6430304.574 E   525601.250        STA  46+217.410
CURVE CURV23
        Distance      874.592 m   Azimuth  10°42'05"
CURVE CURV24
```

```
        BC N  6431163.955 E   525763.653        STA  47+092.002
        CC N  6431071.110 E   526254.957
        PI N  6431478.000 E   525823.000        STA  47+411.605
                TAN 319.603 m
                DB    10°42'05"
                DA    75°52'31"
                LChord  Distance      538.579 m   Azimuth  43°17'18"
                External Distance 93.419 m
                Middle Ordinate 78.713 m
                Radius 500.000 m
                DEG     3°29'34"
                DELTA    65°10'26"
                LENGTH 568.750 m
        EC N  6431555.994 E   526132.941        STA  47+660.752
CURVE CURV24
        Distance     1723.166 m   Azimuth  75°52'31"
CURVE CURV25
        BC N  6431976.504 E   527804.010        STA  49+383.918
        CC N  6431200.690 E   527999.237
        PI N  6432053.000 E   528108.000        STA  49+697.385
                TAN 313.467 m
                DB    75°52'31"
                DA   118°40'09"
                LChord  Distance      583.723 m   Azimuth  97°16'20"
                External Distance 59.221 m
                Middle Ordinate 55.140 m
                Radius 800.000 m
                DEG     2°10'59"
                DELTA    42°47'38"
                LENGTH 597.515 m
        EC N  6431902.614 E   528383.037        STA  49+981.433
CURVE CURV25
        Distance       76.319 m   Azimuth  118°40'09"
PNT23 N  6431866.000 E   528450.000 Z 99999.999         STA  50+057.752
        Distance      704.464 m   Azimuth  118°46'04"
CURVE CURV27
        BC N  6431526.971 E   529067.518        STA  50+762.215
        CC N  6433104.812 E   529933.784
        PI N  6431446.000 E   529215.000        STA  50+930.463
                TAN 168.248 m
                DB   118°46'04"
                DA   108°05'16"
                LChord  Distance      335.035 m   Azimuth  113°25'40"
                External Distance 7.846 m
                Middle Ordinate 7.812 m
                Radius 1800.000 m
                DEG     0°58'13"
                DELTA   -10°40'48"
                LENGTH 335.520 m
        EC N  6431393.764 E   529374.933        STA  51+097.736
CURVE CURV27
        Distance      614.431 m   Azimuth  108°05'16"
FLEX2000 N  6431203.000 E   529959.000 Z 99999.999      STA  51+712.166
********************************************************************************
CHAIN LENGTH 51712.166 m
********************************************************************************

>>>> End of Describe Chains <<<<
```

APPENDIX D

Consultation and Engagement

Ministry of Environment
Environmental Assessment and Stewardship Branch
3211 Albert Street
Regina, Saskatchewan S4S 5W6

Phone: 306 787 5971
Fax: 306 787 0930

Government of Saskatchewan

February 6, 2017 File: EASB #: 2010-009

Alison M. Lara, P.Eng.,
Senior Project Manager
Ministry of Highways and Infrastructure
Design and Innovation – Northern
Box 3003, 800 Central Avenue
Prince Albert, SK S6V 6G1

Dear Ms. Lara:

RE: Consultation Notification of Proposed Highway 914 Extension

As you have been previously informed by the Ministry of Environment the proposed Highway 914 Extension Project (the project) is, in the opinion of the Minister, a "development" as defined in section 2(d) of *The Environmental Assessment Act*. This notice is to advise you that information reviewed by the Environmental Assessment and Stewardship Branch (EAS Branch) in relation to the proposed project indicates that the duty to consult has been triggered.

The province recognizes its constitutional obligation to consult with affected First Nations and Métis communities when considering decisions that might adversely impact the exercise of Treaty and Aboriginal rights or traditional uses as described in the province's *First Nation and Métis Consultation Policy Framework* (June 2010).

To assist the province in fulfilling its duty to consult, the province is assigning the Ministry of Highways and Infrastructure (MHI, the proponent) various procedural aspects of the consultation process. The EAS Branch will rely on MHI to work with potentially affected First Nation and Métis communities in the development of the environmental impact statement (EIS). MHI may find it helpful in drafting the EIS to have worked with potentially affected First Nation and Métis communities on the development of the Terms of Reference document.

As part of the environmental assessment process, MHI is required to consult with:

- Black Lake First Nation;
- Fond du Lac First Nation;
- English River First Nation;
- Hatchet Lake First Nation;
- Lac La Ronge Indian Band;
- Peter Ballantyne Cree Nation;
- Kineepik Métis Local #9;
- A la Baie Métis Local #21;
- Beauval Sipishik Métis Local #37;
- Buffalo Narrows Métis Local #62;
- La Ronge Métis Local #19;
- Stony Rapid Métis Local #80; and
- Métis Nation Northern Region I, II and III (cc only).

and provide them with project-specific information to help in understanding how the project may potentially affect their Treaty and Aboriginal rights and traditional uses.

As stated in the Provincial *First Nation and Métis Consultation Policy Framework* (2010), the duty to consult lies with the Government of Saskatchewan. In determining whether the Crown's duty has been met in relation to the Minister's decision on an environmental assessment, the EAS Branch will consider whether the proponent has engaged in meaningful consultation, and accommodation that is appropriate to the significance of the potential adverse impacts to Treaty and Aboriginal rights and traditional uses.

In consulting with these communities, the proponent is assigned responsibility, at their cost, to carry out the following activities:

- Provide information to the First Nation and Métis community(s) to ensure they are reasonably informed as to the nature of the proposed activities and are aware of any potential environmental impacts.
    - Include short, medium and long-term plans in the area.

- Arrange meetings by mutual agreement with First Nation and Métis community elected officials or their formally authorized designate to discuss appropriate means of engagement recognizing community specific requirements.

- Engage with the First Nations and Métis communities to identify and discuss specific potential adverse impacts of the project on First Nations and Métis ability to exercise their right to hunt, fish and trap for food and carry out traditional uses.

- Consider the views of First Nations and Métis communities and, where necessary, work with the community(s) to avoid or minimize adverse impacts on First Nations and Métis ability to hunt, fish and trap for food and carry out traditional uses.

- Document the consultation efforts and include in the EIS a consultation report outlining:
    - Attempts to contact and steps taken to engage the First Nation and Métis communities;
    - Specific community concerns related to potential adverse impacts on their ability to exercise Treaty and Aboriginal rights and carry out traditional uses;
    - How the concerns identified were considered and addressed by the proponent;
    - Any outstanding issues the proponent was unable to address and the reasons why;
    - Any agreements developed with the community(s); and
    - Other relevant information related to community discussions.

- Where required by the EAS Branch, participate in follow-up consultations between the EAS Branch and First Nations and Métis communities.

As part of the consultation process, the proponent should engage the community to discuss their consultation needs. A comprehensive consultation process may require funding for:

- a local consultation coordinator to coordinate, manage and participate in consultation events, liaise with proponent and elected leaders, research and gather information, and prepare and coordinate information packages and communications for consultation events;
- an independent technical expertise, professionals and/or consultants to help the community understand the project proposal, complete reporting requirements and provide facilitation services;

- facility rentals, equipment rentals, miscellaneous office costs to support the process;
- consultation events, such as meetings with Chief and Council, community meetings site visits;
- travel, accommodations and meal allowances for local coordinators, First Nation and Métis traditional users, Elders and elected officials travelling to consultation events;
- honoraria for Elders and traditional users participating in consultation events;
- translation and transcription services; and,
- miscellaneous administrative services associated with the consultation.

The EAS Branch will communicate this assignment to the potentially affected First Nation and Métis communities and advise them to work with the proponent to:

- build their understanding of the project;
- identify their consultation needs and develop an appropriate budget;
- provide information on the potential adverse impacts to their established or credibly claimed Treaty and Aboriginal rights and traditional uses; and
- identify accommodations to minimize, mitigate, or avoid potential adverse impacts to rights and traditional uses.

Based on the information received on consultation efforts as reported in the draft EIS, the EAS Branch may deem that the consultation efforts undertaken by the MHI are satisfactory or the EAS Branch may require MHI to undertake additional measures of consultation where appropriate and as required.

Information provided regarding this proposed project's effects on the respective communities' ability to exercise Treaty and Aboriginal rights to hunt, fish, trap for food and carry out traditional uses will assist the Minister in making one of the following decisions:

1. Approve the project proceeding including any terms and conditions that MHI would have to fulfill in order to proceed;
2. Require the project to undergo further review and assessment; or
3. Refuse approval for the project to proceed.

If you have any questions or require any additional clarification regarding this notice, please refer to *Proponents Guide: Consultation with First Nations and Métis in Saskatchewan Environmental Impact Assessment* found at the following link Saskatchewan.ca/EnvironmentalAssessment.

Alternatively, you may contact me at your convenience at 306-787-5971 or email alvin.yuen@gov.sk.ca.

Sincerely,

Alvin Yuen, P.Eng.
Senior Environmental Assessment Administrator

cc: B. Pollock, Ministry of Environment, Environmental Assessment and Stewardship Branch
K. Bolton, Government Relations, Lands and Consultation
Aboriginal Affairs, Ministry of Environment, Aboriginal Affairs Unit

Government of Saskatchewan

Ministry of Highways and Infrastructure
Box 3003, 800 Central Avenue
Prince Albert, SK S6V 6G1

April 28, 2017

[Community]
[Address]

Dear [Community Leadership or Representative],

Re: Highway 914 Extension Project

The Saskatchewan Ministry of Environment (SK MOE) provided a consultation notification on December 22, 2016 notifying communities that procedural aspects of the consultation process have been delegated to the Saskatchewan Ministry of Highways and Infrastructure (SK MHI) for the proposed Highway 914 Extension Project (the Project). As a follow-up to this consultation notification, this letter is being sent to you to provide an update on the Project, a summary of previous engagement with your community for the Project, and to provide your community with additional opportunities for feedback and participation.

Project Background

SK MHI is proposing a highway extension project consisting of the construction and operation of approximately 51 km of all-weather roadway that will extend Highway 914 starting near the McArthur River uranium mine site to an existing road near the Cigar Lake uranium mine site. Additionally, SK MHI is considering a by-pass route option (as an alternative to a portion of the preferred route), approximately 14 km in length, to avoid the McArthur River uranium mine site surface lease. If the McArthur River By-pass option is selected as part of the final preferred route, the roadway would be approximately 54 km in length. When completed, the roadway will become part of the public road network in the area. It should be noted that the SK MOE's consultation notification that was sent on December 22, 2016 indicated that a 5 km by-pass around the Key Lake uranium mill site was a part of the Project; however, this component has been removed from the Project. An overview map of the Project is attached with this letter.

SK MHI has retained Stantec Consulting Ltd. (Stantec), an environmental and engineering company, to conduct an independent, third-party environmental assessment of the Project for submission to the SK MOE. The components considered in the environmental assessment process include the construction, operation, and decommissioning phases of the Project. The environmental assessment will look at the possible effects the Project may have to land, water, plants, animals, fish, people, traditional land use, and communities.

The Project was initiated by SK MHI in February 2010 with the submission of a Project Proposal to the SK MOE and Canadian Environmental Assessment Agency. Several years have passed since the submission of the Project Proposal to the regulators in 2010. As such, the Project has been subject to several changes. The most notable changes include deferral and restart of the Project; assessment of alternative route and by-pass options; modification to the preferred route; and changes to regulatory requirements, including the termination of the comprehensive study of the Project pursuant to the former *Canadian Environmental Assessment Act*. The Project continues to be subject to a provincial-level environmental assessment under Saskatchewan's *The Environmental Assessment Act* legislation.

Previous Engagement

[Summary of Previous Engagement Specific to Community]

This feedback will be addressed, along with any new feedback you may have, and will assist with Project planning and development of the environmental assessment. A section of the Environmental Impact Statement will be dedicated to summarizing engagement throughout the Project, including potential adverse effects of the Project identified by your community and what actions have been integrated into the Project to avoid or mitigate those potential effects.

What is Happening Now?

The Project is being assessed under Saskatchewan's *The Environmental Assessment Act*. As part of the ongoing assessment, key tasks that have been completed or are currently underway for the Project include:

- Environmental Surveys:
    - Aerial caribou and ungulate
    - Aerial waterbird and raptor
    - Rare plant and wetland
    - Stream crossing and fish habitat
    - Heritage resource (archaeology)
- Indigenous and public engagement to inform potentially affected communities and gather their input on the Project, as well as identify any potential adverse effects to the community's ability to hunt, fish, and trap for food and to carry out traditional uses in the Project area

Information gathered during environmental surveys, indigenous and public engagement activities, and traditional land use studies will be used to prepare an Environmental Impact Statement for submission to the SK MOE.

Project Schedule

Environmental surveys were completed in Fall 2016 and engagement activities will continue through the Spring 2017. SK MHI plans to submit the Environmental Impact Statement in mid-2017. Following the completion of the Environmental Assessment and submission of the Environmental Impact Statement, detailed engineering design and construction will be undertaken. It is estimated that the completion of construction activities will take approximately three years. As this project has not been approved and the construction start date has not been determined, Table 1 provides a general idea of the sequence of activities associated with the regulatory approvals and construction of the project.

Table 1 Anticipated Highway 914 Extension Project Schedule

Activity	Tentative Schedule
Environmental surveys	Complete
Aboriginal engagement and community consultation	Spring 2017
Submission of Environmental Impact Statement	Mid 2017
Technical review of Environmental Impact Statement and 30-day public comment period	Summer 2017
Environmental Impact Statement approval decision (Ministerial Decision)	Fall 2017*
Geotechnical and granular testing	Year 1
Roadway design, Right-of-way (ROW) acquisition and surveying	Year 1
Route centreline establishment	Year 1
ROW clearing and construction	Year 2
Commencement of operation	Year 3
Cleanup and remediation	Year 3

***Schedule has the potential to be delayed depending on the results of engagement, consultation, and the technical review of the Environmental Impact Statement**

Opportunities for Feedback and Participation

SK MHI is committed to keeping you informed about the Project as it progresses and we welcome any feedback that you would like to provide. This may include, but is not limited to perspectives of the Project, Traditional Land Use Information, or any questions you may have about the Project.

Closure

Your views and input are important for the successful development of this Project and we hope that your community will participate in the engagement process.

Should you have any questions or comments about the project or the engagement process, please contact Lauren Stead at MHIengages@stantec.com or 306-667-2493. Inquiries and feedback can also be mailed to:

Stantec Consulting Ltd
100-75 24th Street East
Saskatoon, SK S7K 0K3

or faxed to: (306) 667-2500, Attention: Lauren Stead.

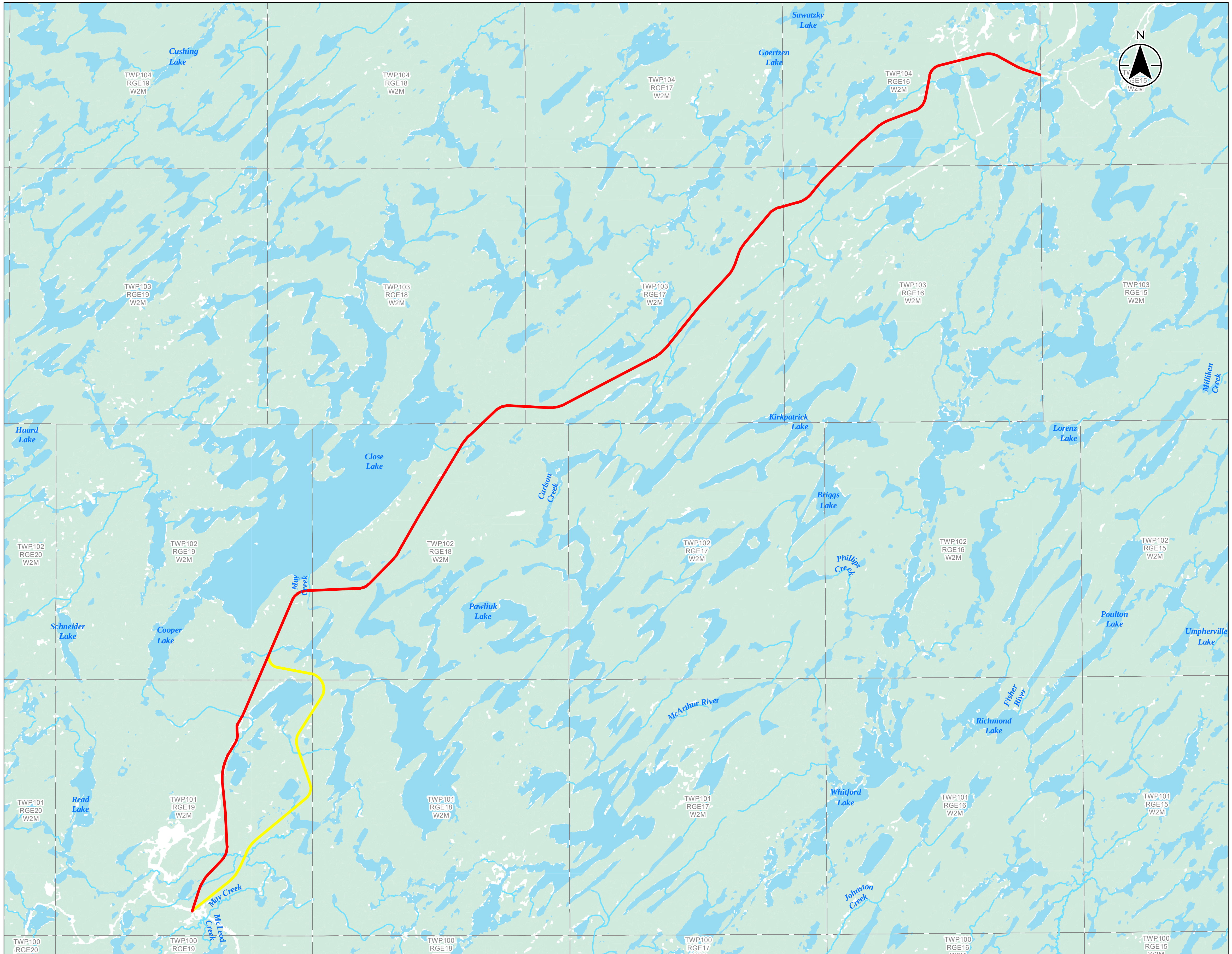
We request that all formal responses be received in writing by **June 2, 2017**.

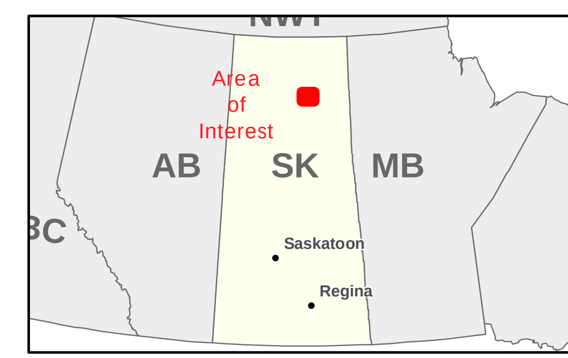
Thank you for your continued feedback on this Project. We appreciate any information you can provide for the completion of our study.

Sincerely,

Alison Lara

Alison Lara, P.Eng.
Senior Project Manager
Ministry of Highways and Infrastructure
Northern Region





- McArthur River By-pass Option
- Preferred Route
- Watercourse
- Waterbody
- Wooded Area
- Township

0 2.5 5 Kilometres

1:150,000 (At original document size of 11x17)

Notes
1. Coordinate System: NAD 1983 UTM Zone 13N
2. Base features: Produced under license from the Government of Saskatchewan

Project Location
Northern Saskatchewan

113253645-031 REVB
Prepared by clee on 2016-05-02
Independent Review by Jordan Hennig on 2016-05-02

Client/Project
MINISTRY OF HIGHWAYS AND INFRASTRUCTURE
HIGHWAY 914

Figure No.
1

Title
Highway 914 Extension Preferred Route and McArthur River By-pass

Government of Saskatchewan

Ministry of Highways and Infrastructure
#18 – 3603 Millar Ave.
Saskatoon, Sk, S7P 0B2

August 16, 2019

[Community]
[Address]

Digital copy emailed to [Email Address]

Dear [Community Leadership or Representative]

Re: Highway 914 Extension Project Update

The Saskatchewan Ministry of Highways and Infrastructure (SK MHI) is nearing completion of the environmental assessment for the proposed Highway 914 Extension Project (the Project). As such, MHI would like to provide an update on the Project and a summary of engagement to date. Information packages were distributed to community leadership on April 28, 2017 and, although Project components and activities have not changed, the following Project background has been provided again for your records.

Project Background

SK MHI is proposing a highway extension project consisting of the construction and operation of an approximately 51 km-long all-weather roadway that will extend Highway 914 from near the McArthur River uranium mine to an existing road near the Cigar Lake uranium mine. An overview map of the Project is attached with this letter. Additionally, SK MHI is considering a by-pass route option (as an alternative to a portion of the preferred route), approximately 14 km in length, to avoid the McArthur River uranium mine's surface lease. If the McArthur River By-pass option is selected as part of the final preferred route, the roadway would be approximately 54 km in length. When completed, the roadway will become part of the public road network in the area and be accessible by the public. The Project was initiated by SK MHI in February 2010 with the submission of a Project Proposal to the SK MOE and Canadian Environmental Assessment Agency.

Several years have passed since the submission of the Project Proposal to the regulators in 2010. As such, the Project has been subject to several changes. The most notable changes include deferral and restart of the Project; assessment of alternative route and by-pass options; modification to the preferred route; and changes to regulatory requirements, including the termination of the comprehensive study of the Project pursuant to the former *Canadian Environmental Assessment Act*. A provincial environmental assessment is still required. Stantec Consulting Ltd. (Stantec) was retained by SK MHI to conduct an independent, third-party environmental assessment of the Project pursuant to provincial environmental leglislation. The environmental assessment is nearing completion and will result in the submission of an Environmental Impact Statement to the Saskatchewan Ministry of Environment (SK MOE). In the Fall of 2019, the Project will be submitted for a provincial-level review under Saskatchewan's *The Environmental Assessment Act* legislation. The components considered in the environmental assessment process include the construction, operation, and decommissioning phases of the Project and the potential effects the Project may have to water, land, plants, animals, fish, traditional land use, heritage resources, people, and communities.

Previous Engagement

[Summary of Previous Engagement Specific to Community]

The feedback provided by [Community] in 2011 and 2017 was considered during the environmental assessment and will assist with Project planning activities. A section of the Environmental Impact Statement will be dedicated to summarizing engagement throughout the Project, including potential adverse effects of the Project identified by your community and what actions have been integrated into the Project to avoid or mitigate those potential effects.

What is Happening Now?

The Environmental Impact Statement for the Project is being completed and will be submitted to the SK MOE for review and approval by the Minister of Environment. Project details as well as the information gathered during environmental surveys, Indigenous and public engagement activities, and traditional land use studies will be used to prepare an Environmental Impact Statement for submission to the SK MOE.

Once the Environmental Impact Statement has been submitted to the SK MOE, the Environmental Assessment and Stewardship Branch will review the document for technical accuracy and provide comments to SK MHI. Following this review, the document will be made available for review by Indigenous communities and the public.

Ministry of Highways and Infrastructure
#18 – 3603 Millar Ave.
Saskatoon, Sk, S7P 0B2

Project Schedule

SK MHI plans to submit the Environmental Impact Statement in Fall 2019. Following the completion of the Environmental Assessment and submission of the Environmental Impact Statement, detailed engineering design will occur, and construction will be undertaken, pending funding for the Project. Currently, the Project has not received funding and there is no timeline for the start of construction. Once funding is secured and construction begins, it is estimated that construction activities will take approximately three years to complete. Table 1 provides a general idea of the sequence of activities associated with the regulatory approvals and construction of the project.

Table 1 Anticipated Highway 914 Extension Project Schedule

Activity	Tentative Schedule
Submission of Environmental Impact Statement	Fall 2019
Technical review of Environmental Impact Statement and 30-day public comment period	Winter 2019
Environmental Impact Statement approval decision (Ministerial Decision)	Winter 2019
Geotechnical and granular testing	Year 1
Roadway design, Right-of-way (ROW) acquisition and surveying	Year 1
Route centreline establishment	Year 1
ROW clearing and construction	Year 2
Commencement of operation	Year 3
Cleanup and remediation	Year 3

Opportunities for Feedback and Participation

Should [Community] wish to identify any concerns regarding potential adverse effects of the Project to their ability to exercise Treaty or Aboriginal Rights, including the right to hunt, fish, and trap for food and carry out traditional uses, we would welcome [Community] to share those concerns with us. We would appreciate a timely response so that information can be incorporated into the Environmental Impact Statement before submission in Fall 2019.

Government of Saskatchewan

Ministry of Highways and Infrastructure
#18 – 3603 Millar Ave.
Saskatoon, Sk, S7P 0B2

Closure

Should you have any questions or comments about the project or the engagement process, please contact Lauren Stead at MHIengages@stantec.com or 306-667-2493. Inquiries and feedback can also be mailed to:

Stantec Consulting Ltd
100-75 24th Street East
Saskatoon, SK S7K 0K3

or faxed to: (306) 667-2500, Attention: Lauren Stead.

We request that all formal responses be received in writing by **September 13, 2019**.

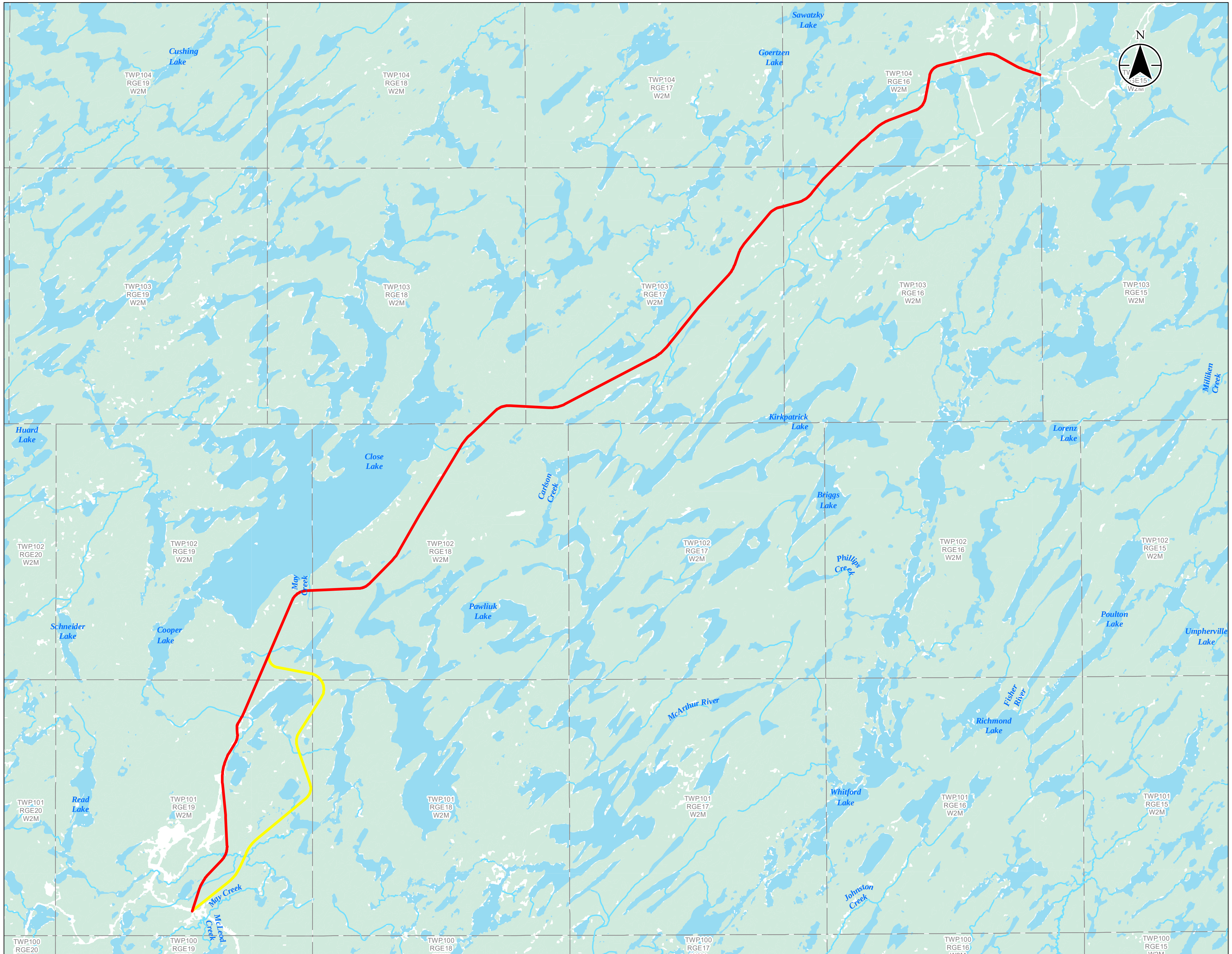
Thank you for your continued feedback on this Project. We appreciate any information you can provide for the completion of our study.

Sincerely,

Adrien Blais

Adrien Blais, P.Eng.
Senior Project Manager
Design Branch
Ministry of Highways and Infrastructure

cc. [Métis Regional Director (for letters to Métis communities)]
Jordan Hennig, Stantec
Lauren Stead, Stantec
Tracey Leibel, Director, Design Branch
Terri Arendt, Executive Director, Design Branch

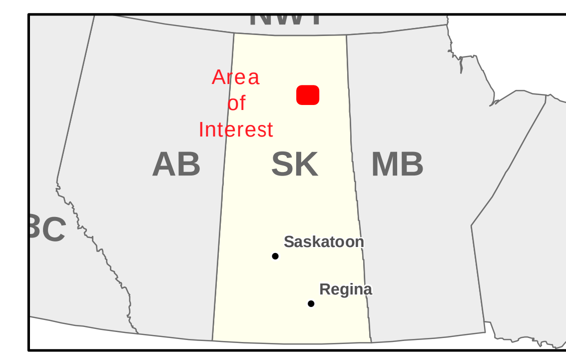


Stantec

- McArthur River By-pass Option
- Preferred Route
- Watercourse
- Waterbody
- Wooded Area
- Township

0 2.5 5 Kilometres
1:150,000 (At original document size of 11x17)

Notes
1. Coordinate System: NAD 1983 UTM Zone 13N
2. Base features: Produced under license from the Government of Saskatchewan



Project Location
Northern Saskatchewan

113253645-031 REVB
Prepared by clee on 2016-05-02
Independent Review by Jordan Hennig on 2016-05-02

Client/Project
MINISTRY OF HIGHWAYS AND INFRASTRUCTURE
HIGHWAY 914

Figure No.
1

Title
Highway 914 Extension Preferred Route and McArthur River By-pass

Highway 905 Stony Rapids to Lake Athabasca near Fond du Lac
Highway 914 McArthur River to Cigar Lake

Information Package

Saskatchewan Highways wishes to build two new all-weather highways in northern Saskatchewan. One is Highway 905 (Stony Rapids to Fond-du-Lac) and the other is Highway 914 (McArthur River to Cigar Lake). A map showing the two proposed roads is attached.

These two highways are described below.

Highway 905

This highway is an all weather road from Stony Rapids to a point on the south shore of Lake Athabasca near Fond du Lac located on Fond du Lac Reserve 223 and 228. The first 31.9 km of the project will follow parts of an existing winter road west of Stony Rapids; the remaining 56.6 km of the all weather road will be new construction. The purpose of the project is to provide more efficient transportation of goods and services to Fond du Lac.

A map is attached.

Highway 914

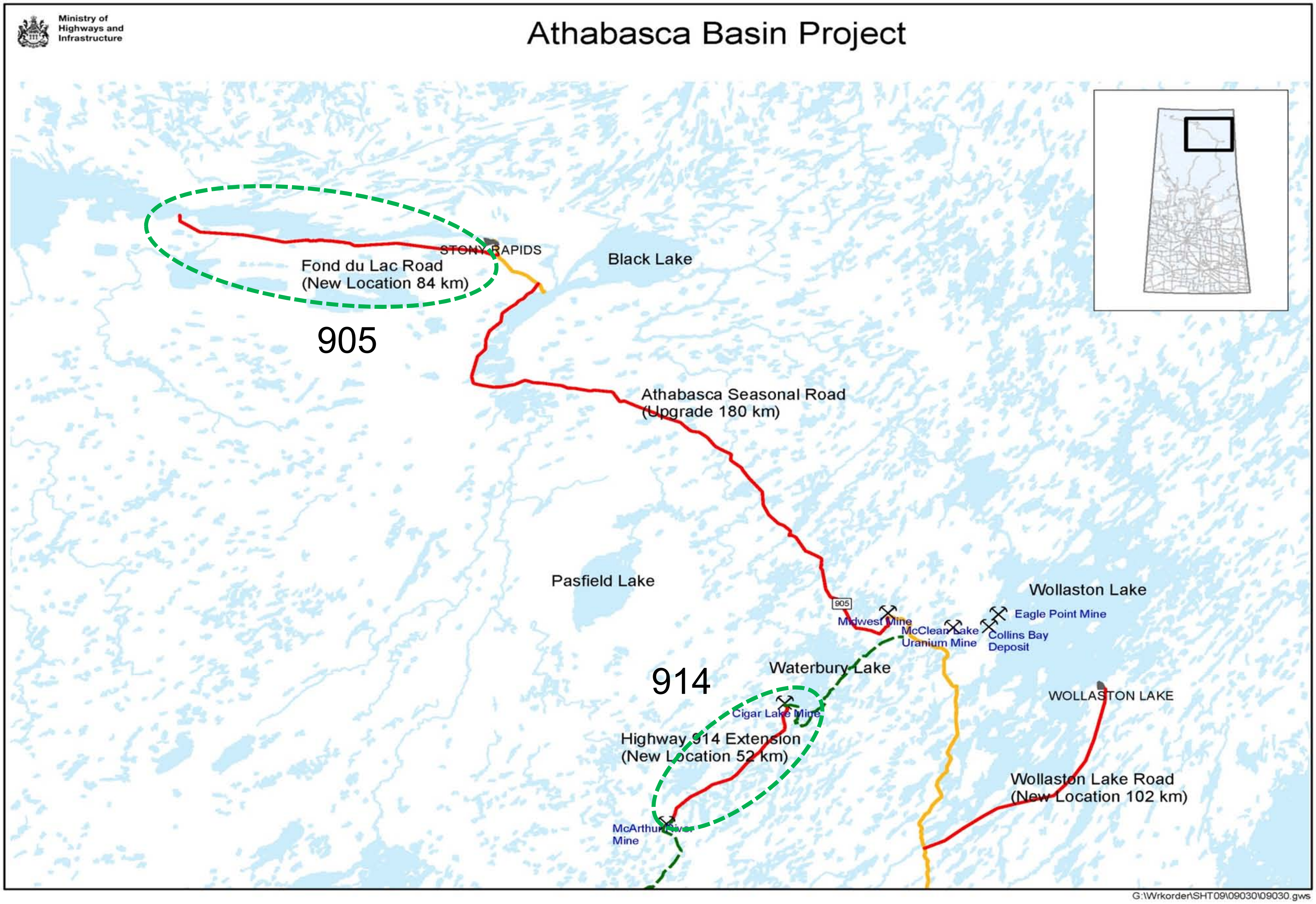
This highway is an all weather roadway commencing at a point near the McArthur River Mine Site and connecting to an existing private Cameco access road near the Cigar Lake Mine Site in northern Saskatchewan. The only access between the locations right now consists of an undeveloped winter trail that is no longer used. The project will establish 51.71 km of all weather roadway in an entirely new location and will avoid entering areas currently considered within the limits of the two mine sites. The purpose of the project is to provide a more efficient route for traffic to access mines operated by Cameco and others in northern Saskatchewan. Highway 914 will be opened as a public roadway after construction of the connector is complete. Ring roads will be constructed around the mine sites.

A map is attached.

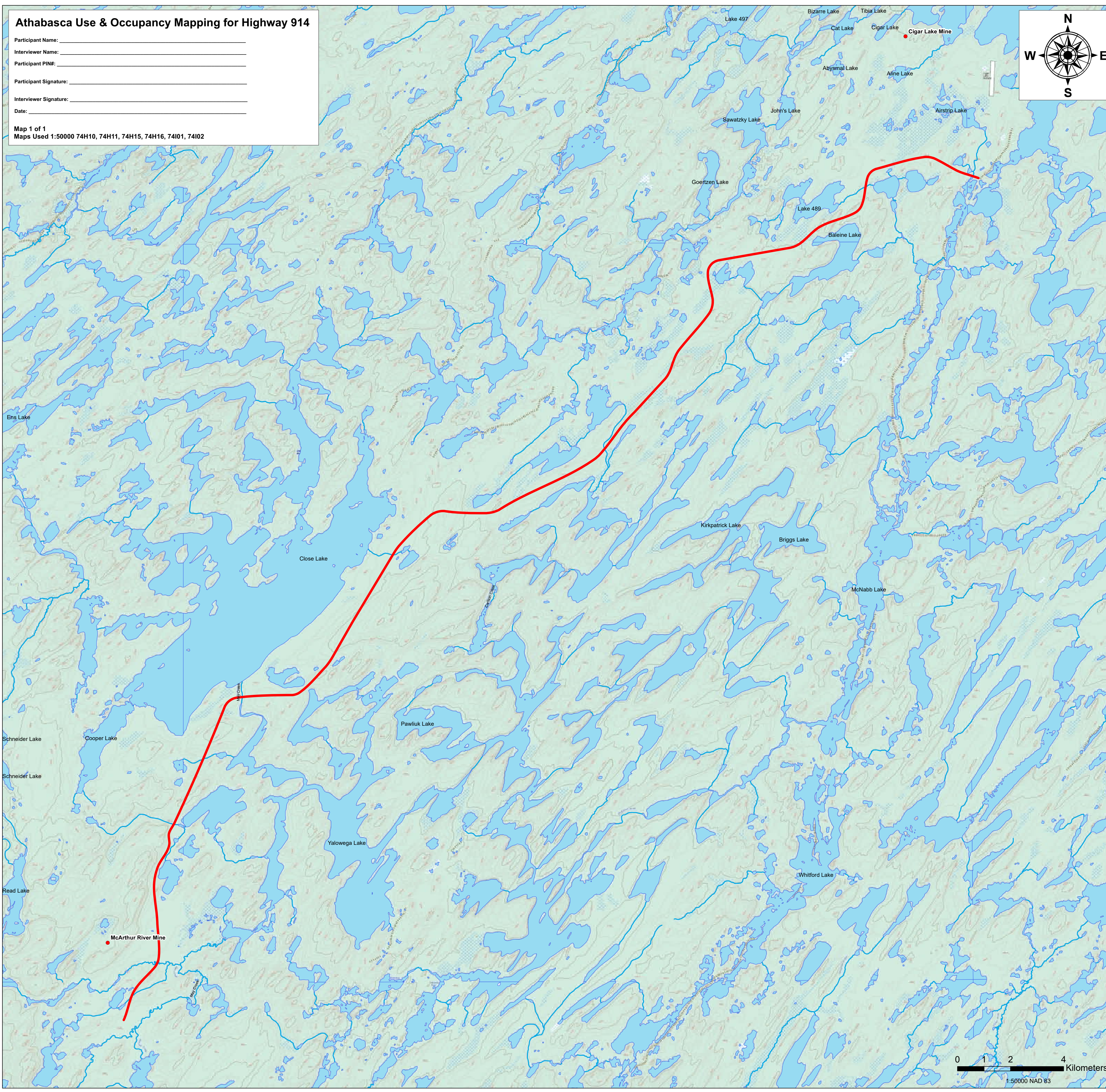
Next Steps

On behalf of Highways, Stantec Consulting Ltd is conducting an Environmental Impact Assessment for the two roads. This study will look at all the possible impacts the construction of the roads may have to land, water, plants, animals, people, and communities.

Saskatchewan Ministry of Highways and Infrastructure



Proposed Highway 905
Maps Used 1:50000 74O01, 74O02, 74O03,
74O04, 74O05, 74O06, 74O07, 74O08, 74P04, 74P05
N
W
E
S
English Lake
Temple Lake
Maguire Lake
Bates Lake
Duane Lake
Talkington Lake
Megaffin Lake
McCombie Lake
Stratychuk Lake
Riesen Lake
Lowe Lake
Simpson Lake
Tolver Lake
McKenzie Lake
McNair Lake
Trithart Lake
Rehill Lake
Vossen Lake
Turcotte Lake
Vincent Lake
Storozuk Lake
FOND DU LAC INDIAN RESERVE #351
Brager Lake
Rayner Lake
Kowbel Lake
Todos Lake
Harvey Lake
Schull Lake
Fond-du-Lac
Lake Athabasca
Tederoff Lake
Malinoski Lake
Lake Athabasca
Locke Lake
Otherside River
Linklater Lake
Moore Lake
Richard Lake
Munroe Lake
Engler Lake
Riou Lake
Pratt Lake
Fenuik Lake
Lindstad Lake
Koshney Lake
West Hawkes Lake
East Hawkes Lake
Jaeger Lake
Prokopchuk Lake
MacLachlan Lake
Scharfe Lake
Rheillander Lake
Brooks Lake
Clut Lakes
Coughlin Lake
Honsvall Lake
Owens Lake
Konkol Lake
McClelland Lake
MacGilivary Lake
Griffi Lake
Hardie Lake
Rosinski Lake
Kostenly Lake
Stony Rapids
Stoney Lake
Woodward Lake
CHICKEN INDIAN RESERVE #359
Black Lake
Raibl Lakes
Black Lake
Richie Lake
Black Lake
Hocking Lake
0 1 2 4
Kilometers
1:100000 NAD 83



Athabasca Use & Occupancy Mapping for Highway 914
Participant Name:
Interviewer Name:
Participant PIN#:
Participant Signature:
Interviewer Signature:
Date:
Map 1 of 1
Maps Used 1:50000 74H10, 74H11, 74H15, 74H16, 74I01, 74I02
N
W
E
S
Lake 497
Bizarre Lake
Tibia Lake
Cat Lake
Cigar Lake
Cigar Lake Mine
Abysmal Lake
Aline Lake
John's Lake
Sawatzky Lake
Airstrip Lake
Goertzen Lake
Lake 489
Baleine Lake
Ens Lake
Close Lake
Kirkpatrick Lake
Briggs Lake
McNabb Lake
Pawliuk Lake
Schneider Lake
Cooper Lake
Schneider Lake
Yalowega Lake
Whitford Lake
Read Lake
McArthur River Mine
0
1
2
4
Kilometers
1:50000 NAD 83

Saskatchewan Ministry of Highways and Infrastructure

Environmental Impact Assessments

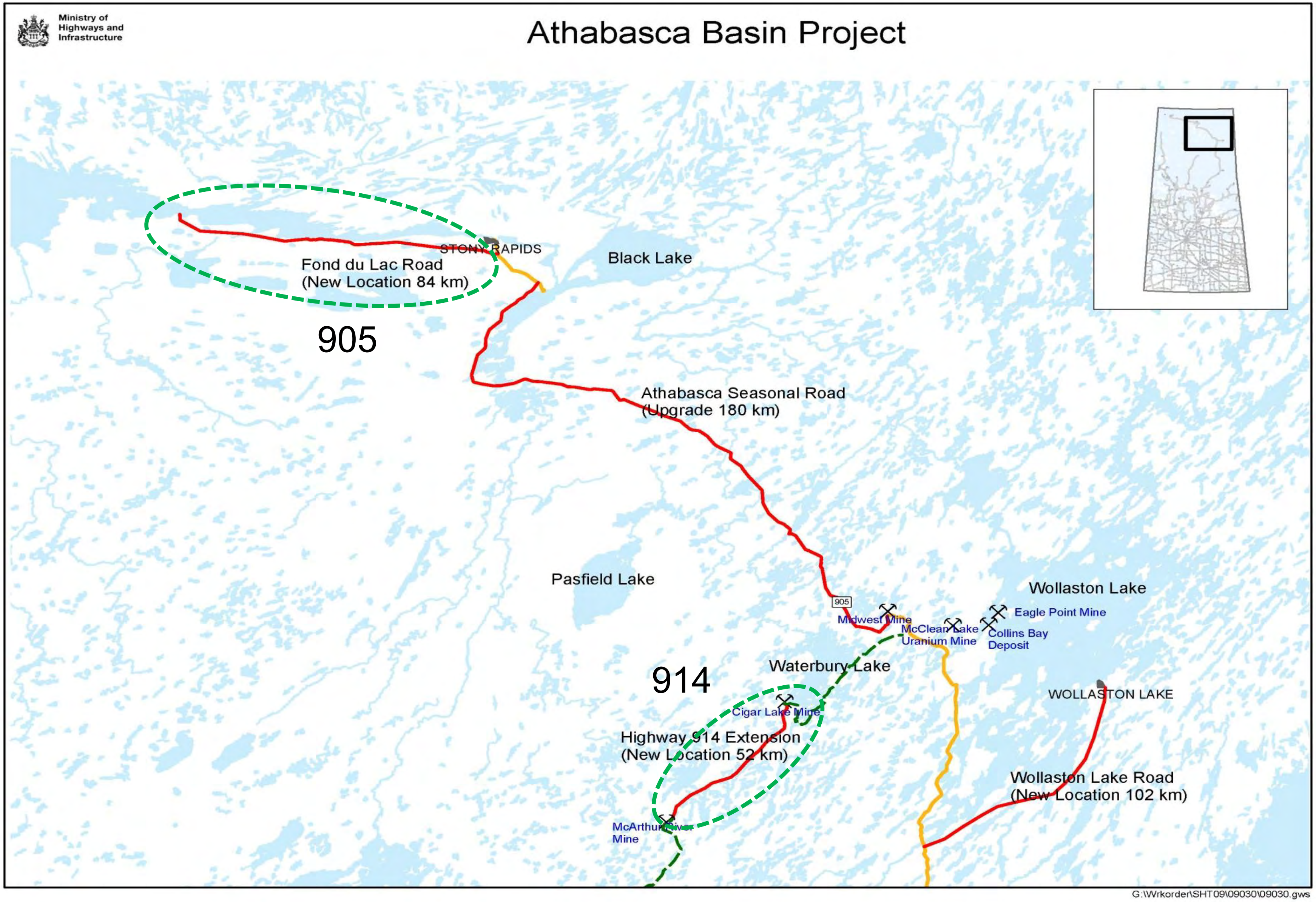
Athabasca Basin

Highway 905,995 and 914

Including the Athabasca Seasonal Road

Saskatchewan Ministry of Highways and Infrastructure

Athabasca Basin Project



Four new all-weather roads in the Athabasca Basin Region have been under discussion for many years. They are:

- Athabasca Seasonal Road Upgrade (180 km);
- Wollaston Lake Road New Construction (102 km);
- Fond Du Lac Road New Construction (85 km); and
- Extension to Highway 914 between McArthur River and Cigar Lake (53 km).

Goals and Objectives of Highway Capital Projects are:

The main goal of road construction is to secure value for money for the province, through the procurement and contract structure chosen, while ensuring the public interest such as health, safety, equality and sustainability are met.

The key objectives are:

- Achieve balanced risk allocation / Promote life cycle management
- Meet or exceed performance specifications
- Establish cost certainty /Achieve “value for money”
- Fulfill commitments and manage expectations

Road Partnerships

Over the past several years, governments have looked at innovative and new ways to procure infrastructure.

There are partnership procurement models that include alternative financing and procurement that is based on a long term, performance-based contract where appropriate risks associated with a project can be transferred cost effectively to a private sector partner.

The Ministry is exploring possible partnership delivery methods with P3Canada.

Athabasca Seasonal Road Upgrade

EIS FOR 905 Points North to Stony
Rapids Completed June 2010

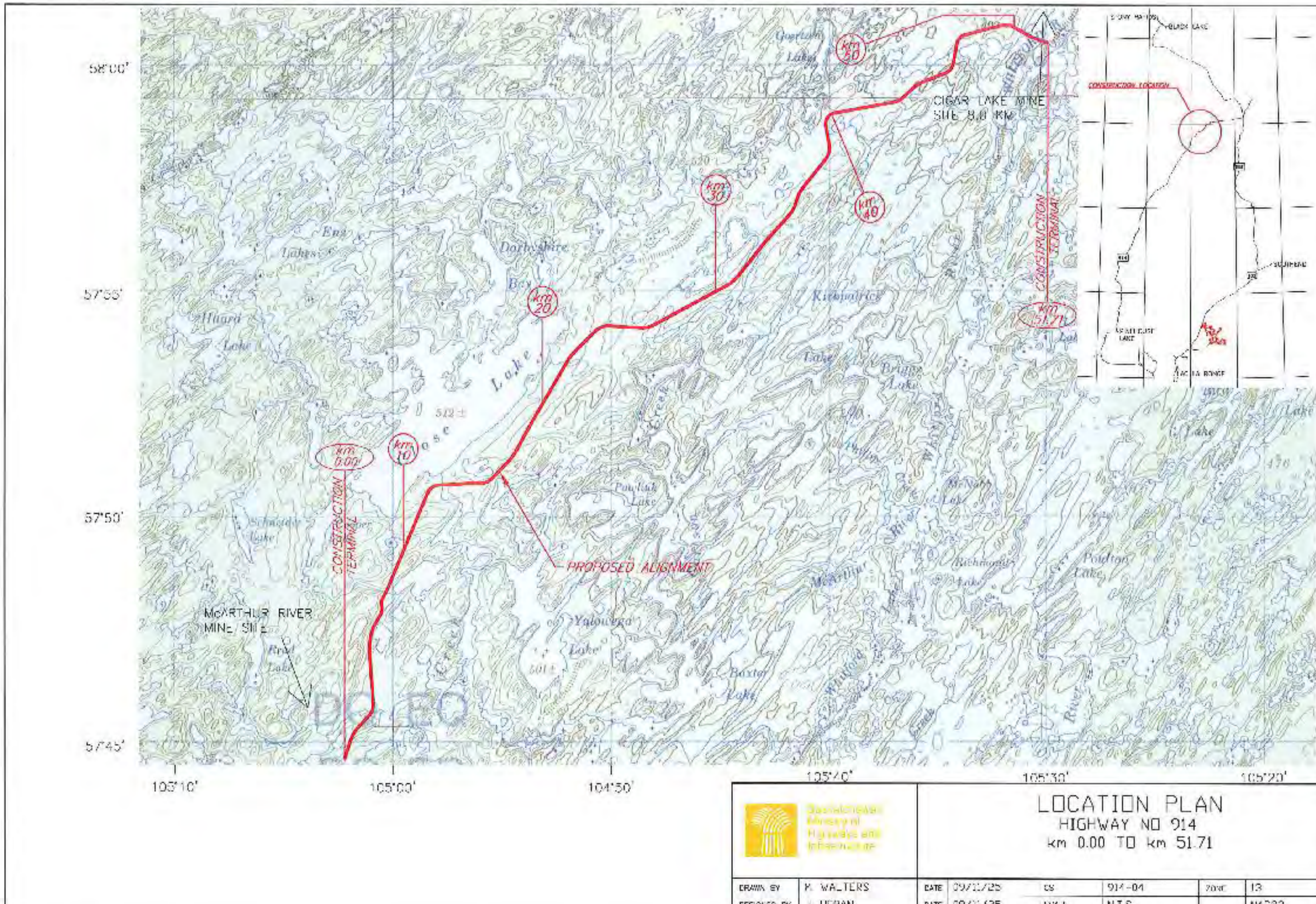
Saskatchewan Ministry of Highways and Infrastructure

Fond Du Lac

- Existing Winter/Ice road is approx 83 km
- Proposed overland road total length is 88.5 km
  - First 31.9 km follows existing winter road location
  - Remaining 56.6 km on entirely new location

Saskatchewan Ministry of Highways and Infrastructure

HWY 914 McArthur River to Cigar Lake 52 km to completion



COMMUNITY OF WOLLASTON
and
HATCHET LAKE DENESULINE FIRST NATION

Highway 995 Up Date

- Work is progressing with 10 km completed and an additional 4 Km is in contract to Silvertown Contracting Ltd

- The center line has been cleared for 102 km, and Right way has been cleared to km37

- EIS Completed

All Road Update:

- Community meetings
- Location Reports
- On site location work
- Lidar Imaging Work completed
- Environmental Project Proposal for Ministry of Environment
- EIS started JULY 2010 for Hwy 905-08 and 914-04 completion date September 2011
- BCR signed by Chief and Council for both rights-of-way across reserve land on HWY 905

Upcoming Steps

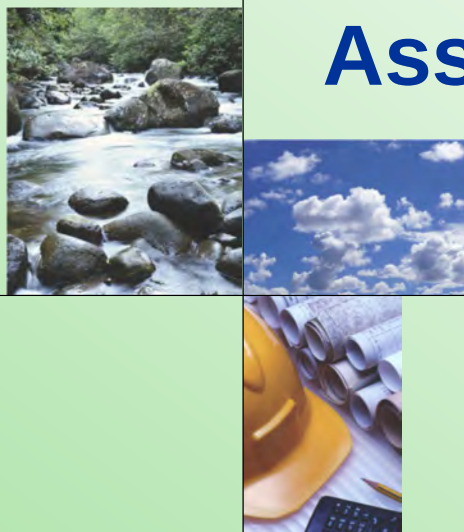
- Environmental Assessment
  - Community consultations
  - Traditional land use studies
  - Wildlife studies
  - Fish surveys/Stream crossing assessments
  - Socio-economical Impacts assessment
  - Etc
- Finalize EIA on Fond Du Lac road and Hwy 914 extension. This positions the Ministry to know all the environmental requirements necessary to move forward on any of the four road projects.

Potential Timelines/Thoughts

- Provincial EIA approvals summer/fall, 2011
- Federal EIA approvals fall/winter, 2011
- Must complete EIA's prior to starting design or construction work.
- Design/construction work not currently scheduled due to EIA completion.

Questions/Discussion

Canadian Environmental Assessment Agency



Federal Environmental Assessment Process

Highways 905 and 914

May 2011

Overview

- When the *Canadian Environmental Assessment Act* applies
- Law List triggers
- Types of EA under the Act
- Comprehensive study steps
- Opportunities for input by the public and Aboriginal groups
- Status of EA process for Highways 905 and 914

Canadian Environmental Assessment Act

A federal law that requires consideration of environmental effects of proposed projects before any actions are taken to allow them to proceed

When Does the *Canadian Environmental Assessment Act* Apply?

Money

Permits / Authorizations

Land

Proponent

Law List Triggers

- Authorizations under subsection 35(2) of the *Fisheries Act* for watercourse crossings (Highways 905 and 914)
- Approvals under section 5 of the *Navigable Waters Protection Act* for watercourse crossings (Highways 905 and 914)
- Interest in land under section 35 of the *Indian Act* to be granted for crossing reserve land (Highway 905 only)

Types of EA under the Act

Screening

Comprehensive Study

Review Panel

Who Does the Comprehensive Studies?

- CEAA was amended through *Jobs and Economic Growth Act* on July 12, 2010
- Non-CNSC and non-NEB projects: the Agency is responsible for conducting the comprehensive studies and preparing the comprehensive study reports (e.g. Highway 905 and Highway 914)

Comprehensive Study Steps

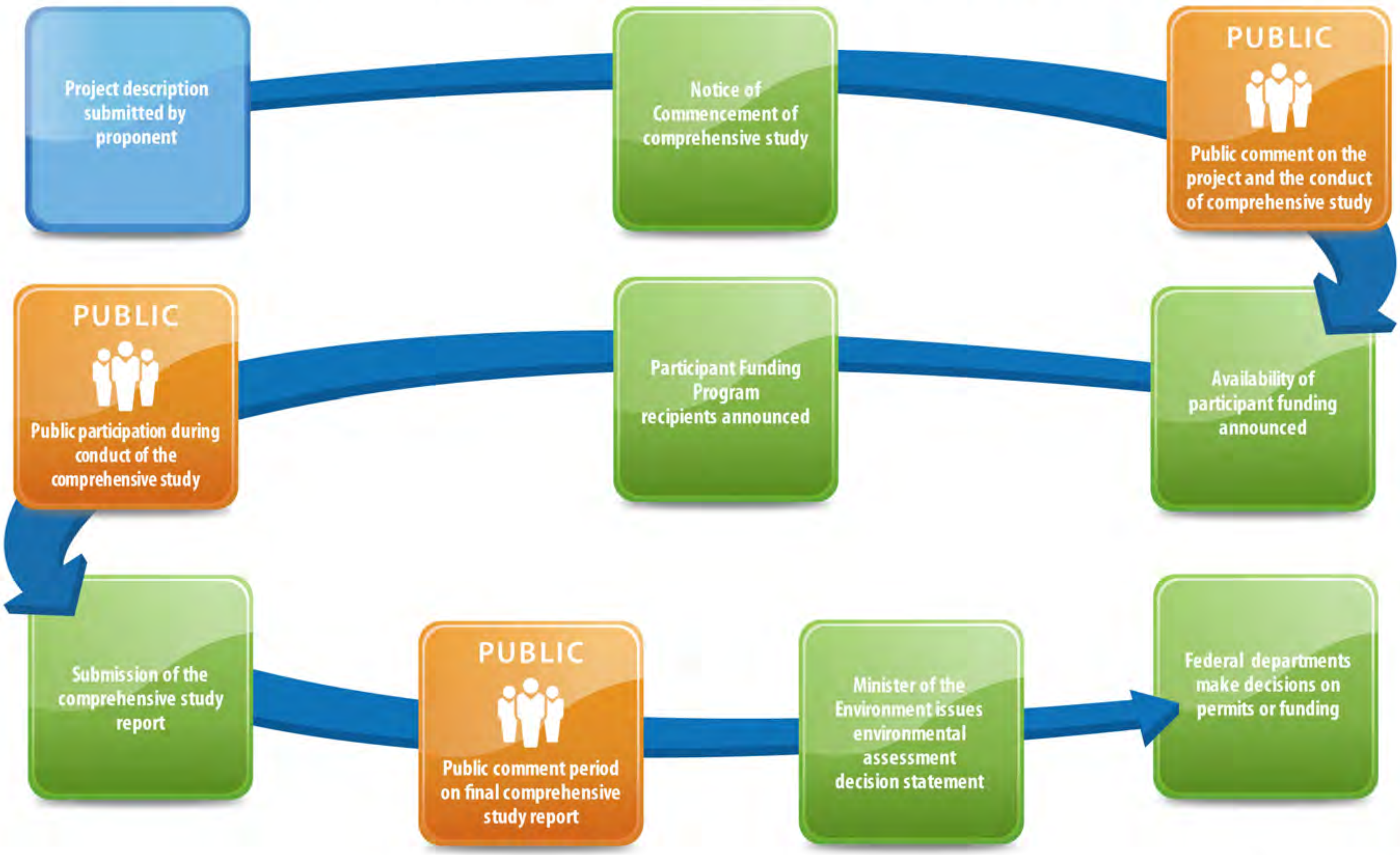
- Submission of project description *(Proponent)*
- Project Specific Guidelines and Scoping Document *(Canada and Saskatchewan)*
- Environmental Impact Statement *(Proponent)*
- Comprehensive Study Report *(Canada)*
- EA Decision by Minister *(Canada)*
- Course of action by federal department(s)

CEAA Requirements for Public Participation (Comprehensive Study)

- Notice of Commencement of comprehensive study
- Public comment on the project and the conduct of the comprehensive study
- Public participation during conduct of the comprehensive study
- Public comment period on final comprehensive study report

FEDERAL ENVIRONMENTAL ASSESSMENT PROCESS

COMPREHENSIVE STUDY UNDER THE *CANADIAN ENVIRONMENTAL ASSESSMENT ACT*



Opportunities for Public input
Federal Responsibilities
Proponent Responsibilities

Canada

Highway 905 Project EA

- January 2010 – proposal submitted by SMHI
- August 2010 – draft Project-Specific Guidelines and Scoping Document released for review and letters sent to potentially affected Aboriginal groups
- September 2010 – Project-Specific Guidelines and Scoping Document finalized
- Next step – submission of EIS

Highway 905 Aboriginal Consultation

- The following Aboriginal groups are being consulted:
  - Fond du Lac Denesuline First Nation
  - Black Lake Denesuline First Nation
  - Lac La Ronge Indian Band
  - Metis Nation Northern Region I
  - Camsell Portage Local #79
  - Stony Rapids Local #80
  - Uranium City Local #50

Highway 914 Project EA

- February 2010 – proposal submitted by SMHI
- October 2010 – draft project specific guidelines and scoping document released for review and letters sent to potentially affected Aboriginal groups
- December 2010 – project specific guidelines and scoping document will be finalized
- Next step – submission of EIS

Highway 914 Aboriginal Consultation

- The following Aboriginal groups are being consulted:
  - Hatchet Lake Denesuline First Nation
  - Black Lake Denesuline First Nation
  - English River First Nation
  - Lac La Ronge Indian Band
  - Peter Ballantyne Cree Nation (Southend)
  - Metis Nation Northern Region I
  - Metis Nation Northern Region II
  - Metis Nation Northern Region III
  - Kineepik Local (Pinehouse #9)

Agency Contacts

Canadian Environmental Assessment Agency
Suite 101-167 Lombard Avenue
Winnipeg, Manitoba R3B 0T6
Tel: (204) 983-5127 Fax: (204) 983-7174

Peter Boothroyd – Project Manager – (204) 984-8020

Myrna O'Soup-Bushie – Senior Aboriginal Advisor – (204) 983-8142

Kristina Farmer – Section Leader – (204) 984-0427

Dan McNaughton – Regional Director – (204) 984-2457

www.ceaa-acee.gc.ca

Traditional Land Use Studies

Highway 905 Stony Rapids to near Fond du Lac

Highway 914 McArthur River to Cigar Lake

One Team. Infinite Solutions

Stantec

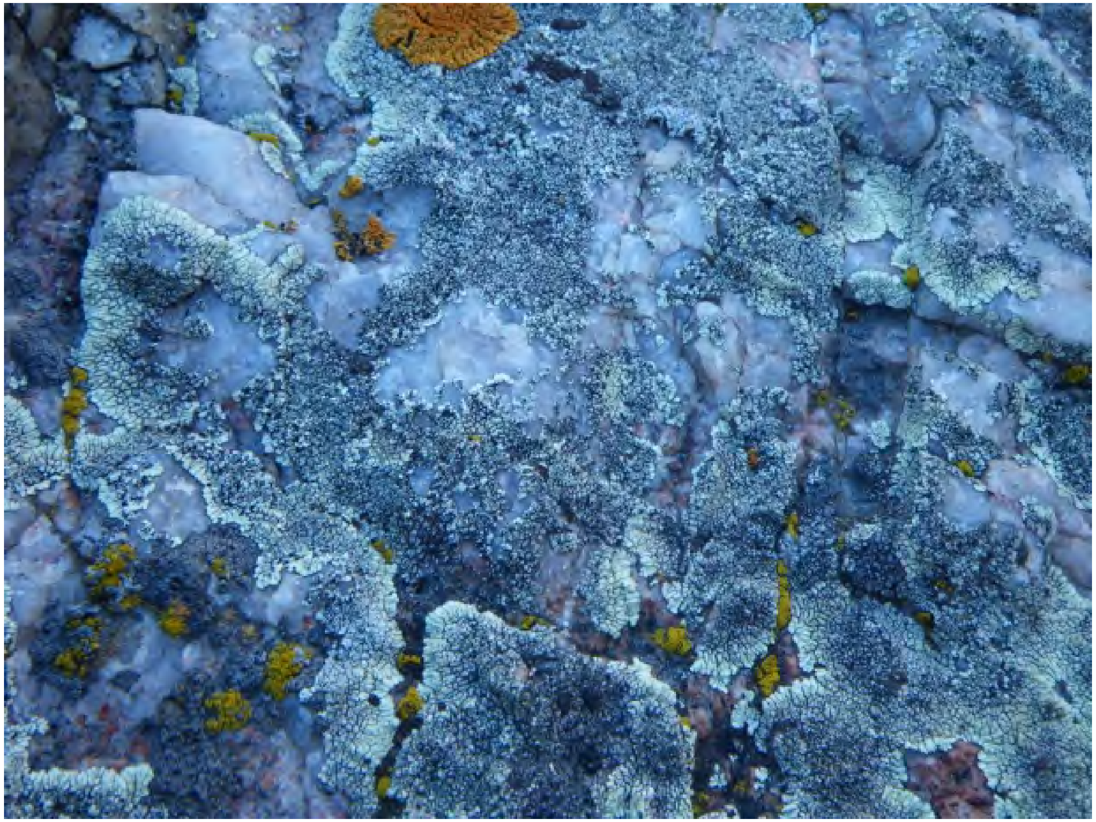
Environmental Assessments

Examining possible impacts to land, water, plants, animals and people

Environmental Assessments

- *Land surface studies*
- *Hydrology*
- *Aquatic resources*
- *Vegetation*
- *Wetlands*
- *Wildlife and fish habitat*
- *Socioeconomic impacts*

Traditional Land Use Studies



Community Involvement in the Planning Process

Questions

One Team. Infinite Solutions

Stantec

Highway 914 Extension Project

June 6, 2017

Stantec

saskatchewan.ca

Saskatchewan

Agenda

1 Introductions and Goals of Presentation
2 Project Overview
3 Environmental Surveys
4 Heritage Resources, Indigenous and Public Engagement, and Traditional Land and Resource Use
5 Next Steps
6 Questions

1 Introductions and Goals of Meeting

1. Provide an overview of the project
2. Discuss previous work completed for the project
3. Outline project schedule and next steps

2 Project Overview

- Project History
- Current Project Details
- Preferred Route and McArthur River Bypass
- Regulatory Status
- Project Schedule

2 Project Overview - History

- **2010 –** Project Initiation and submission of Project Proposal to the MOE
- **2010 to 2011** – Environmental and heritage resource field surveys, public engagement and traditional land and resource use studies, Project Specific Guidelines issued by the MOE in January 2011
- **2012 to 2014 –** Project deferral
- **2015 –** Alternative route studies and field surveys, and addition of McArthur River Bypass
- **2016 –** Environmental and heritage resource field surveys, heritage resource impact assessment
- **2017 –** Indigenous engagement, community consultation, and EIS completion

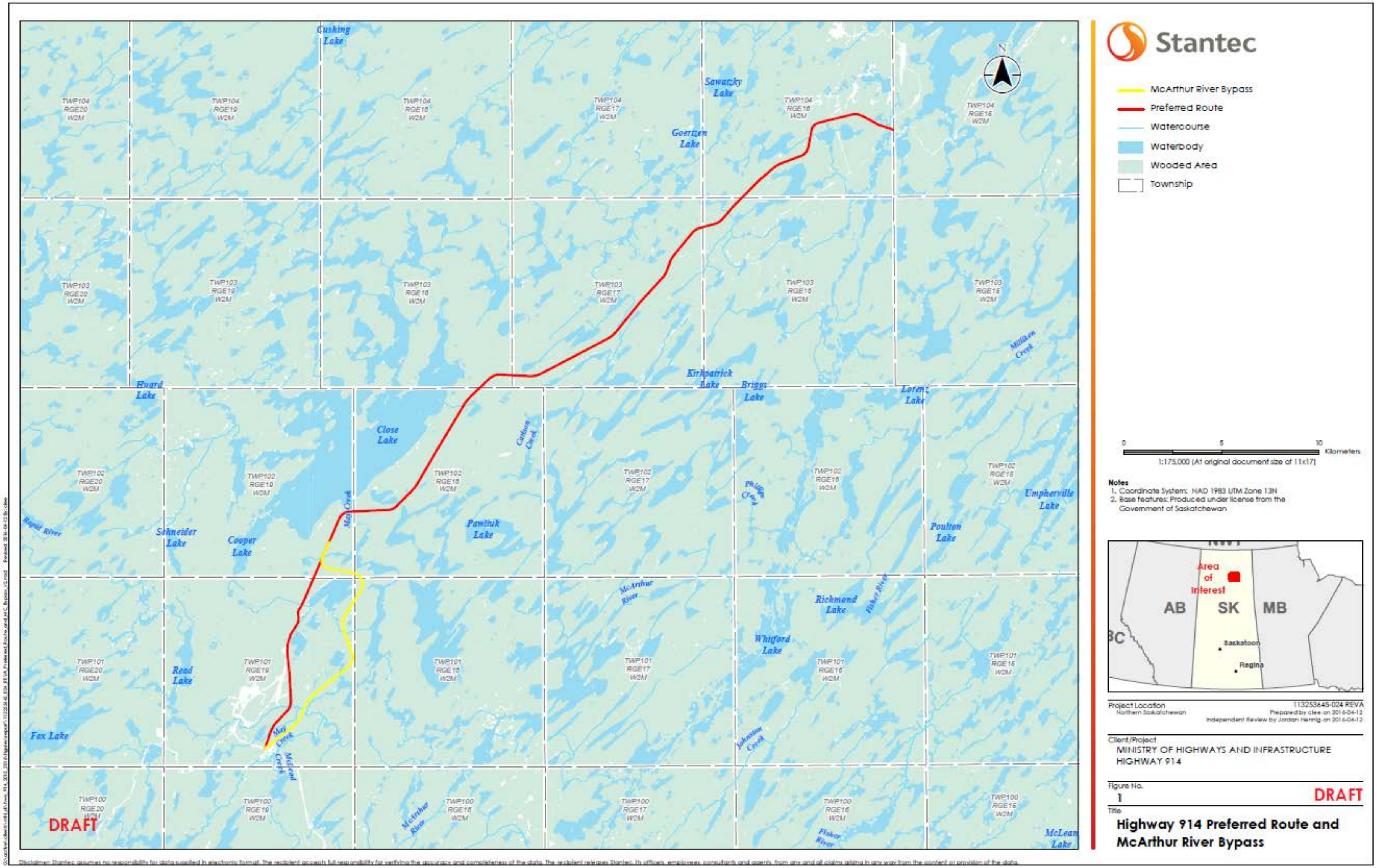
2 Project Overview – Current Project Details

The project is a 50.7 km long all weather roadway between Cameco's McArthur River and Cigar Lake mine sites

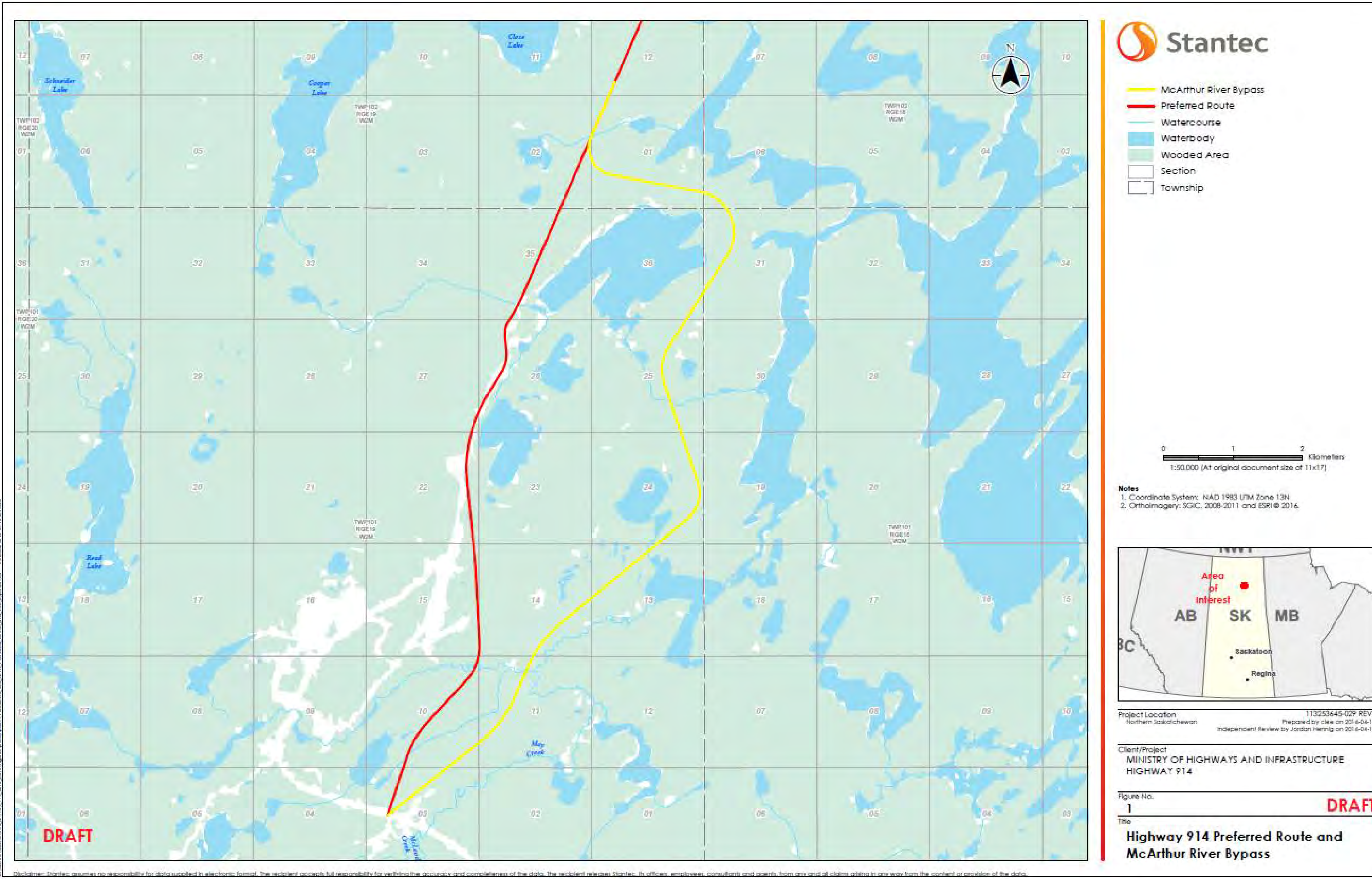
Other Project details:

- **14.4 km** bypass option around the McArthur River surface lease
- **46 m** wide right-of-way
- **8 m** wide road surface
- **8%** maximum vertical gradient
- **3 year** construction schedule

2 Project Overview – Preferred Route and McArthur River Bypass



2 Project Overview – McArthur River Bypass



2 Project Overview – Regulatory Status

- Project Proposal submitted to the EAB in 2010
- Project was subject to EA requirements under the Saskatchewan *The Environmental Assessment Act* and the *Canadian Environmental Assessment Act*, 1992
- Project Specific Guidelines were issued by the MOE in January 2011
- Terms of Reference were submitted to and approved by the MOE in 2016
- MHI continues to work with regulators on this Project

3 Environmental Field Surveys

2010/2011 Field Surveys:

- Aerial Ungulate
- Rare plant and Wetland
- Aerial Raptor
- Stream Crossing and Aquatics
- Archaeology/Heritage Resources

2015/2016 Field Surveys:

- Route Reconnaissance
- Aerial Caribou
- Aerial Raptor
- Rare Plant and Wetland
- Stream Crossing
- Archaeology/Heritage Resources

4 Heritage Resources, Indigenous and Public Engagement, and Traditional Land and Resource Use

- Heritage Resources
- Indigenous and Public Engagement, Traditional Land and Resource Use

4 Heritage Resources, Indigenous and Public Engagement, and Traditional Land and Resource Use

- Archaeology field surveys originally completed in 2010
- Field surveys completed on a new segment of the preferred route and the McArthur River Bypass
- No archaeological resources have been found within the proposed right-of-way along the preferred route.

4 Heritage Resources, Indigenous and Public Engagement, and Traditional Land and Resource Use

- Meetings were held with twenty-two groups located in twelve communities across Northern Saskatchewan
- The Prince Albert Grand Council, Athabasca Lands Office completed a limited traditional land and resource use study for the project
- Project update letters were sent to potentially interested communities in April 2017

4 Heritage Resources, Indigenous and Public Engagement, and Traditional Land and Resource Use

- One meeting with LLRIB in 2010
- One meeting with LLRIB in 2011
- LRMB was to outline a process on how to determine potential project related effects
- Expressed a desire to participate in consultation and traditional land use studies
- Questions were raised concerning the potential project effects on woodland caribou

5 Project Schedule

Activity	Tentative Schedule
Environmental surveys	Complete
Indigenous engagement and community consultation	Spring/Summer 2017
Submission of Environmental Impact Statement	Mid 2017
Environmental Impact Statement approval decision (Ministerial Decision)	Fall 2017*
Geotechnical and granular testing	Year 1
Roadway design, Right-of-way (ROW) acquisition and surveying	Year 1
Route centreline establishment	Year 1
ROW clearing and construction	Year 2
Commencement of operation	Year 3
Cleanup and remediation	Year 3

*Schedule has the potential to be delayed depending on the results of engagement, consultation, and the technical review of the Environmental Impact Statement

5 Next Steps

- Responses to feedback and information requests, and identifying opportunities for participation.
- Development and submission of the EIS in late 2017

6 Questions?

Lauren Stead
MHIengages@stantec.com
306-667-2493

Welcome to the Community Open House for the

Ministry of Highways & Infrastructure Highway 914 Extension Project

October 2, 2017

Stantec

saskatchewan.ca

Saskatchewan

Project Overview - History

- **2010 –** Project Initiation and submission of Project Proposal to the MOE
- **2010 to 2011** – Environmental and heritage resource field surveys, public engagement and traditional land and resource use studies, Project Specific Guidelines issued by CEA Agency and SK MOE in January 2011
- **2012 to 2014 –** Project deferral
- **2015 –** Alternative route studies and field surveys, and addition of McArthur River Bypass
- **2016 –** Environmental and heritage resource field surveys, heritage resource impact assessment
- **2017 –** Indigenous engagement, community consultation, and EIS completion

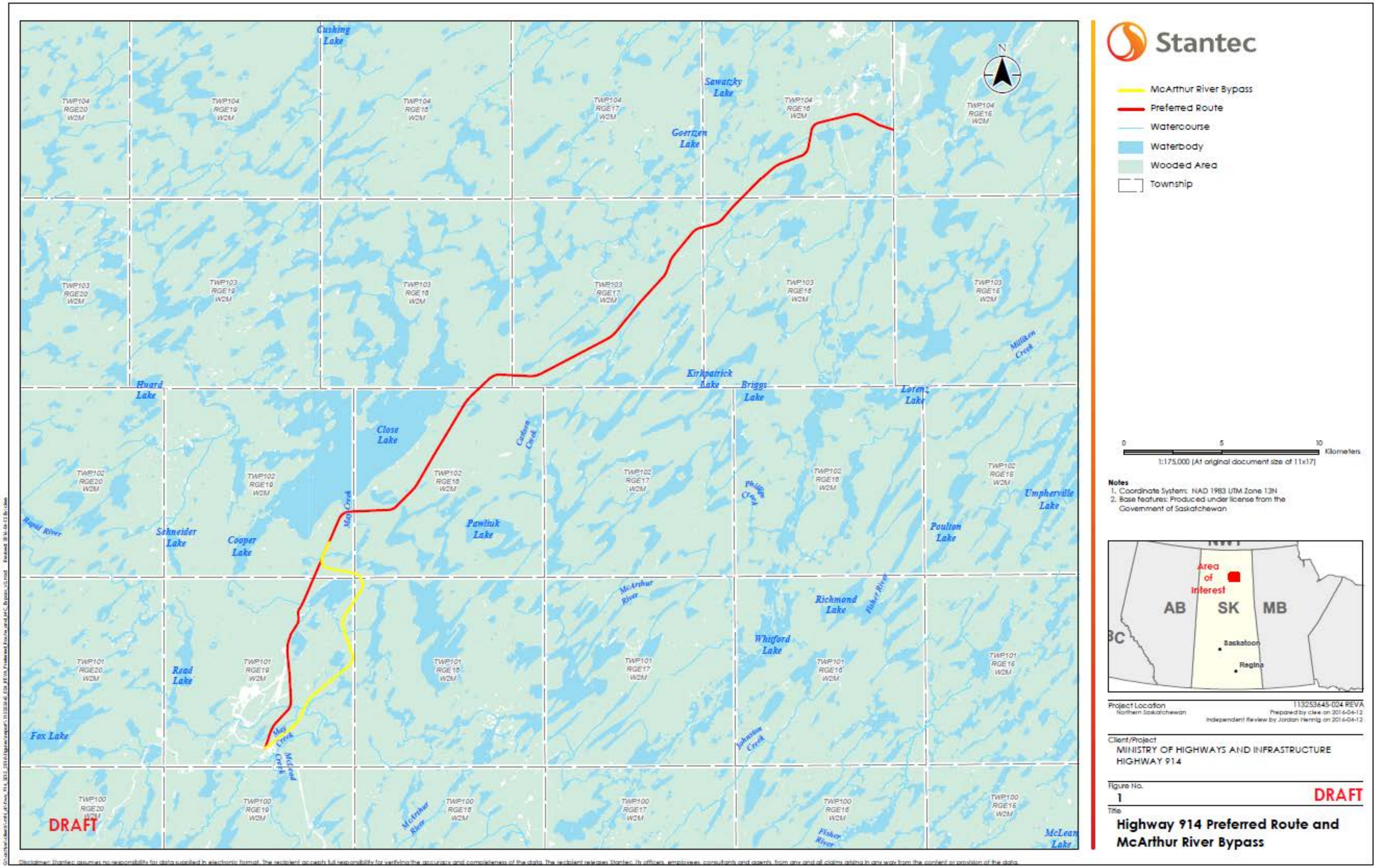
Current Project Details

The project is a 50.7 km long all weather roadway between Cameco's McArthur River and Cigar Lake mine sites

Other Project details:

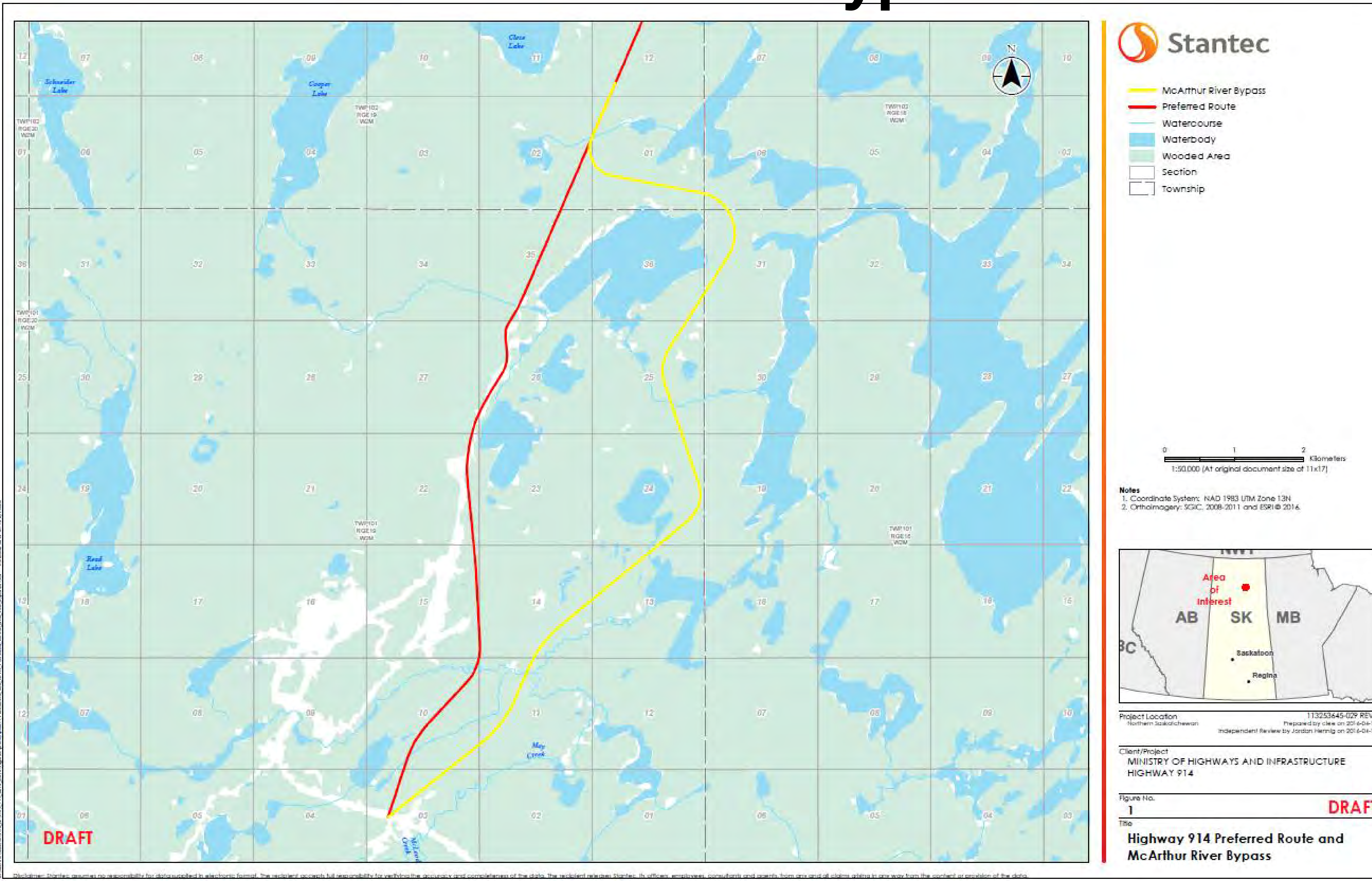
- **14.4 km** bypass option around the McArthur River surface lease
- **46 m** wide right-of-way
- **8 m** wide road surface
- **8%** maximum vertical gradient
- **3 year** construction schedule

Preferred Route and McArthur River Bypass



Saskatchewan

McArthur River Bypass



Regulatory Status

- Project Proposal submitted to the Saskatchewan Environmental Assessment Branch in 2010
- Project was subject to EA requirements under the Saskatchewan *The Environmental Assessment Act* and the *Canadian Environmental Assessment Act (CEAA)*, 1992
- Project Specific Guidelines were issued by CEA Agency and SK Ministry of Environment (MOE) in January 2011
- Further review by CEA Agency indicated that the Project would not be subject to *CEAA*, 2012
- Terms of Reference were submitted to and approved by the SK MOE in 2016
- As Project evolved CEA Agency confirmed in August 2017 that *CEAA*, 2012 would not apply

Environmental Field Surveys

2010/2011 Field Surveys:

- Aerial Ungulate
- Rare plant and Wetland
- Aerial Raptor
- Stream Crossing and Aquatics
- Archaeology/Heritage Resources

2015/2016 Field Surveys:

- Route Reconnaissance
- Aerial Caribou
- Aerial Raptor
- Rare Plant and Wetland
- Stream Crossing
- Archaeology/Heritage Resources

Summary of Previous Engagement

- [Summary of Engagement to Date Specific to Community]

Project Schedule

Activity	Tentative Schedule
Environmental surveys	Complete
Indigenous engagement and community consultation	2017/2018
Submission of Environmental Impact Statement	2018
Environmental Impact Statement approval decision (Ministerial Decision)	2018
Geotechnical and granular testing	Year 1
Roadway design, Right-of-way (ROW) acquisition and surveying	Year 1
Route centreline establishment	Year 1
ROW clearing and construction	Year 2
Commencement of operation	Year 3
Cleanup and remediation	Year 3

*Schedule has the potential to be delayed depending on the results of engagement, consultation, and the technical review of the Environmental Impact Statement

Next Steps

- Responses to feedback and information requests, and identifying opportunities for participation.
- Development and submission of the EIS in 2018

Thank you for attending!

For further information about the Project, please contact:

Lauren Stead
MHIengages@stantec.com
306-667-2493

saskatchewan.ca

Saskatchewan

Welcome!

Thank you for taking the time to attend today's Open House regarding the Ministry of Highways and Infrastructure's Highway 914 Extension Project. We are interested in discussing the Project, answering questions, and making note of any comments you wish to provide.

Project Background

SK MHI is proposing a highway extension project consisting of the construction and operation of approximately 51 km of all-weather roadway that will extend Highway 914 starting near the McArthur River uranium mine site to an existing road near the Cigar Lake uranium mine site. Additionally, SK MHI is considering a by-pass route option (as an alternative to a portion of the preferred route), approximately 14 km in length, to avoid the McArthur River uranium mine site surface lease. If the McArthur River By-pass option is selected as part of the final preferred route, the roadway would be approximately 54 km in length. When completed, the roadway will become part of the public road network in the area. It should be noted that the Saskatchewan Ministry of Environment's consultation notification that was sent on December 22, 2016 indicated that a 5 km by-pass around the Key Lake uranium mill site was a part of the Project; however, this component has been removed from the Project. An overview map of the Project is attached with this handout.

SK MHI has retained Stantec Consulting Ltd. (Stantec), an environmental and engineering company, to conduct an independent, third-party environmental assessment of the Project for submission to the SK MOE. The components considered in the environmental assessment process include the construction, operation, and decommissioning phases of the Project. The environmental assessment will look at the possible effects the Project may have to land, water, plants, animals, fish, people, traditional land use, and communities.

The Project was initiated by SK MHI in February 2010 with the submission of a Project Proposal to the SK MOE and Canadian Environmental Assessment Agency. Several years have passed since the submission of the Project Proposal to the regulators in 2010. As such, the Project has been subject to several changes. The most notable changes include deferral and restart of the Project; assessment of alternative route and by-pass options; modification to the preferred route; and changes to regulatory requirements, including the termination of the comprehensive study of the Project pursuant to the former *Canadian Environmental Assessment Act*. The Project continues to be subject to a provincial-level environmental assessment under Saskatchewan's *The Environmental Assessment Act* legislation.

What is Happening Now?

The Project is being assessed under Saskatchewan's *The Environmental Assessment Act*. As part of the ongoing assessment, key tasks that have been completed or are currently underway for the Project include:

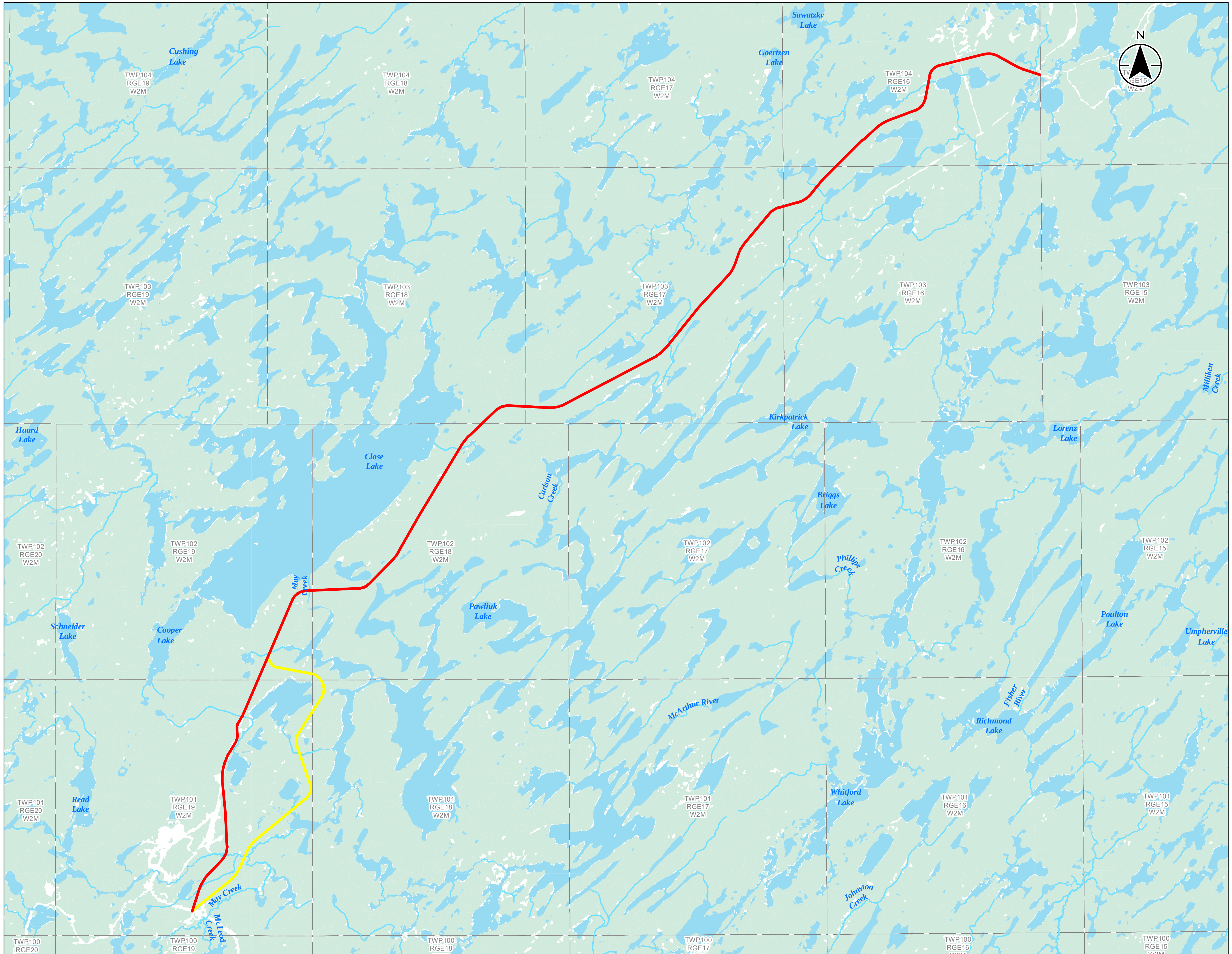
- Environmental Surveys:
    - Aerial caribou and ungulate
    - Aerial waterbird and raptor
    - Rare plant and wetland
    - Stream crossing and fish habitat
    - Heritage resource (archaeology)
- Indigenous and public engagement to inform potentially affected communities and gather their input on the Project, as well as identify any potential adverse effects to the community's ability to hunt, fish, and trap for food and to carry out traditional uses in the Project area

Project Schedule

Environmental surveys were completed in Fall 2016 and engagement activities will continue through the Spring 2018. SK MHI plans to submit the Environmental Impact Statement in mid-2018. Following the completion of the Environmental Assessment and submission of the Environmental Impact Statement, detailed engineering design and construction will be undertaken. It is estimated that the completion of construction activities will take approximately three years. As this project has not been approved and the construction start date has not been determined, Table 1 provides a general idea of the sequence of activities associated with the regulatory approvals and construction of the project.

Table 1: Anticipated Highway 914 Extension Project Schedule

Activity	Tentative Schedule
Environmental Surveys	Complete
Indigenous engagement and community consultation	On going
Submission of Environmental Impact Statement	Late 2018/Early 2019
Technical review of Environmental Impact Statement and 30-day public comment period	Early 2019
Environmental Impact Statement approval	Early 2019
Geotechnical and granular testing	Year 1
Roadway design, Right-of-way (ROW) acquisition and surveying	Year 1
Route centreline establishment	Year 1
ROW clearing and construction	Year 2
Commencement of operation	Year 3
Cleanup and remediation	Year 3



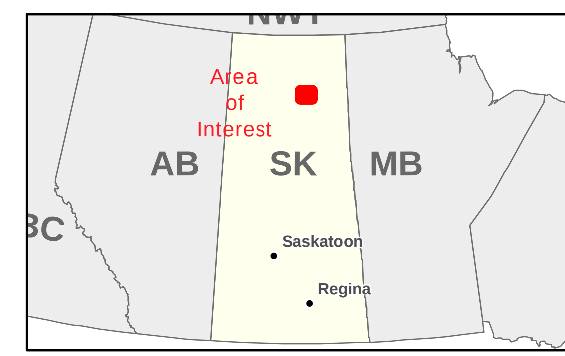
Stantec

- McArthur River By-pass Option
- Preferred Route
- Watercourse
- Waterbody
- Wooded Area
- Township

0 2.5 5 Kilometres

1:150,000 (At original document size of 11x17)

Notes
1. Coordinate System: NAD 1983 UTM Zone 13N
2. Base features: Produced under license from the Government of Saskatchewan



Project Location
Northern Saskatchewan

113253645-031 REVB
Prepared by clee on 2016-05-02
Independent Review by Jordan Hennig on 2016-05-02

Client/Project
MINISTRY OF HIGHWAYS AND INFRASTRUCTURE
HIGHWAY 914

Figure No.
1

Title
Highway 914 Extension Preferred Route and McArthur River By-pass

What was your main reason for attending tonight?

____

____

____

Considering the information you have been provided with this evening, what do you feel are the most important environmental aspects being studied? (Please rank from Not Important to Very Important)

	1-Not Important	2-Neutral	3-Somewhat Important	4-Important	5-Very Important
Wildlife and Fish Habitat					
Surface and Groundwater					
Plants and Country Foods					
Land and Resource Use					
Traditional Land and Resource Use					
Community Health and Wellbeing					
Employment					
Contracts/Business Opportunities					
Training and Job Skills					
Air Quality					
Noise					
Increased Traffic					

Of the items listed above, what three environmental aspects are most important to you, in order of importance (1 – most important to 3 – third most important?

1: ____

2: ____

3: ____

I conduct the following activities in the Project area:

	Check all that Apply	Where?
Hunting		
Gathering		
Fishing		
Trapping		
Snowmobiling		
Boating		
Other: ______________________		
Other: ______________________		

Please rate how helpful this Open House was to you: (Please rank from not helpful to very helpful)

1-Not Helpful	2-Somewhat Helpful	3-Neutral	4-Helpful	5-Very Helpful

Do you have any additional questions, comments, or concerns?

____

____

____

____

Would you like to have someone follow up with you regarding your questions, comments or concerns? If so, please include your contact information below.

Name: ________________________________

Mailing Address:

____

____

Phone Number:

____

Email:

____

Thank you for attending this Open House and completing this questionnaire!

Lands and Resources
Box 480
La Ronge, SK
S0J1L0
Phone: 306-425-2183
Fax: 306-425-2170

Lac La Ronge Indian Band

December 6, 2019

Adrien Blais, P. Eng.
Senior Project Manager
Design Branch
Ministry of Highways and Infrastructure
#18-3603 Millar Ave.
Saskatoon, SK. S7P 0B2

RE: Highway 914 Extension Project

Dear Adrien Blais

The Lac La Ronge Indian Band received a letter from Ministry of Highways and Infrastructure dated August 16, 2019 regarding the Highway 914 Extension Project. Lac La Ronge Indian Band, Lands & Resources Management Board reviewed at our October 25, 2019 meeting there were no concerns.

If you have any further questions or can provide more information, please contact me at 1-306-425-1137 (direct line) or email jpatterson@llrib.ca.

Respectfully,

Jeanine Patterson

Jeanine Patterson
Traditional Lands & Resources Coordinator
LAC LA RONGE INDIAN BAND

CC: Tom J. McKenzie, Land Claims Coordinator
Terence Johnson, GIS Specialist

PETER BALLANTYNE CREE NATION

Chief Joseph Custer Reserve - 2300 - 10th Avenue West
P.O Box 2320, Prince Albert, Saskatchewan, Canada S6V 6Z1
Phone: (306) 765-5388 · Fax: (306) 922-1450
Land Management OFFICE

Wednesday, September 20, 2017 **VIA EMAIL & FAX**

MINISTRY OF HIGHWAYS AND INFRASTRUCTURE
800 Central Avenue, P.O. Box 3003
Prince Albert, Saskatchewan S6V 6G1

Attention: Alison Lara, Senior Project Manager
Laura Stead MHIengages@stantec.com

Re: Consultation Notification – Highway 914 Extension Road (the "Proposed Project")

I am writing in response to your letter dated April 28th, 2017 regarding the Proposed Project and invitation to participate in the Ministry's "duty to consult process". We note that in your letter you mention, "Indigenous and public engagement to inform potentially affected communities and gather their input on the project, as well as identify any potential adverse effects to the communities' ability to hunt, fish, and trap for food and to carry out traditional uses in the project are|". With respect, it is not clear to us how the Ministry could have possibly reached any conclusion based on the information it referred to and in the absence of any direct input from PBCN. Yet, the project seems to be full steam ahead.

As you are aware, the Proposed Project is located within PBCN's traditional territory over which PBCN has constitutionally protected treaty and aboriginal interests. Based on the limited information which has been provided to PBCN in respect of the Proposed Project PBCN is not able at this time, in a detailed way, to identify the extent of the potential impacts to its treaty and aboriginal rights. However, based on what we do know at this point, the Proposed Project is reasonably expected to have adverse effects on at least the following PBCN interests:

- Fish, fish habitat and fish management;
- Wildlife, wildlife habitat and wildlife management;
- Migratory birds and habitat;
- Trap lines; and
- Cultural and heritage values in the vicinity of the Proposed Project.

Con't 1/2

PETER BALLANTYNE CREE NATION
Chief Joseph Custer Reserve - 2300 - 10th Avenue West
P.O Box 2320, Prince Albert, Saskatchewan, Canada S6V 6Z1
Phone: (306) 765-5388 · Fax: (306) 922-1450
Land Management OFFICE

In the letter you note that current studies are underway. As a result, we require that you provide us with sufficient information in respect of the Proposed Project to permit us to better detail our concerns. The information we require would include the following:

- a full and specific description of the Proposed Project's potential impacts known to the Ministry of the Environment, including potential impacts to fish, fish habitat, wildlife, wildlife habitat, migratory birds, migratory bird habitat, cultural and heritage values and traplines; and
- all reports touching upon the above subjects prepared at the request of Ministry of the Highways and Infrastructure, or that may be considered by the Ministry of the Environment before any decisions are to be made on whether or not to grant cooperation from the PBCN.

We look forward to receiving the information referred to above. Once we are satisfied that we have received all sufficient information in respect of the Proposed Project, we will take steps to prepare our views within a reasonable period of time and will arrange to present our views on the Proposed Project. We trust that no further decisions will be made or activities carried out in relation to the Proposed Project until such time as PBCN has been properly consulted. At this time we cannot confirm if anyone from the community of Southend has been involved with this process nor has anyone from the PBCN leadership or executive.

Regards,

Ted. J. Merasty

Theodore Merasty

Cc: Chief Peter A. Beatty
Ben Merasty – Executive Director

Government of Saskatchewan

Ministry of Highways and Infrastructure
Design and Innovation Division - Northern
800 Central Avenue
Prince Albert, Canada S6V 6G1

February 1, 2018

Attention: Vince Natomagan
Kineepik Métis Local #9
P.O. Box 166
Pinehouse Lake, SK S0J 2B0

Dear Mr. Natomagan,

Reference: Responses to Questions Raised by Pinehouse Community Members on October 2, 2017.

Thank you for the opportunity to visit Pinehouse on October 2, 2017 to meet community members and present the Highway 914 Extension Project (the Project). As discussed during our follow-up discussion in Saskatoon on November 3, 2017, Saskatchewan Ministry of Highways and Infrastructure has developed responses to the questions that were raised by community members during the meeting. These responses have been developed in consultation with Stantec Consulting Ltd., the company that is leading the environmental assessment, as well as with input from Cameco Corporation, a partner in the Project.

Please feel free to contact me should you have any comments or concerns.

Regards,

Saskatchewan Ministry of Highways and Infrastructure

Jeff Kusalik
Senior Project Manager
Phone: 306-953-3563
jeff.kuslalik@gov.sk.ca

Attachment: Responses to Pinehouse Community Questions

Cc: Doug Hansen, Executive Director, Northern Region, Ministry of Highways and Infrastructure
Jordan Hennig, Project Manager, Stantec Consulting Ltd.
Kirsten Ketilson, Manager, Cameco Corporation

Government of Saskatchewan

Ministry of Highways and Infrastructure
Design and Innovation Division - Northern
800 Central Avenue
Prince Albert, Canada S6V 6G1

To:	Vince Natomagan Kineepik Métis Local Inc. (#9)	From:	Jeff Kusalik Saskatchewan Ministry of Highways and Infrastructure
File:	Highway 914 Extension Project	Date:	November 27, 2017

Reference: Responses to Questions Raised by Pinehouse Community Members on October 2, 2017.

1. **Who is really driving the Project? Is it the province or the mine?**

Saskatchewan Ministry of Highways and Infrastructure initiated the Highway 914 Extension Project in 2010. The uranium industry initiated the partnership process in 2013. Saskatchewan Ministry of Highways and Infrastructure is leading the project, with Cameco Corporation as a partner.

2. **Why connect the two mines?**

The purpose of the road is to connect Highway 914 to Highway 905. This connection provides an alternate route if there is a catastrophic event (e.g., forest fire, flooding, washouts) on one road or the other. This road is one part of a larger review of transportation in the Athabasca Basin that includes access roads into Wollaston Lake and Fond du Lac.

3. **Has a traffic assessment been conducted?**

In their environmental assessment for the Key Lake Extension Project, Cameco considered the potential for increased traffic following the completion of the Millennium mine and Highway 914 Extension Project. The environmental assessment predicted an average annual daily traffic (AADT) of approximately 100 vehicles per day (vpd) on the Highway 914 Extension.

4. **There are rumours that Cameco will abandon Highway 905 after this road is built. Is this true?**

Highway 905 is a public highway owned and operated by the province of Saskatchewan. It will continue to operate after this extension is completed.

5. **What is the anticipated volume of traffic?**

The estimate vehicles per day on the 914 extension is approximately 100.

6. **Will the existing portion of Highway 914 be widened?**

Highway 914 was built to accommodate the traffic that is using it, including semi-trucks. There are currently no plans to widen the road surface.

7. **Will the road be a provincial road? Will the gate at Key Lake disappear?**

The entire route will be a provincial public road. There will be an unrestricted bypass built around the Key Lake operation. Access to the Key Lake operationwill be through a security gate.

8. **Will the road cut off migration of caribou?**

Caribou will be able to move freely across the road. Saskatchewan Ministry of Highways and Infrastructure is working with Saskatchewan Ministry of Environment on potential effects to caribou as part of the environmental approval process for the project.

9. **The community has conducted a detailed traditional land use (TLU) study with Terry Tobias and there is considerable traditional land use in the project area. Is the government willing to fund the next phase of their TLU Study mapping?**

Saskatchewan Ministry of Highways and Infrastructure is only evaluating the Highway 914 extension and does not have funding for large scale TLU study mapping.

10. Will there be financial compensation for active trappers on the existing portion of Highway 914?

There will be no financial compensation for active trappers on the existing portion of Highway 914. However, when there are problems with animals such as beavers on existing highways, Saskatchewan Ministry of Highways often hires local trappers to remove the animals.

11. Are you engaging with the University of Saskatchewan regarding caribou research?

The University of Saskatchewan will be engaged for additional information on caribou research as it relates to the project. Applicable information collected from the University of Saskatchewan will be used for the environmental assessment.

12. What is the reason for the McArthur River bypass?

It was realized in 2015 that the initial route crosses the current surface lease of the McArthur River operation. The bypass route would eliminate the need to cross the surface lease of the McArthur River operation, and may be necessary. We plan to make the final decision on routing around McArthur River in the future.

13. A community member expressed concern regarding the safety of the road. It was asked if the SK MHI representative had driven down the road to get to Pinehouse to witness it firsthand. The community member asked if there were plans to widen the road and mentioned that they had heard semi-trucks were being widened to accommodate larger loads. The community member noted that the road needed widening for safety.

During the meeting, the SKMHI representative confirmed they had driven down the road to get to Pinehouse and noted its condition. Semi-trucks are a standard regulated width in North America. There are no plans for this to change. There are currently no plans to widen the existing road. The community member's concern regarding widening the road for safety was recorded and will be considered in Saskatchewan Ministry of Highway and Infrastructure's planning process.

14. Are there weight restrictions on the trucks?

All trucks are subject to weight and dimension regulations. Saskatchewan Ministry of Highways and Infrastructure can issue permits to allow heavier weights to be hauled provided specific conditions are met.

15. Are the environmental surveys done?

Yes, the environmental surveys were completed in 2010-2011 and 2015-2016.

16. Why put a road way out there?

To connect Highway 905 and Highway 914

17. How about you fix our existing road before you build a new one out in the boondocks?

Saskatchewan Ministry of Highways and Infrastracture do the best they can to operate and maintain the existing highway network within the budget provided for the use the road handles. As an example of this process, some sections along Highway 165 will have their gravel surface improved over the next couple years. This extension will allow an alternate route if either Highway 905 or Highway 914 experience a catastrophic event (e.g., forest fire, flooding, washouts) on one road or the other.

18. A community Elder spoke in Cree, which was translated by community leadership. The question was related to unions at the mine and if they were an impact group. The question was unclear.

Saskatchewan Ministry of Highways and Infrastructure will respond to this question if clarification is provided.

19. Why isn't Cameco here to answer any of these questions?
Saskatchewan Ministry of Highways and Infrastructure is leading this project.

20. What is the overall cost of this project? $1,000,000 per kilometre?
The estimate without any design work is $1,000,000 per kilometre.

21. What about the gate at the Key Lake mine site?
There will be an unrestricted bypass around the at Key Lake Operation when the Highway 914 Extension Project is complete.

Comment - A community member expressed concerns about tourists having increased access to the north.
Concerns raised by community members during the meeting were recorded and will be considered in the environmental assessment and included in the environmental impact statement submitted to the Saskatchewan Ministry of Environment.

22. When can you come back with traffic numbers?
We are expected an estimated 100 vehicles per day on the extension.

23. Why would Saskatchewan Ministry of Highways and Infrastructure spend money when there is already an existing road?
This project will close a gap where no road currently exists.

24. What about maintenance?
The draft partnership agreement with industry has industry providing the maintenance on this road. This partnership agreement will need to be updated in the future.

25. If you're going to build a road so far north, have you considered the stress on Pinehouse's services? What if there is an accident along the road and Pinehouse's ambulance or police are called away?
This project would extend the existing highway by approximately 51 kilometres. The potential effects to community services will be considered as part of the environmental assessment. Completion of this link allows easier flow of emergency services within this area between Highway 914 and Highway 905.

26. What are the phases of the project? Will it be one contract? What are the procurement opportunities? Temporary camps or catering?
There is no detailed design or schedule at this time. Saskatchewan Ministry of Highways and Infrastructure will work with industry on the execution of the project, which will include opportunities for local communities.

27. When do you propose to come back with more information and more clear answers?
Written responses will be provided. Follow-up will be provided where it is recognized that more information is needed prior to the submission of the environmental impact statement to regulatory agencies.

28. When does the formal Duty to Consult start?
The duty to consult process started in 2010. The project was then put on hold between 2012 and 2014. On December 16, 2016, the Saskatchewan Ministry of Environment sent Kineepik leadership a letter which provided official notification to Kineepik Métis Local #9 of the opportunity to participate in the consultation process during the environmental assessment. Saskatchewan Ministry of Highways and Infrastructure has been assigned procedural aspects of the

Saskatchewan Ministry of Environment's consultation process to assist in fulfilling its duty to consult. The community meeting held on October 2, the follow-up discussion with community leadership on November 3, and any subsequent communication regarding the project are to provide the community of Pinehouse with project-specific information to the Kineepik Métis Local #9 regarding the nature of the proposed activities and any potential environmental effects. All of these activities form part of the duty to consult.

29. An Elder spoke in Cree, which was translated to a question requesting clarification on the valued components listed on the questionnaire that had been distributed.

Comment - An Elder expressed concern about the damage done to vehicles while travelling along the existing road.

Concerns raised by community members during the meeting were recorded and will be considered in the environmental assessment and included in the environmental impact statement submitted to the Ministry of Environment for review.

Comment - The environmental assessment should consider the effect of the extension on the existing road.

Effects will be assessed in the environmental impact statement as outlined in the terms of reference submitted for the project to the Saskatchewan Ministry of Environment on July 20, 2016.

30. Will there be increased logging because of the road extension?

No. This road is north of the commercial forest.

APPENDIX E

Aquatic Resources

Appendix E AQUATIC RESOURCES

E.1 FISH SPECIES LIFE HISTORIES

General Life History of Fish Species

E.1.1 Arctic Grayling

Arctic grayling occupy the northern drainage systems and live in clear waters of large, cold rivers, rocky creeks and lakes (British Columbia Ministry of Fisheries 2010a). They exhibit lacustrine, adfluvial and riverine life history types (Richardson et al. 2001). Arctic graylings begin to spawn in the spring when the ice begins to break up and spawn in small gravel or rock-bottomed tributaries or in mainstream rivers (British Columbia Ministry of Fisheries 2010a). The eggs incubate for 13-18 days and once they are hatched the young usually remain in the gravel substrate for 3-4 days before emerging while the adults return to the lakes and rivers after spawning. The young are typically found in lotic and littoral areas at 0.20 to 0.46 m in depth (Richardson et al. 2001). They are usually completely mature by the time they are six to nine years old and many arctic graylings survive to complete several spawning migrations. The males avoid each other during spawning and may be found in private areas tucked in among boulders or bedrock which protects them from rivaling males and allows them to attack (British Columbia Ministry of Fisheries 2010a). Adult arctic grayling inhabit sand, silt and gravel substrate areas and are a shallow water species typically found at depths less than 3 m in lakes. They are assumed to overwinter in deep pools associated with rivers and in the deeper areas of lakes (Richardson et al. 2001). The young fish eat zooplankton at first but shift later to insect larvae which include mayflies and caddis flies. Adults eat almost any invertebrates but prefer to prey on aquatic and terrestrial insects such as bees, wasps, grasshoppers and ants, and less often on fish, eggs and zooplankton (British Columbia Ministry of Fisheries 2010a).

E.1.2 Brook Stickleback

Brook stickleback are found in heavily weeded areas of spring -fed brooks, boggy lakes, beaver ponds and trout streams and are known to exhibit lacustrine and riverine life history types. They spawn from late April to early July depending upon the local water temperature. Males will move into shallow water before the females to establish a territory and build a nest out of reeds or grass, ticks and debris using a filamentous thread secreted from the kidneys of the males. The nests will be situated in shallow water less than 40 cm deep and usually close to or on the bottom. The female is courted into the nests by the male and lays a clutch of eggs before the male fertilizes them. The female is usually chased away from the nest by the male and may allow other females to lay eggs in the same nest as the male guards it. Eggs are incubated for 7-10 days depending upon the water temperature and during incubation the male may build a second nest and transfer the eggs to the new nest site. After the eggs have hatched, the male will guard the young and bring them back to the nest if they attempt to leave until he can no longer keep them from swimming away. The young are usually found in vegetated shallow water habitats and reach sexual maturity in 1 year. The adult brook stickleback moves between shallow water in the spring to deep water where they overwinter. Brook sticklebacks are known as shallow water species that make use of vegetation for cover, the silty substrate of streams for burying in and the rocks, dead leaves and vegetative detritus to hide in. They are carnivores who feed on aquatic insect larvae, crustaceans, eggs and larvae of other fish, snails, oligochetes and algae (Richardson et al. 2001).

E.1.3 Burbot

Burbots tend to occupy cold freshwater habitats in Europe, Siberia and North America. They spend most of their time on the bottom of lakes and rivers that are cool and deep (British Columbia Ministry of Fisheries 2010b). Burbots typically exhibit lacustrine and riverine life history types (Richardson et al. 2001). They spawn at night in mid-winter (mid-January to March) underneath the ice in shallow water up to 1.25 m deep over sand or gravel and in lakes or occasionally rivers. Burbots are weaker swimmers than trout and need slower water to make the spawning migration. Approximately 10-12 adults usually spawn together in a squirming ball about 60 cm in diameter and move over the bottom of the floor shedding milt and tiny eggs. Female burbots can carry more than a million eggs and they hatch 30 days after lying (British Columbia Ministry of Fisheries 2010b). The eggs are incubated for 3 weeks to 3 months, depending upon the water temperature. After the eggs are hatched, the young become benthic littoral feeders as soon as they reach the fingerling stage, a length of 20-40 mm. After the young transition from crepuscular to nocturnal activity, they find shelter in shallow water during the day under boulders, logs or submerged vegetation and remain inactive unless disturbed (Richardson et al. 2001). Young burbot may be found along rocky lake shores and in weedy areas or in between rocks in tributary streams (British Columbia Ministry of Fisheries 2010b).

Burbots reach maturity between 3 and 4 years of age but may vary with latitude. Males typically mature a year or two before females (Richardson et al. 2001) and have been known to have a maximum life expectancy of 23 years of age (British Columbia Ministry of Fisheries 2010b). Juveniles and adults may both move seasonally offshore to deeper waters in the hypolimnion in the early summer and then back to the shallow water at night to feed. Adult burbots may be found over boulder, rubble, cobble and sand substrates and juveniles over rock and gravel bottoms along rocky shorelines. They have been known to be sensitive to sub surface illumination and will often hide amongst aquatic plants during the daytime (Richardson et al. 2001). Burbots are carnivores that are capable of eating other fish which are nearly their own size. They hunt their prey at night by ambushing them, locating them first by smell, then by vibrations as the prey nears and then making a rapid, close-range attack. They are one of the top predators who play an important role in the fish community and have been known to eat whitefish, suckers, stickleback and perch as well as crayfish and fish eggs. Younger fish may feed on aquatic insects (British Columbia Ministry of Fisheries 2010b).

E.1.4 Cisco

Ciscos are a freshwater fish that inhabits open waters of lakes and large rivers (Discover Life 2010). They form large schools and may inhabit depths of 9-91 m but usually occur at 27-46 m. Ciscos tend to move into shallow waters in the winter to spawn and into deeper waters below the thermocline afterwards. They begin to spawn in late November to mid-December usually when the water temperature reaches 5-6^{o}C. In inland lakes, spawning occurs at depths of 1-3 m when the ice begins to form around the shorelines. The eggs are deposited at night over the rocky bottom and hatch in late April to early May after the spring break-up of ice. Young can be found in shallow, protected bays until they reach 1 month old and can only feed during daylight hours. Ciscos mature between ages 1 to 4 and can have a life expectancy of 13 years. They feed mainly on algae, Cladocera, copepods and Mysis and also on mollusks, insect larvae and small fish (Derosier 2007).

E.1.5 Emerald Shiner

Emerald shiners are a pelagic species which occur in large open lakes and rivers and are known to exhibit a lacustrine life history type and possibly also riverine and adfluvial types as well. They begin to spawn in late spring or early summer in shallow shore water of lakes at depths of 2-6 m. The eggs are typically scattered at the surface or over sand and gravel bottoms with vegetation. The eggs fall to the bottom of the water body and hatch within 24-32 hours after fertilization. The larvae stay on the bottom for approximately 4 days before they begin to swim and form large schools with other emerald shiners in vegetated areas at depths of 2-4 m near the shorelines of lakes. Emerald shiners begin to mature between 1 and 2 years of age and have a life expectancy of approximately 3 years of age. Adult emerald shiners remain in deep water during the day and move to the surface at night to feed. They typically move offshore to deeper water in the summer and return to inshore areas in the fall where they can be found congregated around docks, piers and river mouths. They prey on species such as corixids, algae, midge larvae and *Daphnia* spp. (Richardson et al. 2001).

E.1.6 Flathead Chub

Flathead chubs inhabit large flowing turbid rivers and cool sluggish creeks and exhibit a riverine life history type. Less often, they are found in ponds and lakes that have still waters (Richardson et al. 2001). They begin to spawn in July and continue through to August. Flathead chubs become sexually mature by age 4 and have a life expectancy of 10 years of age. They feed mainly on terrestrial and aquatic insects and occasionally on fish (Nelson and Paetz 1992).

E.1.7 Lake Chub

Lake chubs are found in rivers and streams and are known to exhibit a lacustrine, adfluvial and riverine life history types. They spawn between April and early August along lakeshores and in streams over and among rubble, cobble and gravel substrates at a depth of 0.5-2 m. The females lay as many as 500 yellow eggs which hatch after 2 weeks. Lake chubs are mature in their third or fourth year and have a life expectancy of 5 years. They inhabit the bottom water zone close to the shore, however, may seek deeper water in the summer when the lakes begin to warm. Adult lake chub prefer habitats with sand, rubble, cobble and boulder substrates and a depth of approximately 12-16 ft. They are usually considered a shallow water species but have been known to frequent deep water areas. Lake Chub prey on terrestrial and aquatic insects, algae and zooplankton (Richardson et al. 2001).

E.1.8 Lake Trout

Lake trout are native to northern North America and in Canada are found in the Maritime Provinces and Labrador through to British Columbia, Yukon, Northwest Territories and Nunavut. Their habitat preference includes large, deep, cold water lakes (Department of Fisheries and Oceans Canada [DFO] 2010). They may also be found in large clear rivers but mostly exhibit lacustrine and adfluvial life history types with no evidence of riverine populations in Canada (Richardson et al. 2001). They begin to spawn in the fall; however, this may vary among lakes based on latitude, weather, lake size and topography. Spawning habitat includes large boulders or rubble lake bottoms at depths of less than 12 m and sometimes as shallow as 30 cm for inland lakes. The eggs are scattered over the rocky bottom typically at night and the eggs remain among the rocks for several weeks until they hatch the following spring. A month after hatching, the young lake trout swim to deeper water and stay secluded, feeding on plankton during the first few years of their life (DFO 2010). The young are usually solitary and found close to the bottom, approximately less than 3 m above the bottom and associated with sandy substrates. Juvenile lake trout can be found in deep areas of lakes during the daytime and then shift to the shallow waters at night and are commonly associated with cobble, boulder and rubble substrates within 0.3 m from the bottom. Lake trouts typically mature by the time they are 11 years of age. Adults disperse to deeper waters after spawning and are most commonly found at depths greater than 10 m in the pelagic zone of lakes (Richardson et al. 2001). Lake trout diets vary depending upon their age, size of the fish, locality and the food available but typically feed on a broad range of organisms including zooplankton, insect larvae, small crustaceans, clams, snails, leeches, mice, shrews and sometimes birds. They may also feed on other fish if available including whitefish, grayling, sticklebacks and sculpins (DFO 2010).

E.1.9 Lake Whitefish

Lake whitefish inhabit large rivers and cold freshwater lakes all across Canada with their northern limit being Victoria Island, Nunavut. They are a cool water species which moves from shallow to deep water in warmer months and back again to shallow water as the weather gets cooler. Lake whitefish typically spawn in the fall from November to December and occurs in shallow water at depths less than 7.6 m and over a hard or stony bottom or sand (DFO 2010). In the northern area of their range, they may only spawn every second or third year (Richardson et al. 2001). The eggs are deposited over the spawning area randomly and remain there until they hatch in the spring (DFO 2010). Young remain near the surface in shallow water at depths of less than 1 m near the spawning area with bottom substrates of boulder, cobble and sand with emergent vegetation and woody debris (Richardson et.al. 2001). The larvae form aggregations with other species on steep shorelines and leave the shallow shore waters and move into deeper water in the early summer (DFO 2010). Age of maturity is typically between 5 and 8 years for lake whitefish. The adults leave the spawning grounds shortly after spawning and will return to deep water greater than 10 m to overwinter (Richardson et al. 2001). The adult lake whitefish are mainly bottom feeders which prey on small fish, fish eggs, aquatic insect larvae, clams, snails and plankton (DFO 2010).

E.1.10 Longnose Sucker

Longnose suckers are found in freshwater lakes, rivers and streams and are known to exhibit a lacustrine, adfluvial and riverine life history types. They spawn in the spring from April to June, after the ice melts, in rivers and the shallows of lakes. In lakes, spawning typically occurs at depths of 15-30 cm along rocky wave-swept shorelines over gravel and sand substrates. The eggs are adhesive and deposited over gravel and sand substrates with an 11-15 day incubation period. They remain in the gravel and sand substrate for 1 to 2 weeks prior to emerging and inhabiting shallow areas of lakes in association with vegetation and sandy bottoms. Males reach maturity at 5 years and females at 6 or 7 years. They feed on amphipods, chironomids, midge larvae, caddis fly larvae and sphaeriid clams and inhabit deeper water than white suckers (Richardson et al. 2001).

E.1.11 Ninespine Stickleback

Ninespine stickleback is known to occur in shallow bays of lakes, slow streams and tundra ponds and exhibit lacustrine, riverine and andromous life history types. Spawning occurs in late spring and summer (May to late July) and in shallow water at depths of up to 40 m in some areas. Males build the nest and are usually among weeds in dense vegetation and approximately 10-15 cm off of the bottom, in contact with the bottom, in burrows constructed in muddy organic bottoms, or under and between rocks along wave swept lakeshores. The nests are constructed out of aquatic vegetation and debris that is bound together by a thread-like kidney secretion. Females are enticed into the nest and deposit 20-30 eggs before the males enter the nest and fertilize the eggs and chase the female away. The eggs incubate for 4-7 days before hatching and after that the young are moved to a nursery area which the male constructs from the nest building material just above the original nest. The young remain in the nest until they become free swimming and then disperse into the shallow water in the vegetation and move to deepwater areas in the fall to overwinter. Most ninespine sticklebacks mature in their first year and have a life expectancy of three and a half years. The adults can be found among dense vegetation, tolerating low oxygen tensions, and can also be found in the open water over sand and gravel beaches with sparse vegetation. They frequent shallow water areas the most but may also be found at depths greater than 70 m. They prey upon aquatic insects, chironomid larvae, small crustaceans, mollusks, cladocerons and other zooplankton (Richardson et al. 2001).

E.1.12 Northern Pike

Northern pike are mainly a freshwater fish with a circumpolar distribution throughout the northern hemisphere and is found in both rivers and lakes. They are a cool water species who inhabits warm, slow, heavily vegetated rivers or weedy bays of lakes (DFO 2010) that exhibit lacustrine, adfluvial and riverine life history types (Richardson et al. 2001). Northern pikes begin to spawn in the spring after the ice melts and their breeding grounds include areas which flood in the spring and early summer and that may be dry the remainder of the year. Spawning in lakes occurs in the shallowest parts at depths of less than 1 m and in wind sheltered areas. The bottom substrate on the spawning grounds is made up of soft fine substrates of silt and mud but may also contain gravel, rock, boulder and cobble substrates. Vegetation in the spawning areas consists of short emergent vegetation of grasses, sedges and bulrushes with fine leaves for egg deposition (Richardson et al. 2001). During spawning, they swim through areas that are well vegetated with shallow water and scatter the eggs randomly (DFO 2010). The eggs that are laid are adhesive and attach to the vegetation above the substrate. They are incubated for 10-21 days (Richardson et al. 2001) and the eggs hatch in approximately 12-14 days. The young will remain attached to the vegetation for 6-10 days and in the shallow spawning area for several weeks after hatching (DFO 2010).

The young northern pike may be found where there is abundant vegetation with a soft bottomed substrate and a depth of less than one meter before moving to the deeper regions in the summer. Northern pikes typically reach maturity at age 6 for females and age 5 for males. Juvenile northern pikes usually inhabit quiet bays with submerged vegetation that would provide cover from predators and potential prey. Adult northern pike frequent areas that are less than 5 m deep for most of the year and overwinter into deeper waters. Northern pikes are ambush predators which use cover such as logs, weeds and stumps to stalk and ambush prey. They are most commonly found in areas that are moderately vegetated as opposed to heavily vegetated in order to seek prey and are most often associated with soft substrates (Richardson et al. 2001). Young northern pike will feed on zooplankton and immature aquatic insects until they reach about 5 cm in length; at this point they will switch to a fish diet. Adult northern pike will not travel far from spawning areas and are usually solitary and territorial. They are omnivorous carnivores that are opportunistic and prey on fish, crayfish, frogs, mice, muskrats and young waterfowl (DFO 2010).

E.1.13 Round Whitefish

Round whitefish inhabit the shallows of lakes, ponds, slow flowing rivers, and streams and brackish waters and are known to exhibit a riverine life history type in some regions. Spawning occurs from the fall to early winter (typically in October) in lakes and occasionally in streams and rivers. Spawning occurs over gravel and rubble substrates and sand and silt with emergent vegetation. Round whitefish usually spawn at depths less than 1 m deep but have been known to at depths from 5-10 m. The eggs are deposited over the bottom substrate and are incubated for 4-5 months with hatching occurring from March to May. The young are often found on the bottom associated with rocky, sandy or gravel substrates at depths of 1.5-4.5 m in depth. Age of maturity is usually 6 and the adults can be found over rocky bottoms associated with boulders. They are bottom feeders and almost exclusively on small benthic invertebrates (Richardson et al. 2001).

E.1.14 Shortjaw Cisco

Shortjaw ciscos are known to occur in cool deepwater lakes and usually exhibit a lacustrine life history type. They begin to spawn in the fall (October to early December) or possibly earlier and may also spawn in the spring and early summer depending upon the population. Spawning usually occurs at varying depths from 9-73 m and the eggs are deposited over clay and sandy bottoms. The larvae are pelagic, occur in open water, and become mature between 5 and 6 years of age. Adult shortjaw ciscos occur at depths ranging from 55-144 m, usually well below the thermocline in lakes. The depth at which they occur changes seasonally from 110-114 m in the spring, 55-71 m in the summer, and 73-90 m in the winter. This species mainly feeds on small crustaceans and insects (Richardson et al. 2001).

E.1.15 Slimy Sculpin

The slimy sculpin is found in rivers, streams, creeks and sometimes lakes and is known to exhibit lacustrine and riverine life history types. Spawning for slimy sculpin begins in May and occurs over sand, gravel and rock substrates in shallow waters or lakes. The males select the nest site on the underside of stones and logs in shallow water that is approximately less than 1.5 m deep. The males court the females into their nest area and the females then lay a clutch of adhesive eggs on the ceiling of the nest. Several females may lay eggs in one nest and the males then guard the eggs until they hatch 4 weeks later. The young are found over gravel and sand substrate in shallow water approximately 0.5-1.5 m deep and then gradually shift from shallow water to deep water habitat as they are older. Age of maturity for slimy sculpin varies; however, maturity is usually reached by age 2 or 3. The adults inhabit depths of 0.5-210 m and usually are found near gravel and rocky substrate in lakes. Slimy sculpin prey on aquatic insects, crustaceans, small fish and aquatic vegetation (Richardson et al. 2001).

E.1.16 Spoonhead Sculpin

Spoonhead sculpin are found in the shallows of large muddy rivers and at great depths in large lakes and are known to exhibit a lacustrine life history. Spawning occurs in the early spring from early to mid-May and may occur in the summer or fall as well. The eggs are deposited underneath stones or logs and usually over rubble, boulders, gravel, sand or mud substrates at depths of up to 270 ft. Eggs are incubated for 4 weeks before hatching and the young of the year may be found among the rocks at depth of 40-67 ft. Adult spoonhead sculpin are found at varying depths of 5-210 m but usually stay between 50-90 m depths and live a maximum age of 6 years (Richardson et al. 2001).

E.1.17 Spottail Shiner

Spottail shiners typically inhabit larger lakes and rivers and are one of the most abundant minnow species in northern lakes that are known to exhibit lacustrine and riverine life history types. Spawning occurs during the spring through to early summer (June to July) and over sand, gravel and rubble in shallow waters of 0-5 m in depth. The young mature between the ages of 1 and 2 years old. During the spring and summer, the preferred habitat is shallow, warmer waters over sand and gravel at depths of less than 13 m. Spottail shiners feed on insect larvae, plankton and masses of algae (Richardson et al. 2001).

E.1.18 Troutperch

Troutperch are found along sandy beaches of lakes, slow-moving streams and backwaters of large muddy rivers and are known to exhibit lacustrine, adfluvial and riverine life history types. They spawn mostly during the night from late spring to early summer (early May to July) in the shallows of slow streams or along beaches in lakes. In lakes, spawning occurs on beaches and shoals in shallow water that is less than 1 m deep and over gravelly and sandy bottoms. The eggs are large and adhesive when laid and will stick to vegetation or the bottom. Incubation lasts for 6 to 7 days and after hatching, the young stick to inshore areas near spawning grounds and near the bottom over sand, gravel and mud at a depth of less than 10 m. Troutperch are mainly benthic and later in the summer the young move to deeper waters. They are found most commonly over sand and mud bottoms in inshore areas and at depths of 7-15 m in lakes during the summer. Troutperch mainly prey on chironomids, amphipods, mollusks and small crustaceans (Richardson et al. 2001).

E.1.19 Walleye

Walleye are native to freshwaters in North America and are a cool water species that inhabit turbid water in either large shallow lakes or rivers but deep enough to give shelter from daylight. Their eyes are very sensitive to bright light and they frequent sunken trees, boulders, weed beds or thick layers of ice and snow as a shield from the sun. They enjoy more turbid water and are more active during the day. They spawn in the spring or early summer depending upon latitude and water temperature. The adults migrate to rocky areas near dams in rivers or to boulder to course gravel areas in lakes to spawn at night. The eggs are placed into crevices in the rocky substrate and hatch between 12-18 days after laying; the young disperse into the upper levels of the open water at 10-15 days (DFO 2010). The young walleye become pelagic as they mature and move to the deeper water in the summer at depths of 10-30 ft. Males typically mature between 2 and 4 years of age and females at 3 to 6 years of age. The adults may be found over gravel, rubble, and sand substrates and will migrate into the shallow water at night to feed and to deeper water during the daytime (Richardson et al. 2001). The young walleye prey upon invertebrates and as they grow in size their diet shifts to fish (DFO 2010). Adults are primarily piscivorous and prey on many fish species including burbot, arctic grayling, troutperch, northern pike, longnose sucker, white sucker, yellow perch and aquatic insects (Richardson et al. 2001).

E.1.20 White Sucker

The white sucker occupies lakes, rivers and streams in warm shallow areas and exhibits lacustrine, adfluvial and riverine life history types. They spawn in both rivers and lakes in outlets or along lake shores. In the spring (May to June) they spawn after the ice cover melts and the adhesive eggs are deposited over gravel. Incubation lasts for 5-15 days and the young remain in the gravel substrate for 1-2 weeks before emerging. The young inhabit shallow protected water along lake shores, over rocks, and sandy bottoms with vegetation. Later in the summer the young move offshore to deeper areas of the water body to avoid the inshore water temperatures. White suckers reach sexual maturity between 5 and 7 years of age and prey upon insects, chironomids, crustaceans and mollusks. White suckers prefer shallower water (depths of 7-13 m) than the longnose sucker (Richardson et al. 2001).

E.1.21 Yellow Perch

Yellow perch are a freshwater fish with a circumpolar distribution in the northern hemisphere. They enjoy cool water and are abundant in the open water of lakes with moderate vegetation, clear water and bottoms of muck to sand and gravel. Yellow perch spawn in the spring from mid-April to May as the adults migrate to shallow waters of lakes and tributaries of rivers. Spawning takes place during the night and early morning and near rooted vegetation, submerged brush or fallen trees and over sand or gravel. The eggs hatch after 8-10 days and the young remain inactive for approximately 5 days. The young yellow perch feed on cladocerans, ostracods, and chironomids larvae and, in the first summer, they form large, compact schools. The adults and young tend to be gregarious as they often move in loose groups of 50-200 individuals and move seasonally from shallow to deeper water depending upon the temperature and food distribution. Adult yellow perch mainly feed on immature insects, larger invertebrates, fish eggs, and juvenile fish, depending on the size of the individual and the season (DFO 2010).

E.1.22 References

British Columbia Ministry of Fisheries. 2010a. British Columbia Fish Facts: Arctic Grayling (*Thymallus arcticus*). Available at: https://www.env.gov.bc.ca. Accessed on: December 17, 2010.

British Columbia Ministry of Fisheries. 2010b. British Columbia Fish Facts: Burbot (*Lota lota*). Available at: https://www.env.gov.bc.ca. Accessed on: December 20, 2010.

DFO (Department of Fisheries and Oceans Canada). 2010. Ontario-Great Lakes Area Fact Sheets. Available at: http://www.dfo-mpo.gc.ca. Accessed on: December 20, 2010.

Derosier, A.L. 2007. Special Animal Abstract for *Coregonus artedi* (cisco, lake herring). Michigan Natural Features Inventory. Lansing, MI. 3pp.

Discover Life. 2010. *Coregonus artedi*. Available at: http://discoverlife.org. Accessed on: December 21, 2010.

Nelson, J.S. and M.J. Paetz. 1992. The fishes of Alberta. The University of Alberta Press, Athabasca hall, Edmonton, AB.

Richardson, E.S., J.D. Reist, and C.K. Minns. 2001. Life history characteristic of freshwater fishes occurring in the Northwest Territories and Nunavut with major emphasis on lake habitat requirements. Can. MS Rpt. Fish. Aquat. Sci. 2569: vii +146p.

E.2 DETAILED HABITAT DESCRIPTIONS

E.2.1 Crossing 914-PR-01

The unnamed watercourse at crossing 914-PR-01 (Photos 1-4) is a small permanent watercourse. At the time of the assessment in June 2010, the width of the watercourse was approximately 0.5 m and 0.2 m in depth. Approximately 100 m upstream of the proposed crossing location, the watercourse has no visible channel and instead flows through a boulder field beneath a layer of sedge and soil. Approximately 1 km downstream of the proposed crossing location, the watercourse flows into a small lake with is connected through a tributary to a larger unnamed lake. This tributary was assessed in August 2015 during low flow conditions with a width of 0.6 m. It is likely that at the crossing location this watercourse would freeze to bottom in the winter.

At the crossing location, spawning habitat was rated as nil for coarse and sport fish as there was minimal coarse substrate within the channel. The spawning habitat was rated as moderate for small bodied forage fish as there was some aquatic vegetation present and suitable flows. Downstream of the crossing location, within the tributary between the two lakes, spawning habitat was rated as poor for coarse fish, as there is coarse substrate present, but water depth is not sufficient. Spawning habitat for sport fish was rated as nil due to lack of depth and gravel substrate. For forage fish, spawning habitat was rated as good as there is aquatic vegetation and, downstream of the crossing location, large woody debris present.

Rearing habitat at the crossing location was rated as good for coarse, sport, and forage fish. There is substantial overhanging vegetation along the undercut banks of the watercourse for cover as well as large boulders that can provide instream cover. Overwintering was rated as poor for all fish species due to the depth which is suggests the watercourse is likely to freeze to bottom during the winter. However, approximately 1 km downstream of the crossing location and 100 m from the tributary is a lake that likely provides sufficient depth for all fish species overwintering in the area. Passage was rated as good downstream of the crossing location but poor upstream of the crossing location because of the boulder field. It may be challenging for large bodied fish to navigate through the boulder field but likely accessible to smaller bodied fish and juveniles allowing access to upstream habitats.

In 2010, one (1) small (6 – 8 cm) northern pike (*Esox lucius*) was observed in the watercourse near the crossing location. In 2015, within the tributary, possible forage fish spawning activity was observed.

Photo 1. Facing upstream at crossing location (2010)

Photo 2. Facing downstream at crossing location (2010)

Photo 3. Approximately 900 m downstream of crossing location facing upstream (2015)

Photo 4. Approximately 900 m downstream of crossing location facing downstream (2015)

E.2.2 Crossing 914-PR-02

The unnamed tributary to May Creek at crossing 914-PR-02 (Photos 5-8) is a medium permanent watercourse that may freeze to bottom in winter. The crossing location was assessed in June 2010, at which time water depth was 0.5 m and was 6 – 12 m in width, and 100 m upstream of the crossing location in 2015, at which time the depth was estimated to be 0.36 m and had a moderate flow measured at 0.35 m/s.

At the crossing location, spawning is rated good for forage fish as there is aquatic vegetation and woody debris present throughout the area. Spawning is rated as moderate to good for sport and coarse fish both up and downstream of the crossing location as coarse cobble and boulder substrate is present and riffles were observed. Rearing habitat at the crossing location was rated as good for all fish species. There is cover through water turbulence, overhanging vegetation, woody debris, and undercut banks. Overwintering was rated as moderate for forage fish as the watercourse should not fully freeze to bottom in the winter. For coarse and sport fish, overwintering was rated as poor due to lack of depth; nearby lakes could provide suitable habitat for coarse and sport fish as well as forage fish. Passage was rated as good, there were no impoundments or impediments observed to obstruct fish passage.

In 2010, five (5) burbot (*Lota lota*), three (3) lake chub (*Couesius plumbeus*), two (2) slimy sculpin (*Cottus cognatus*), one (1) juvenile longnose sucker (*Catostomus catostomus*), and two (2) Arctic grayling (*Thymallus arcticus*) fry were captured at this location. During helicopter travel at the crossing location, one northern pike (30 – 40 cm) was observed.

Photo 5. Facing downstream at crossing location (2010)

Photo 6. Approximately 300 m downstream of crossing location (2010)

Photo 7. Approximately 500 m downstream of crossing location facing upstream (2015)

Photo 8. Approximately 500 m downstream of crossing location facing downstream (2015)

E.2.3 Crossing 914-PR-03

The unnamed tributary at crossing 914-PR-03 (Photos 9-12) is a small intermittent watercourse with poor fish habitat for all fish groups. At the crossing location and upstream of the crossing location, the flow is generally underground through a field of boulders. There is an existing bridge downstream of the crossing location at which the flow emerges from underground and enters a beaver impoundment.

At the crossing location, spawning is rated as nil for all fish species as there is limited coarse substrate within the tributary and limited depth. Spawning habitat for forage fish may exist where the tributary emerges from underground as there is instream woody debris and some aquatic vegetation. At the crossing location, rearing habitat for coarse and sport fish is nil as the flow is through a boulder field. Rearing habitat for forage fish in this area is nil to poor as there is potential for cover with some of the boulders, particularly where the tributary enters the boulder field and where it emerges from underground flow. Downstream of the crossing location, where the tributary emerges from the boulder field and upstream from the beaver pond, there is woody debris and overhanging vegetation which could provide cover to rearing forage fish. For all fish species, overwintering habitat at the crossing location is nil as water depth is too shallow and beneath the boulder field. The area behind the impoundment could provide overwintering habitat to small bodied forage fish. Fish passage is poor at the crossing location because the boulder garden makes it challenging to migrate through the area. If any fish are migrating through this area, they are likely small bodied forage fish.

Photo 9. Facing upstream approximately 200 m upstream from crossing location (2010)

Photo 10. Facing upstream approximately 300 m downstream from crossing location (2010)

Photo 11. Location where stream emerges from subsurface approximately 100 m downstream from crossing (2010)

Photo 12. Existing crossing at crossing at crossing (2010)

E.2.4 Crossing 914-MB-01

The unnamed tributary to May Creek (Photos 13-16) is a medium permanent watercourse. At the time of the assessment (July 2016), water depth was approximately 0.61 m at the crossing location but was deeper both up (maximum 0.87 m) and downstream (maximum 0.97 m) and the tributary was at a moderate stage of flow and was approximately 5.8 m across.

At the crossing location, spawning is rated as nil for sport and coarse fish because the tributary's substrate is fine sand with limited organics. Approximately 300 m downstream there are some larger boulders with could provide some spawning habitat to coarse fish. Approximately 100 m up and downstream of the crossing location, riparian vegetation appears to be flooded which might provide some habitat for some species such as northern pike. Spawning for forage fish is rated as poor at the crossing location as there was sufficient water depth but no woody debris was observed and there was limited instream vegetation.

Rearing habitat for all fish species is rated as poor at the crossing location. There is overhanging vegetation along both banks but limited instream cover from woody debris or boulders and banks are not heavily undercut. Approximately 100 m upstream and 100 m downstream of the crossing location the area is flooded, and riparian vegetation provides substantial cover for rearing fish. At the crossing location, overwintering habitat for coarse and sport fish is rated as nil and nil to poor for forage fish since it is unlikely that the tributary freezes to bottom in winter but unlikely to have sufficient depth for larger bodied species. It is more likely that species will overwinter in Close Lake which May Creek empties into. There is better fish habitat potential where the unnamed tributary empties into May Creek approximately 185 m downstream compared to the unnamed tributary itself.

Photo 13. Facing upstream at proposed crossing location (2016)

Photo 14. Facing downstream at proposed crossing location (2016)

Photo 15. 100 m upstream of crossing location (2016)

Photo 16. 100 m downstream of crossing location (2016)

E.2.5 Crossing 914-MB-02

The unnamed watercourse at Crossing 914-MB-02 (Photos 17-20) connects two lakes and is 393 m long. This watercourse is a small intermittent watercourse. At the time of the assessment, water depth at the crossing location was 0.23 m and it is likely the watercourse freezes to bottom in winter and may dry up in summer.

Spawning habitat for coarse and sport fish is nil and poor for forage fish as the substrate is composed entirely of organics and the watercourse is almost completely covered by overhanging vegetation and woody debris. Rearing habitat for coarse and sport fish is nil and poor for forage fish. The overhanging vegetation may provide some rearing habitat for small bodied fish, but it is so dense it may restrict movement within the watercourse. Overwintering habitat is rated as nil for all fish species as the watercourse likely freezes to bottom in the winter. Resident fish species are more likely to overwinter in one of the lakes connected to the unnamed watercourse. Fish passage is rated as nil for all fish species given the amount of vegetation and woody debris. In addition, given that the watercourse is likely frozen to bottom in winter and dry in summer, it likely provides passage only during times of high flow or flood conditions in the spring.


Photo 17. Facing upstream at crossing location (2016)


Photo 18. Facing downstream at crossing location (2016)


Photo 19. Facing upstream 293 m upstream of crossing location (2016)


Photo 20. 100 m downstream of crossing location (2016)

E.2.6 Crossing 914-MB-03

The unnamed watercourse at crossing location 914-MB-03 (Photos 21-24) is a medium permanent watercourse. At the time of assessment (July 2016), water depth at the crossing location was 0.47 m. The assessed reach is a series of impoundments with narrow stretches of run between them. The downstream impoundment created water depths that were not wadable and were assessed from banks and air. There was a beaver impoundment downstream of the crossing location and a boulder garden upstream of the crossing location where the vast majority of flow is below ground surface.

Spawning habitat at the crossing location for all fish species is rated as moderate as there is abundant coarse substrate, instream vegetation and suitable depth and flow. Rearing habitat for coarse and sport fish is rated as moderate as there is instream cover from riparian vegetation, large boulders, and water depth but limited cover from the banks which are not heavily undercut. Rearing habitat for forage fish is rated as moderate to good given sufficient instream cover and water depth for small bodied fish. Overwintering is rated as moderate to good for forage and coarse fish as the impounded areas likely provide sufficient depth for overwintering. Overwintering for sport fish is rated as poor to moderate as the impoundments should provide sufficient depth but sufficient oxygen may not be available for sport fish which require high dissolved oxygen concentrations. It is likely fish will overwinter in nearby Close Lake. Migration is rated as poor for all fish because the beaver impoundment and boulder garden limit the ability of fish to migrate through the area and likely limits access over the impoundments to times of high flow or flood conditions.

Photo 21. Facing upstream at crossing location (2016)

Photo 22. Facing downstream at crossing location (2016)

Photo 23. 100 m upstream of crossing location (2016)

Photo 24. 100 m downstream of crossing location (2016)

E.2.7 Crossing 914-PR-04

The unnamed watercourse at crossing 914-PR-04 (Photos 25-28) is a small permanent watercourse with a small unnamed lake approximately 800 m upstream. Downstream, the watercourse flows into a smaller lake which empties into Yalowega Lake approximately 1.5 km downstream of the crossing location. At the time of the assessment in June 2010, water depth was approximately 0.2 m. During the second assessment in July 2016, the water depth was 0.40 m. The watercourse is approximately 1 m across.

Spawning habitat was rated as nil for coarse and sport fish as the substrate is predominately fines. For forage fish, spawning habitat was rated as moderate as there was well established aquatic vegetation and some limited woody debris observed and water depth is more suited to small bodied fish. Rearing habitat was rated as moderate for all fish species given flow is moderate and there is substantial overhanging vegetation from the banks and well-established aquatic vegetation however, there were no deep pools. Overwintering habitat was rated as nil for all fish species as it is likely the watercourse freezes to bottom in winter and fish will winter in Close Lake or Yalowega Lake. Fish passage was rated as poor because during winter it is likely the watercourse freezes to bottom and cannot be accessed during this time.

Fish sampling efforts in 2010 yielded two (2) northern pike fingerlings and four (4) white sucker (*Catostomus commersoni*) fingerlings. In 2015, small bodied fish were observed throughout the assessed reach but were not able to be identified.

Photo 25. Facing upstream at crossing location (2016)

Photo 26. Facing downstream at crossing location (2016)

Photo 27. 100 m upstream of crossing location (2016)

Photo 28. 100 m downstream of crossing location (2016)

E.2.8 Crossing 914-PR-05

May Creek at crossing 914-PR-05 (Photos 29-32) is a large permanent watercourse that flows into Close Lake (approximately 500 m downstream). Approximately 500 m upstream, May Creek flows out of Yalowega Lake. At the time of the initial assessment (June 2010) the crossing location the width of the watercourse was approximately 20 m and was approximately 0.6 m deep. The second assessment was completed 150 m downstream of the 2010 crossing location in August 2015 and which point the width of the crossing was 6.4 m across and approximately 0.55 m deep.

Spawning was rated as good for all fish species as there were riffle/run transitions with rapids and coarse cobble substrate suitable for coarse and sport fish spawning. In addition, there was woody debris throughout the area to support forage fish spawning. Rearing habitat was rated as moderate to good for all fish species as there are large boulders throughout and along the banks for cover, the banks are well vegetated and overhanging May Creek. Flow may be too high for some smaller bodied fish, however, Yalowega and Close Lakes are nearby and are suitable for rearing for species that are less tolerant of higher flows. Overwintering habitat was rated as moderate for all fish species as the watercourse is unlikely to freeze to bottom however given the depth, shallower areas may freeze to bottom, however nearby Yalowega and Close Lakes are suitable for overwintering. Fish passage was rated as good for all species, no barriers to migration between the lakes were observed.

In 2010, fish sampling yielded 13 slimy sculpin (*Cottus cognatus*) and four (4) lake chub (*Couseius plumbeus*). There was evidence of eagles feeding on suckers throughout the assessment area. There were concentrations of unidentified large bodied fish observed from the air in a bay of Yalowega Lake, approximately 800 m downstream of the crossing location. In 2015, 20 to 30 adult Arctic grayling (*Thymallus arcticus*) were observed feeding throughout the area. Numerous lake chub (*Couesius plumbeus*) were observed throughout the area and one (1) juvenile white sucker (*Catostomus commersoni*).


Photo 29. Facing upstream at crossing location (2010)


Photo 30. Facing downstream at crossing location (2010)


Photo 31. 145 m upstream of crossing location facing upstream (2015)


Photo 32. 145 m upstream of crossing location facing downstream (2015)

E.2.9 Crossing 914-PR-06

Crossing 914-PR-06 is ephemeral as there was no visible channel at the crossing location. The area is a wet black spruce and tamarack bog. There are wet sedge meadows within a few hundred metres on either side of the proposed crossing location but there is no distinct channel. As such, the fish habitat potential in this area is rated as none. Findings were consistent between 2010 and 2015.

E.2.10 Crossing 914-PR-07

The unnamed watercourse at crossing 914-PR-07 (Photos 33-36) is a small intermittent watercourse with poor fish habitat overall. At the time of the assessment (June 2010), it was not possible to measure depth as a result of the substrate which is predominantly large boulders with some water flowing between them and continues in this fashion for at least 500 m downstream. Downstream, approximately 200 m, there is very little water visible. The width of the channel at the crossing location was approximately 1 m. There is a lake within 1 km upstream and a lake downstream within 2 km. Three inactive beaver impoundments with partially drained ponds were observed between 100 and 400 m upstream of the crossing location.

Spawning habitat is rated as nil for all fish species given the very coarse substrate and intermittent flow as well as flow beneath the boulders. Rearing habitat was rated as nil for coarse and sport fish and poor for forage fish. It is possible that small bodied fish could access the watercourse from either one of the lakes, but the boulder substrate and subsurface flows make the watercourse unsuitable for larger bodied fish. There is some overhanging riparian vegetation. Overwintering habitat was rated as nil for all fish species as the watercourse is likely to freeze to bottom in winter. Fish passage was rated as nil to poor as a result of the beaver impoundments upstream and the downstream flow through the boulder substrate with little water. It is unlikely that there is fish passage between the two lakes through this watercourse, however small bodied fish could potentially use the watercourse during flood conditions.

Photo 33. Facing upstream at crossing location (2010)

Photo 34. 100 m downstream of crossing location facing downstream (2010)

Photo 35. 100 m downstream of crossing location facing upstream (2010)

Photo 36. 100 m upstream of crossing location showing old beaver impoundment (2010)

E.2.11 Crossing 914-PR-08

The unnamed watercourse at crossing 914-PR-08 (Photo 37-40) is a small intermittent watercourse with no fish habitat overall. It is possible that the channel at the crossing location could convey significant flows during large spring runoff events and provide a temporary connection between the two lakes that are approximately 600 m at either end of the channel. At the time of the assessment (August 2015), the channel was dry. The substrate was predominately boulders. The area was predominately a willow flat with a wide floodplain, approximately 20 m across. Three braided channels were observed within the willow flat. A forest fire had recently occurred in the area and evidence was observed throughout the assessment area.

Spawning, rearing, and overwintering habitat was rated as nil for all fish species due to the lack of water and potential ephemeral flows. Fish passage was also rated as nil for all fish species, however, if there were sufficient spring flows to accommodate the wide floodplain, there is the potential that there could be limited and temporary connectivity between the two lakes.

Photo 37. Facing “upstream” at crossing location (2015)

Photo 38. Facing “downstream” at crossing location (2015)


Photo 39. 50 m “upstream” of crossing location (2015)


Photo 40. 100 m “downstream” of crossing location (2015)

E.2.12 Crossing 914-PR-09

The unnamed watercourse at crossing 914-PR-09 (Photos 41-44) is a small intermittent watercourse that is likely to freeze to bottom in winter with nil to poor fish habitat for all fish groups. At the time of assessment (June 2010), the stream was flowing underground through a soil and vegetation covered boulder garden from approximately 600 m upstream of the crossing location to slightly downstream of the crossing. Approximately 350 m downstream of the crossing location there were three inactive beaver impoundments with partially drained ponds. This assessment was confirmed when a nearby site approximately 100 m downstream was assessed in August 2015 which identified numerous braided channels running predominately subsurface. There is a lake within 1 km upstream and a second lake within 400 m downstream of the crossing location.

Spawning habitat was rated as nil for all fish species. The watercourse flows subsurface for most of the assessed area and where there is water on the surface, there is some riparian vegetation overhanging instream, however water depths observed do not appear suitable. Rearing habitat was rated as nil for coarse and sport fish and poor for forage fish. There is substantial cover from riparian vegetation and boulders, however the depth and subsurface flow limits suitable habitat. Overwintering habitat is rated as nil for all fish species as the watercourse is likely to freeze to bottom in the winter. There are some partially drained ponds behind beaver impoundments downstream which may provide more suitable overwintering habitat for small bodied fish. Resident fish are most likely to overwinter in nearby lakes. Fish passage is rated as nil to poor for all fish species given the subsurface flows through the boulder garden but may allow potential for small bodied fish. There may be better connectivity between the two lakes through the unnamed watercourse during flood conditions.

Photo 41. Channel at crossing location (2010)

Photo 42. Facing upstream from crossing location (2010)

Photo 43. Downstream of crossing location (2010)

Photo 44. Facing northwest across crossing location (2010)

E.2.13 Crossing 914-PR-10

The unnamed tributary to Waterbury Lake at crossing 914-PR-10 (Photos 45-48) is a small permanent watercourse that likely freezes to bottom in winter. Upstream of the crossing location is a small lake approximately 2 km upstream. At the time of assessment (August 2015), the width of the watercourse was approximately 1.3 m, depth was less than 0.3 m. There were low flow conditions at the time of assessment and substrate was predominately sand (80%) and organics (20%) at the crossing location.

Spawning habitat was rated as nil for coarse and sport fish and poor for forage fish as the substrate is composed of fines and organics and has low flow, however, there is some instream vegetation that might be suitable for forage fish. Rearing habitat was rated as moderate for all fish species that are in the area as there is cover from undercut banks and overhanging riparian vegetation. Approximately 100 m upstream there is woody debris available for cover as well. However, water depth is likely not suitable for larger bodied fish. Overwintering habitat was rated as nil for all species given that the watercourse is likely to freeze to bottom in winter. Suitable overwintering habitat exists downstream in Waterbury Lake and it is likely that is where resident fish will overwinter. Fish passage is rated as poor, particularly for larger bodied fish. It is likely that small bodied fish will be able to migrate through the watercourse during high flow or flood conditions.

Photo 45. Facing upstream at crossing location (2015)

Photo 46. Facing downstream at crossing location (2015)

Photo 47. 20 m downstream of crossing location facing upstream (2015)

Photo 48. 20 m downstream of crossing location facing downstream (2015)

E.3 MITIGATION MEASURES

Mitigation Description	
Timing	Time instream works with respect to the timing windows to protect fish during sensitive time periods (e.g., restricted activity timing window).
	Minimize the duration of instream work
	Conduct instream work during periods of low flow; to further reduce the risk to fish and their habitat, allow instream works to be isolated from flow.
	Schedule work to avoid wet, windy, and rainy periods that may increase erosion and sedimentation
Operation of Machinery	Ensure that machinery arrives on site in a clean condition and is maintained free of fluid leaks, invasive species, and noxious weeds
	Develop and implement a Containment and Spill Management Plan that minimizes risk of accidental spills or releases from entering the watercourse during all phases of the Project
	Use a biodegradable hydraulic fluid for equipment when working instream
	Wash, refuel, and service machinery and store fuel and other materials for the machinery in such a way to prevent any deleterious substances from entering the water.
	Whenever possible, operate machinery on land above the high-water mark or on ice in a manner that minimizes disturbance to the bed and banks of the waterbody
	Use temporary crossings structures or other practices to cross watercourses with steep and/or highly erodible (e.g., dominated by organic materials and silts) banks and beds
	Limit machinery fording of the watercourse to a one-time event (i.e., over and back) and only if no alternative crossing method is available. If repeated crossings of the waterbody are required, construct a temporary crossing structure
	Remove all construction materials from site upon completion of works.
Erosion and Sediment Control	Develop and implement an Erosion and Sediment Control Plan that minimizes the risk of sedimentation during the Project
	Installation of effective erosion and sediment control measures before starting work to prevent sediment from entering the water body • Regular inspection and maintenance of erosion and sediment control measures and structures during the course of construction • Repairs to erosion and sediment control measures and structures, if damage occurs • Removal of non-biodegradable erosion and sediment control materials once site is stabilized
	Develop measures for containing and stabilizing waste material (e.g., dredging spoils, construction waste and materials, commercial logging waste, uprooted or cute aquatic plants, accumulated debris) above the high-water mark of nearby watercourses and/or waterbodies to prevent re-entry
	Implement subsurface drainage controls, where appropriate, to maintain groundwater and surface water interactions and to maintain the stability of reclaimed land. The type and location of subsurface drainage controls should be determined through onsite investigation with considerations for subsurface flow potential, erodibility of backfill materials, and degree of slope.
Maintenance and Reclamation	Minimize the removal of natural woody debris, rocks, sand, or other materials from the banks, shoreline, or the bed of the waterbody below the high-water mark. If material is removed from the waterbody, set it aside and return it to the original location once construction activities are completed
	Revegetate areas with surface (i.e., terrestrial) disturbance following construction works. If there is insufficient time remaining in the growing season, the site should be stabilized (e.g., cover exposed areas with erosion control blankets to keep the soil in place and prevent erosion) and vegetated the following spring.
	Do not fertilize in the immediate vicinity of a waterbody unless requested by the landowner and approved by DFO
	Revegetated streambanks and approach slopes with an appropriate native seed mix or erosion control mix
	Develop specific procedures to prevent the invasion or spread of undesirable non-native vegetation (e.g., purple loosestrife, *Eurasian milfoil*)

Mitigation Description	
Riparian Vegetation Removal	Design and construct approaches to the watercourse or waterbody such that they are perpendicular to the watercourse or waterbody to minimize loss or disturbance to the riparian vegetation
	Clearing of riparian vegetation should be kept to a minimum; use existing trails, roads, or cut lines wherever possible to avoid disturbance to the riparian vegetation and prevent soil compaction. When practicable, prune or top the vegetation instead of grubbing/uprooting
	Do not use herbicides for clearing or maintenance of riparian vegetation unless approved by DFO
Isolation and Water Extraction	In the event that open water conditions are encountered during construction, in stream work will be isolated from the rest of the watercourse through use of appropriate measures (e.g., bulk bags, sandbags) to mitigate sediment releases into the watercourse
	Before isolation works commence, retained a qualified environment professional to ensure applicable permits for relocating fish and to capture fish trapped within an isolated/enclosed area at the work site and safely relocate them to an appropriate location in the same waters. Fish may need to be relocated again if flooding occurs on the site.
	Use appropriate isolation materials and designs to minimize disturbance to the bed and banks of the watercourse or waterbody. Specific isolation design and materials may be dependent on the location and timing of the crossing.
	Pump sediment-laden dewatering discharge into a settling basin or vegetated area that provides adequate filtration such that discharged water meets or exceeds the quality of water in the waterbody. Protect pump discharge area(s) to prevent erosion and the release of suspended sediments downstream and remove this material when the works have been completed
	Screen any water intake pipes as per DFO's interim code-of-practice: End-of-pipe fish protection screens for small water intakes in freshwater (DFO 2019) to prevent entrainment or impingement of fish. Entrainment occurs when a fish is drawn into a water intake and cannot escape. Impingement occurs when an entrapped fish is held in contact with the intake screen and is unable to free itself. Follow these measures for design and installation of intake end of pipe fish screens to protect fish where water is extracted from fish-bearing waters
	Remove accumulated sediment and excess spoil from the isolated area before removing the isolation
	Ensure the pumping system is sized to accommodate any expected high flows of the watercourse during the construction period
	Monitor pumps at all times, and have back-up pumps readily available on-site in case of pump failure to facilitate isolation to be completed outside the RATW
Monitoring	Develop and implement a Turbidity Monitoring Plan, which includes specifications for turbidity sampling locations, frequency, and detection response procedures prior to construction. The turbidity monitoring program will be led by a qualified environment professional and reviewed in detail with the Contractor prior to the commencement of instream work.
Excavation	Store excavated materials above the high-water mark until the materials can be backfilled. The top 10-50 cm of channel substrate should be stored separately and replaced during backfilling
	Backfill with material of the same quality and gradation that was removed
	Restore bed and banks of the watercourse or waterbody to their original contour and gradient; if the original gradient cannot be restored due to instability, a stable gradient that does not obstruct fish passage should be constructed
	Use clean rock for instream construction associated with any instream isolations
Culverts	The culverts must be of an appropriate size and constructed in a manner to accommodate flows expected during the period of use so that any back-flooding does not result in damage to public and private land and property
	Culverts should be designed and installed in a manner to accommodate the upstream and downstream passage of fish that may be present in the waterbody
	If replacement rock reinforcement/armoring is required to stabilize eroding or exposed areas, then ensure that appropriately sized, clean rock is used, and that rock is installed at a similar slope to maintain a uniform bank/shoreline and natural stream/shoreline alignment. Riprap should be clean, free of fine materials, and of sufficient size to resist displacement during design flood events.