MASKWA ENVIRONMENTAL CONSULTING

City of Edmonton Transmission Reinforcement Project

Environmental and Land Use Effects Assessment Update

EPCOR Distribution & Transmission Inc.

Maskwa Environmental Consulting Ltd.

1817 10 Avenue SW, Calgary, AB T3C 0K2

January 13, 2022

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1 Introduction

1.1 Project description

The Alberta Electric System Operator (AESO) is responsible for the safe, reliable, and economic operation and long term planning of the Alberta Interconnected Electric System (AIES). The AESO is considering transmission system improvements in the city of Edmonton. The AESO has directed EPCOR Distribution & Transmission Inc. (EDTI) to assist in the preparation of an Environmental and Land Use Effects Assessment (ELUEA) consistent with the requirements under section 7.1.1 NID 2 of Alberta Utilities Commission (AUC) Rule 007[1] for the system improvement alternatives being contemplated by the AESO. This includes the AESO "Environment and Land Use Evaluation Scope"[2] which outlines specific requirements and content within the ELUEA. In the NID Specification document, the AESO is considering a number of alternatives to improve the EDTI transmission system, which are described in section 1.2.

The Project is referred to as the City of Edmonton Transmission Reinforcement Project (CETR). Figure 1 shows the area within the City of Edmonton that the AESO is considering transmission system improvements.

It is important to note that this assessment is a high-level desktop analysis using available information supplemented with some field reconnaissance. Aspects of this assessment are subject to change once the more detailed siting analysis is completed during the facility application stage where a more comprehensive assessment will be completed utilizing information that is currently unavailable (i.e.: stakeholder input, detailed engineering, biophysical surveys, etc.).

[1] Alberta Utilities Commission Rule 007 - Applications for Power Plants, Substations, Transmission Lines, Industrial System Designations and Hydro Developments, September 1, 2021
[2] AESO Environment and Land Use Evaluation Scope, V2-2021-08-23

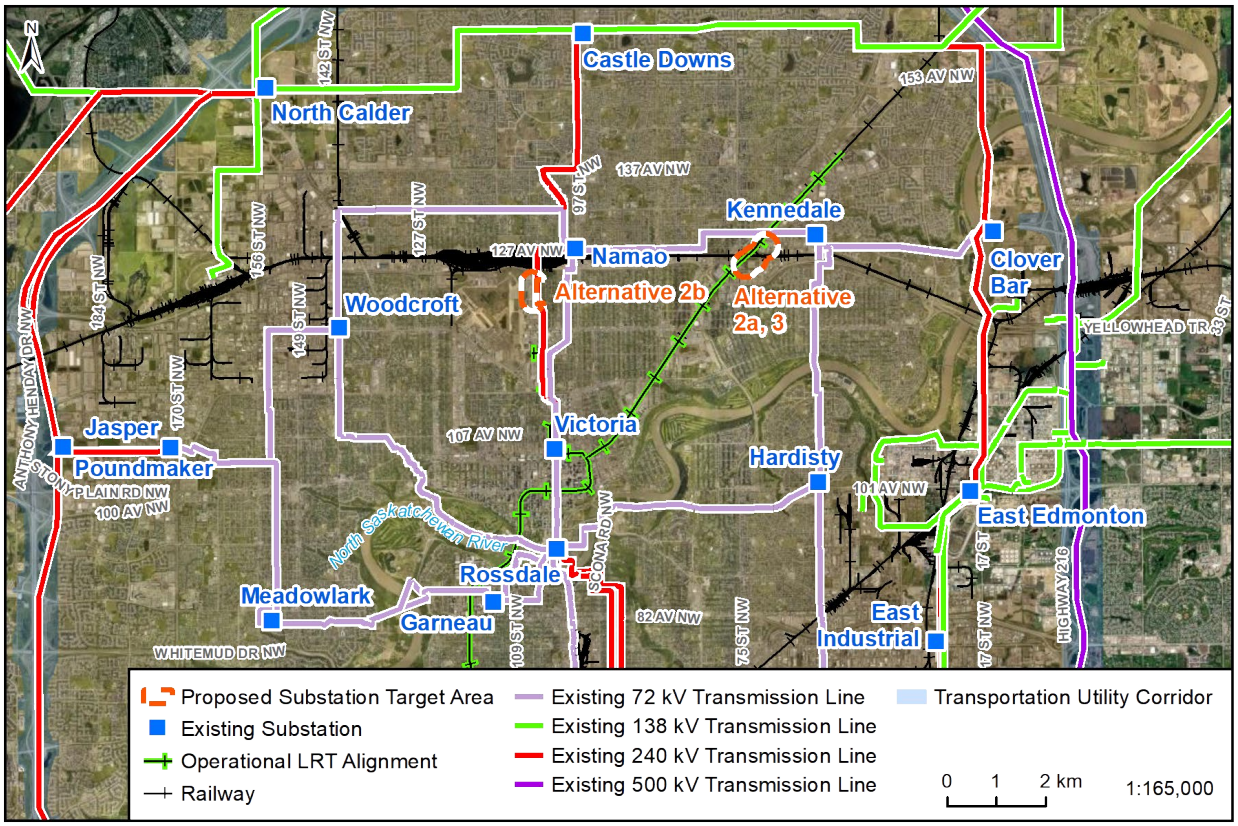


Figure 1 – Project location map

1.2 AESO System improvement alternatives

1.2.1 72 kV Alternatives

1.2.1.1 Alternative 1a

Upgrade the existing 72 kV circuits in the city of Edmonton with 72 kV circuits of higher thermal rating, while maintaining the existing transmission system configuration:

- 72 kV underground lines (72CK12 and 72CK13) between the existing Clover Bar and Kennedale substations;
- 72 kV underground lines (72CH9 and 72CH11) between the existing Clover Bar and Hardisty substations; and
- 72 kV underground lines (72RG1 and 72RG7) between the existing Rossdale and Garneau substations.

1.2.1.2 Alternative 1a (i)

Upgrade the existing 72 kV circuits in the city of Edmonton with 138 kV circuits, while maintaining the existing transmission system configuration:

- 138 kV underground lines (72CK12 and 72CK13) between the existing Clover Bar and Kennedale substations;
- 138 kV underground lines (72CH9 and 72CH11) between the existing Clover Bar and Hardisty substations; and
- 138 kV underground lines (72RG1 and 72RG7) between the existing Rossdale and Garneau substations.

1.2.1.3 Alternative 1b

Upgrade the existing 72 kV circuits in the city of Edmonton with 72 kV circuits of higher thermal rating, while maintaining the existing transmission system configuration of the 72kV lines:

- 72 kV underground line (72JW19) between the existing Jasper and Woodcroft substations;
- 72 kV overhead line (72NW15) between the existing Namao and Woodcroft substations;
- 72 kV underground line (72KN23) between the existing Kennedale and Namao substations;
- 72 kV underground lines (72CK12 and 72CK13) between the existing Clover Bar and Kennedale substations;
- 72 kV underground lines (72CH9 and 72CH11) between the existing Clover Bar and Hardisty substations;
- 72 kV underground lines (72RG1 and 72RG7) between the existing Rossdale and Garneau substations;
- Install a new 240/72 kV transformer at Clover Bar substation with 200 Mega Volt Amp (MVA) rating; and
- Reconnect three (3) existing 72kV Capital Power Corporation (CPC) peaker generators to 240 kV Clover Bar substation yard.

1.2.1.4 Alternative 1b (i)

Upgrade the existing 72 kV circuits in the city of Edmonton with 138 kV circuits, while maintaining the existing transmission system configuration:

- 138 kV underground line (72JW19) between the existing Jasper and Woodcroft substations;
- 138 kV overhead line (72NW15) between the existing Namao and Woodcroft substations;
- 138 kV underground line (72KN23) between the existing Kennedale and Namao substations;

- 138 kV underground lines (72CK12 and 72CK13) between the existing Kennedale and Clover Bar substations;
- 138 kV underground lines (72CH9 and 72CH11) between the existing Clover Bar and Kennedale substations;
- 138 kV underground lines (72RG1 and 72RG7) between the existing Rossdale and Garneau substations;
- Install a new 240/72 kV transformer at Clover Bar substation with 200 MVA rating; and
- Reconnect three (3) existing 72 kV Capital Power Corporation (CPC) peaker generators to 240 kV Clover Bar substation yard.

1.2.2 240 kV Alternatives

1.2.2.1 Alternative 2a

Build a new 240/72 kV substation as a source to supply at 72 kV the existing Kennedale and Namao substations with the following configuration:

- A 240/72 kV proposed substation near the intersection of Yellowhead Trail NW and 50 Street NW;
- A double-circuit 240 kV in-out interconnection from the proposed substation to the existing 915L 240 kV overhead transmission line;
- A single-circuit 240 kV line from the proposed substation to the existing Victoria substation;
- A single-circuit 72 kV line from the proposed substation to the existing Kennedale substation;
- A single-circuit 72 kV line from the proposed substation to the existing Namao substation;
- Upgrade the 72 kV underground line (72KN23) to a higher thermal rating between the existing Kennedale and Namao substations;
- Upgrade the 72 kV underground lines (72CH9 and 72CH11) to a higher thermal rating between the existing Clover Bar and Hardisty substations; and
- Upgrade the 72 kV underground lines (72RG1 and 72RG7) to a higher thermal rating between the existing Rossdale and Garneau substations.

1.2.2.2 Alternative 2b

Build a new 240/72 kV substation as a source to supply at 72 kV the existing Kennedale and Namao substations, but using an alternate system configuration than Alternative 2a:

- A 240/72 kV proposed substation south of the existing Namao substation;
- A 240 kV in-out interconnection from the proposed substation to the existing 240CV5 240 kV underground transmission line;
- A single-circuit 72 kV line from the proposed substation to the existing Namao substation;

- A single-circuit 72 kV line between the existing Castle Downs and Kennedale substations;
- Install a new 240/72 kV transformer at Castle Downs substation with 200 MVA rating;
- Upgrade the 72 kV underground line (72KN23) to a higher thermal rating between the existing Kennedale and Namao substations;
- Upgrade the 72 kV underground lines (72CH9 and 72CH11) to a higher thermal rating between the existing Clover Bar and Hardisty substations; and
- Upgrade the 72 kV underground lines (72RG1 and 72RG7) to a higher thermal rating between the existing Rossdale and Garneau substations.

1.2.3 138 kV Alternative

1.2.3.1 Alternative 3

Build a new 138/72 kV substation as a source to supply at 72 kV the Kennedale and Namao substations with the following configuration:

- A 138/72 kV proposed substation near the intersection of Yellowhead Trail NW and 50 Street NW;
- A single-circuit 138 kV interconnection from the proposed substation to the existing 726L 138 kV overhead transmission line;
- A single-circuit 138 kV interconnection from the proposed substation to the existing 761L 138 kV overhead transmission line;
- A single-circuit 72 kV line from the proposed substation to the existing Kennedale substation;
- A single-circuit 72 kV line from the proposed substation to the existing Namao substation;
- Upgrade the 72 kV underground line (72KN23) to a higher thermal rating between the existing Kennedale and Namao substations;
- Upgrade the 72 kV underground lines (72CH9 and 72CH11) to a higher thermal rating between the existing Clover Bar and Hardisty substations; and
- Upgrade the 72 kV underground lines (72RG1 and 72RG7) to a higher thermal rating between the existing Rossdale and Garneau substations.

1.2.4 Additional 240 kV Alternatives

1.2.4.1 Alternative 4

Build a new 240 kV substation as a source to supply the existing Woodcroft, Victoria, Kennedale and Namao substations/loads with the following configuration:

- A 240/72/15 kV proposed substation near 66 Street and the LRT Capital line;
- A double-circuit 240 kV in-out interconnection from the proposed substation to the existing 915L 240 kV overhead transmission line;

- A single-circuit 240 kV line from the proposed substation to the existing Victoria substation;
- Two (2) single-circuit 72 kV lines from the proposed substation to the existing Namao substation (staged with end-of-life of 72CN10);
- An expansion and upgrade to the existing 240 kV East Industrial substation to 240/72 kV with one (1) 240/72kV autotransformer;
- De-commission (end-of-life, no upgrades required) the 72 kV underground lines (72CK12 and 72CK13) between the existing Clover Bar and Kennedale substations;
- De-commission existing Kennedale substation (high voltage and medium voltage equipment & sell land)
- De-commission (end-of-life, no upgrades required) the 72 kV underground line (72KN23) between the existing Kennedale and Namao substations;
- De-commission (end-of-life, no upgrades required) the 72 kV underground line (72CN10) between the existing Clover Bar and Namao substations; and
- A single-circuit 72 kV line between the existing East Industrial and Hardisty substations;
- De-commission (end-of-life, no upgrades required) the 72 kV underground lines (72CH9 and 72CH11) between the existing Clover Bar and Hardisty substations;
- Tie the existing single-circuit 72 kV overhead lines (72VN21 and 72NW15) as a bypass of the Namao substation to feed the existing Woodcroft substation;
- Remove the 72 kV overhead lines (72VN21 and 72NW15) into the Namao substation;
- No expected fence expansion required to the existing Namao substation;
- De-commission (end-of-life, no upgrades required) the oil-tie-line 72RH7 between the existing Rossdale and Hardisty substations when 72CH9 and 72CH11 are decommissioned; and
- Upgrade the 72 kV underground lines (72RG1 and 72RG7) to a higher thermal rating between the existing Garneau and Rossdale substations

1.2.4.2 Alternative 5

Upgrade the existing 72 kV circuits in the city of Edmonton with 72 kV circuits of higher thermal rating, while maintaining the existing transmission system configuration:

- A new 72 kV breaker and associated equipment at the existing Kennedale substation to upgrade the existing feed-through 72 kV bus configuration to a 72 kV ring bus (all within the existing fence line);
- 72 kV underground lines (72CH9 and 72CH11) between the existing Clover Bar and Hardisty substations; and
- 72 kV underground lines (72RG1 and 72RG7) between the existing Rossdale and Garneau substations.

1.3 ELUEA Scope of work

The scope of work includes a desktop assessment of environment and land use effects for the City of Edmonton Transmission Reinforcement Project (‘CETR’ or ‘Project’) including a mixture

of a qualitative and quantitative analysis that meets the requirements of NID2 outlined in subsection 7.1.1 of *AUC Rule 007*[3].

This assessment is intended to contribute to EDTI's and the AESO's larger assessment on the overall viability of the system improvement alternatives outlined above in section 1.2. The objective of this ELUEA is to assess the viability of each of the alternatives (69kV, 138kV and 240kV) considered for the Project from a land use and environmental impact perspective, identify the types and degree of potential impacts, and provide general conclusions on how these compare to each alternative. For the purposes of this study, a series of conceptual routes were developed to complete the analysis and associated recommendations. General determinations were made in relation to the feasibility of overhead and underground configurations based on apparent and expected siting and technical constraints within the study areas for each of the alternatives.

EDTI's siting methodology[4] is to approach initial routing with the assumption that all potential routing will be overhead and then move to an underground configuration when driven to do so by the collective consideration of various siting and technical constraints (i.e.: lack of physical space, lack of existing facilities to re-purpose or overbuild, adjacent land uses, etc.). Generally, an underground configuration may have lower overall impacts when routing involves locating within dense residential neighbourhoods where existing overhead facilities are not already present to follow or overbuild. As a result, some indicative routing segments used for this analysis were considered to be viable from an underground perspective only. For all remaining overhead indicative routing, the working premise is that an underground route would be possible in the same general location pending additional study (i.e.: detailed engineering, stakeholder input, subsurface data review, etc.).

It should be noted that detailed siting analysis, stakeholder feedback and other information have not been gathered as part of the high-level assessment outlined in this document. As a result, it is expected that further refinements would occur through the detailed siting efforts typically associated with the facility application stage once a technical solution has been selected and direction has been given to EDTI by the AESO. Detailed siting activities would include the acquisition of additional data sources, biophysical surveys, field reconnaissance, stakeholder feedback, and other inputs. Refinements will potentially include changes to the indicative routes developed for this assessment, the development of other viable routes not considered in this assessment, as well as changes to the feasibility of overhead versus underground configurations.

[3] Alberta Utilities Commission Rule 007 - Applications for Power Plants, Substations, Transmission Lines, Industrial System Designations and Hydro Developments, September 1, 2021
[4] EPCOR Distribution & Transmission Inc., Siting Methodology – Summary of Route and Site Determination Approach for Proposed Overhead Transmission Facilities

2 Environmental and land use effects assessment

2.1 Project setting

The Project is located entirely within the municipal boundaries of the city of Edmonton. The focus of the Project is on system improvements to the existing 72 kV transmission system. These are aging circuits which are reaching the limits of their capacity and life cycle, which in turn pose potential longer-term implications to the broader system configurations and operational planning within the transmission system for the area.

All of the alternatives considered are located within highly developed areas of the city, with many of the substations located within well-developed residential and/or commercial land use districts. The majority of the existing 72 kV circuits are located in a combination of underground and overhead configurations within existing roadways. In some locations, the existing lines cross over green spaces, parks, and the North Saskatchewan River Valley (NSRV).

2.2 Assessment methodology

The environmental and land use effects were assessed using primarily a desktop evaluation methodology that leveraged available information within the Project area as well as the knowledge and experience of EDTI and Maskwa siting professionals. The evaluation included the development of a Study Area for each component with conceptual route(s) that were used to determine and assess the presence, types and levels of potential land use and environmental impacts that would be expected with the proposed development of a transmission line in these areas.

- As per section 7.1.1 of NID2[5], the purpose of the ELUEA, is to complete a desktop evaluation to evaluate the environmental and land use effects of the connection alternatives being considered by the AESO as part of their NID application. The AESO's "Environment and Land Use Evaluation Scope"[6] was also referenced, which outlines specific requirements and content within the ELUEA. In addition to what is outlined in Rule 007, the AUC has also provided some indication in relation to what an ELUEA should include through their regulatory decisions and certain information requests for previous applications. These include consideration of:
- Land assessment: public and private, federal, First Nations' reserve lands, and transportation utility corridor considerations;
- Agricultural and other land use features including native grassland;

[5] Alberta Utilities Commission Rule 007 - Applications for Power Plants, Substations, Transmission Lines, Industrial System Designations and Hydro Developments, September 1, 2021
[6] AESO Environment and Land Use Evaluation Scope, V2-2021-08-23

- Environmental features such as:
    - Wildlife sensitivity areas that may be assessed from AEP wildlife sensitivity maps;
    - Provincially protected areas such as provincial parks, wilderness areas, ecological reserves, wildland parks, Willmore Wilderness Park, provincial recreation areas, heritage rangelands and natural areas;
    - Provincially designated environmentally significant areas where maps are available from AEP;
    - Federally protected areas such as national parks, wilderness areas, and areas subject to special orders such as the Emergency Order for the Protection of Greater Sage-Grouse;
- Applicable regional land use plans adopted under the Alberta Land Stewardship Act and whether the proposed development meets the requirements of the plans.

2.2.1 Data sets

Conceptual routing scenarios were developed through the application of siting expertise and compared using available data sets that included:

- Fish and Wildlife Management Information system (FWMIS);
- Alberta Conservation Information Management System (ACIMS);
- Alberta Parks Environmentally Significant Areas Report (ESA);
- Alberta Listing of Historic Resources;
- Federal and Provincial Contaminated Sites Inventory;
- Industry Canada communication facility sites;
- City of Edmonton and Strathcona County statutory and non-statutory plans;
- City of Edmonton transportation network (including rail);
- City of Edmonton land ownership parcel classification (public vs. private owned parcels);
- City of Edmonton and Strathcona County Zoning Bylaw and land use activities; and
- The most current aerial imagery.

2.2.2 Routing principals

In consideration of EDTI's siting methodology for siting overhead transmission facilities, when proposing new 72 kV, 138 kV, and 240 kV transmission lines within an urban setting, the initial approach is to locate facilities within public transportation corridors and/or public utility rights-of-way/easements as much as possible in order to avoid the need to use private property. This practice aligns with industry standard siting practices and direction provided in several legislative resources, including:

- *Rule 007, Applications for Power Plants, Substations, Transmission Lines, Industrial System Designations and Hydro Developments, Alberta Utilities Commission;*
- *Environmental and Land Use Evaluation Scope, AESO, August 23, 2021*

- *Environmental Protection Guidelines for Transmission Lines, Alberta Environment, R&R/11-03;*
- *Public Lands Operational Handbook, Alberta Environment and Parks;*
- *Alberta Electrical Utilities Act, Transmission Regulation 86/2007*
- *Alberta Electrical Utility Code, Fifth Edition;*
- *Alberta Hydro and Electric Energy Act*; and
- *Previous regulatory decisions for similar projects.*

For this Project, siting in existing public transportation corridors and/or public utility rights-of-way/easements includes the Transportation and Utility Corridors (TUC), utility rights-of-way/easements, provincial government highways, municipal roadways, undeveloped road allowances, and back alleys.

Figure 2 shows a utility rights-of-way (URW) in Edmonton which contains five (5) underground 72 kV circuits and three (3) pipelines.

Figure 2 – Typical utility rights-of-way in an established area

Public transportation corridors commonly serve as public utility corridors from a land use planning perspective and are routinely used for siting typical 72 and/or 138 kV overhead transmission lines in urban environments. It becomes more challenging to accommodate larger 240 kV transmission lines within typical transportation corridors without acquiring easements on adjacent private property due to the larger size and space requirements of 240 kV structures. These types of facilities, particularly in an overhead configuration, would generally be confined to the TUC or other major corridors, such as the Yellowhead Trail or the Light Rail Transit (LRT) transportation corridors.

Figure 3 below shows an overhead 72 kV transmission line in a public transportation corridor and a 138 kV transmission line in a URW located within the city of Edmonton. It is expected that an underground circuit at either voltage could be located beneath the roadway or elsewhere within these types of corridors.

Figure 3 – 72 kV (left) and 138 kV (right) alignment within transportation corridor and URW

reasons corridors are viewed as compatible from a siting perspective for a variety of infrastructure developments. This is even more the case when proposed transmission facilities can be co-located or overbuilt on existing electrical facilities, as illustrated on the left side of Figure 3 above.

2.2.3 Underground versus overhead configurations

EDTI's siting methodology emphasizes the initial consideration of overhead configurations for new facilities unless driven to use of underground configurations due to siting or technical constraints. This is a similar approach used by other utilities and is supplemented by the regulatory guidance to utilize existing facilities and rights-of-way[7], lower costs associated with overhead facilities, longer-term maintenance practices and the consideration of project specific aspects that may make one more feasible than the other.

For this Project, the limited amount of available information and absence of more detailed information that typically comes from stakeholder engagement, detailed engineering, biophysical surveys, and other activities makes it challenging to determine which configuration would have a lower overall impact for any of the alternatives accurately. General assumptions can be made in relation to the alternatives based on proximity to residential, parks and other areas where underground is typically used to address commonly raised stakeholder concerns and other factors. The exception would be where existing overhead facilities are present in these areas and able to be replaced or overbuilt with a new facility, thus resulting in an incremental impact versus an entirely new one. It is generally assumed when siting new transmission routes that overhead configurations are possible, with the exceptions of alternatives that involve routing through these more sensitive areas and where no existing overhead facility is present.

[7] Alberta Electrical Utilities Act, Transmission Regulation 86/2007, October 30, 2019, Section 15.1 and 38(a)(iii)

3 Findings

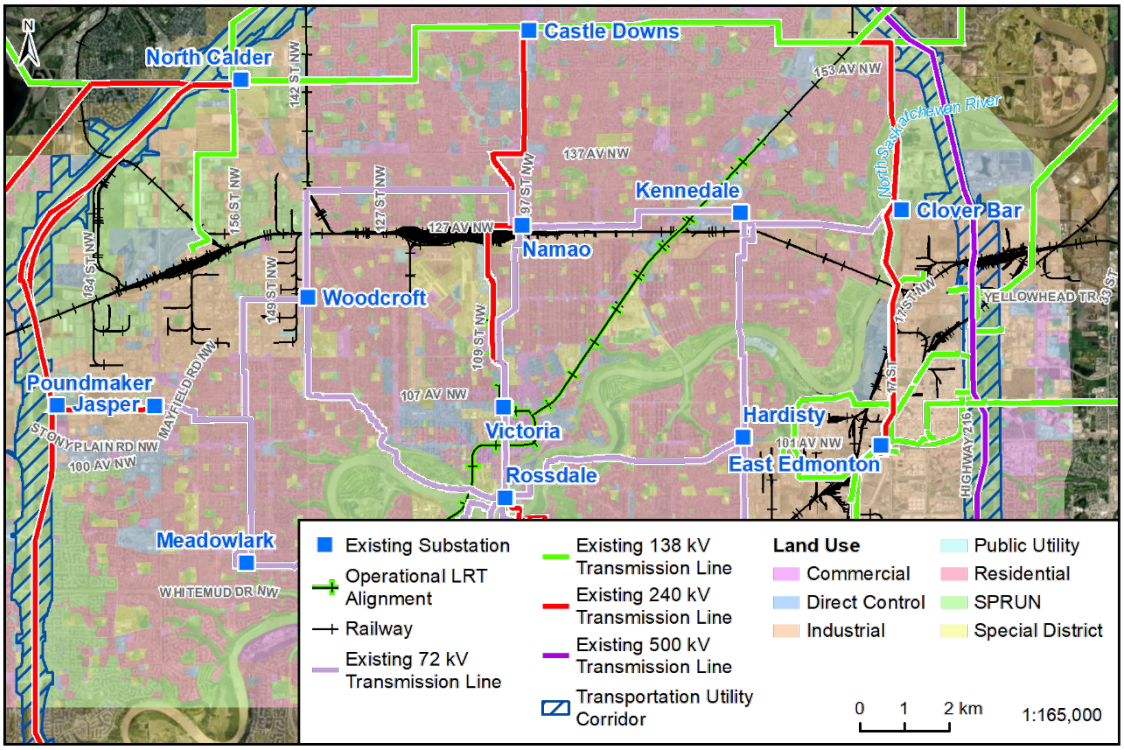
3.1 Key features

As described in section 1.2, there are three (3) voltage alternatives being considered, a 72 kV alternative, a 138 kV alternative, and a 240 kV alternative, each made up of various components. There are two (2) components that are common to each alternative: Rossdale to Garneau and Clover Bar to Hardisty. Of the remainder of the components, some are common to more than one alternative while some are unique to only one alternative.

The key features that typically have the potential to influence the type and level of potential impacts from these alternatives include:

- The number of residences located in close proximity to a transmission line;
- Size/voltage of the transmission line (72 kV, 138 kV or 240 kV);
- The presence of Environmentally Significant Area (ESAs);
- The presence of historical resources;
- The length of the transmission line;
- Any potential off-sets or trade-offs resulting from replacement or decommissioning of facilities that will result in a net decrease in land use and/or environmental impacts; and
- The amount of existing infrastructure constraints present.

The land use districts and key features for the Project area are shown on Figure 4 and Figure 5 respectively.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North Calder
Castle Downs
Kennedale
Clover Bar
Namao
Woodcroft
Poundmaker
Jasper
Victoria
Hardisty
East Edmonton
Rossdale
Meadowlark
142 ST NW
153 AV NW
137 AV NW
97 ST NW
127 AV NW
127 ST NW
156 ST NW
184 ST NW
149 ST NW
109 ST NW
107 AV NW
101 AV NW
MAYFIELD RD NW
STONY PLAIN RD NW
100 AV NW
WHITEMUD DR NW
YELLOWHEAD TR
HIGHWAY 216
North Saskatchewan River
Existing Substation
Operational LRT Alignment
Railway
Existing 72 kV Transmission Line
Existing 138 kV Transmission Line
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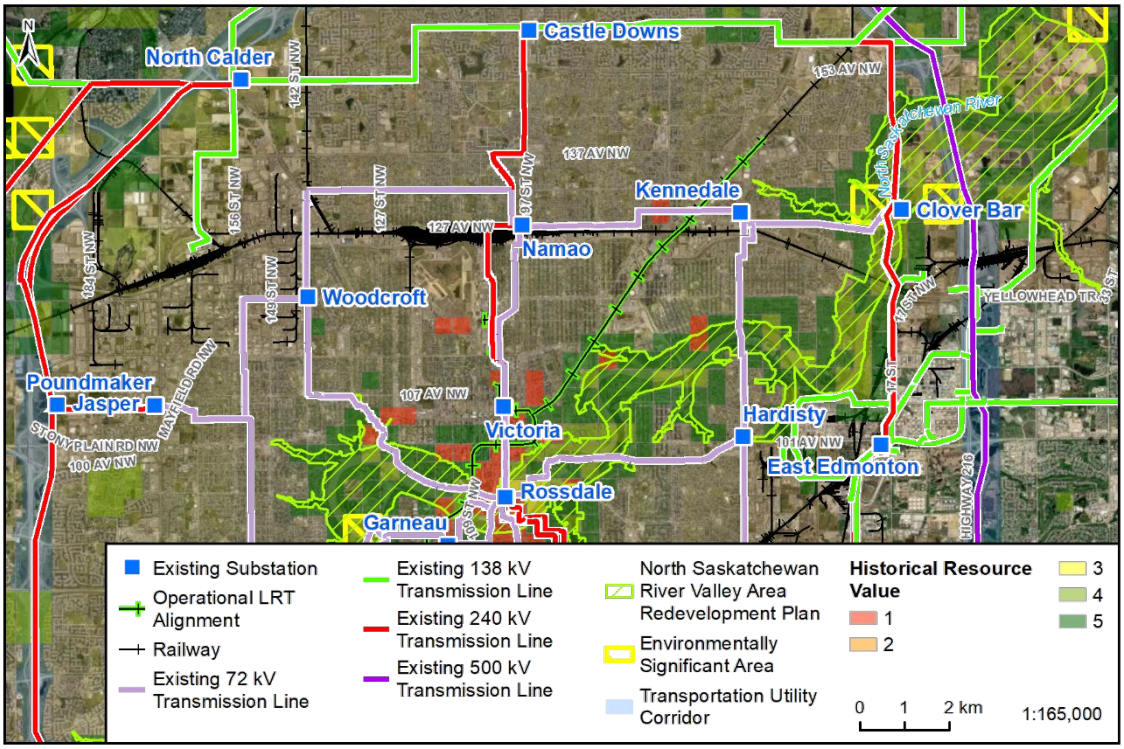
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East Edmonton
Rossdale
Garneau
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153 AV NW
137 AV NW
97 ST NW
127 AV NW
127 ST NW
156 ST NW
184 ST NW
149 ST NW
107 AV NW
101 AV NW
MAYFIELD RD NW
STONY PLAIN RD NW
100 AV NW
YELLOWHEAD TR
HIGHWAY 216
North Saskatchewan River
Existing Substation
Operational LRT Alignment
Railway
Existing 72 kV Transmission Line
Existing 138 kV Transmission Line
Existing 240 kV Transmission Line
Existing 500 kV Transmission Line
North Saskatchewan River Valley Area Redevelopment Plan
Environmentally Significant Area
Transportation Utility Corridor
Historical Resource Value
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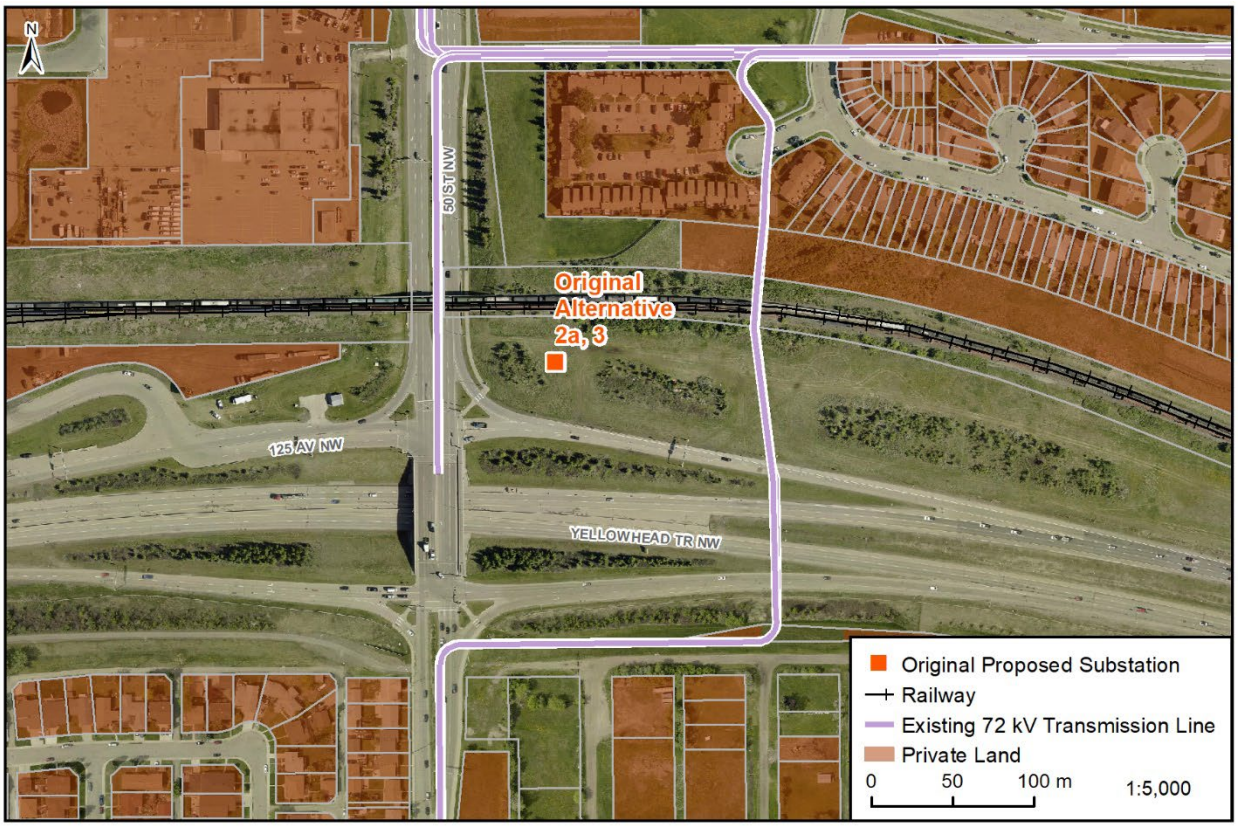
3.2 New substation locations

Alternatives 2a and 3 originally considered the addition of a new substation near the intersection of Yellowhead Trail and 50 Street[8]. At this intersection, there does not appear to be the necessary space required for a substation available without acquiring private lands, which would reduce the level of viability depending on the costs and impacts associated with the acquisition and repurposing of these private lands as shown in Figure 6.



As part of collaborative discussions with EDTI, an alternative location to the intersection of Yellowhead Trail and 50 Street was identified and has been considered as a more suitable and feasible substation target area for the purposes of this assessment. The new recommended location is near 66 Street and the existing LRT line (Capital Line) as shown in Figure 7. This area is primarily industrial with more options that could provide the required space and interconnections involved with the proposed alternative. This includes not only more open

[8] NID Specification – City of Edmonton Transmission Reinforcement, AESO Project Number: P7008, September 12, 2019

space, but also city or privately owned land parcels that could possibly be acquired and re-purposed for use in this Project.

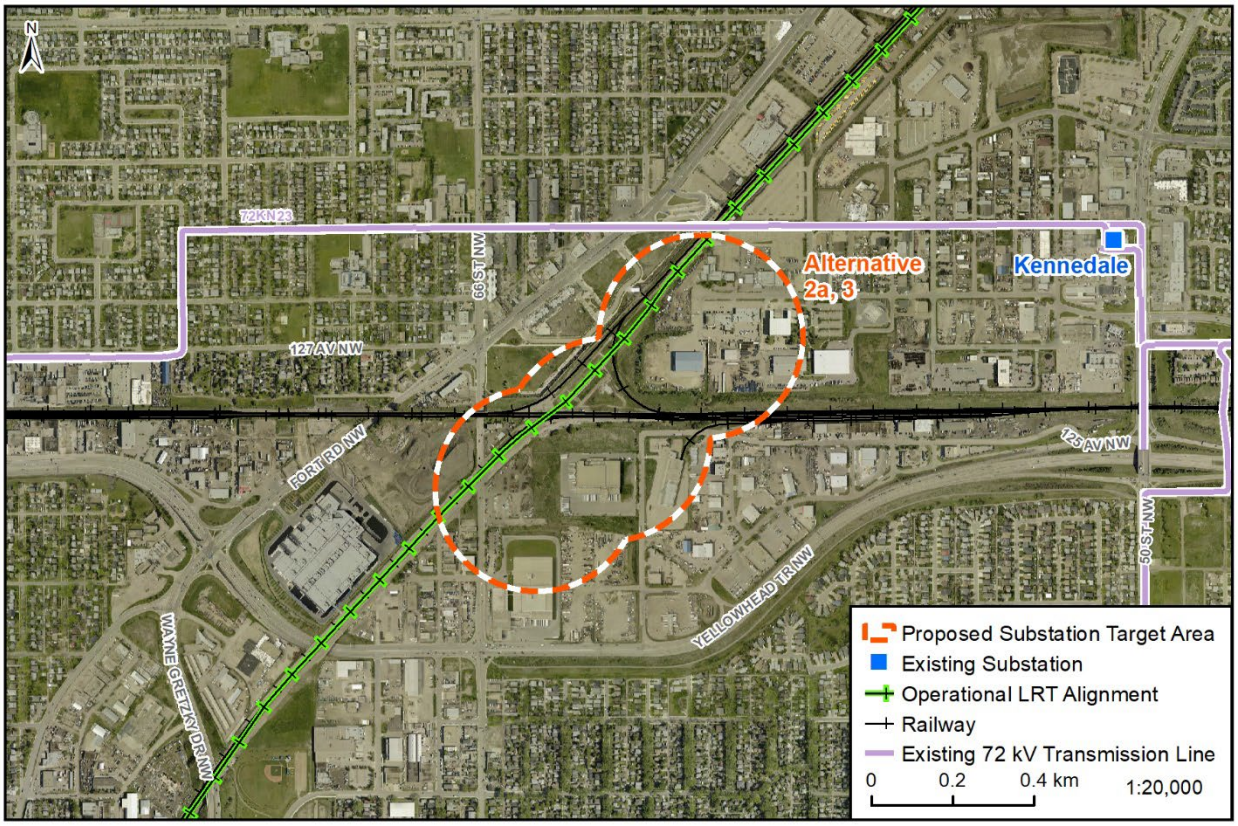


Figure 7 – Alternative 2a and 3 proposed substation target area

Alternative 2b considers a new substation target area south of the existing Namao substation along the existing transmission line 240CV5 as shown in Figure 8. The land parcels in the vicinity of 240CV5 consist of a large cemetery, privately owned residences, and industrial sites. To address any limitations of open space available for a substation, EDTI has confirmed that a portion of their Hugh J. Bolton Service Centre property along 107 Street could be made available and considered as a location for Alternative 2b substation.

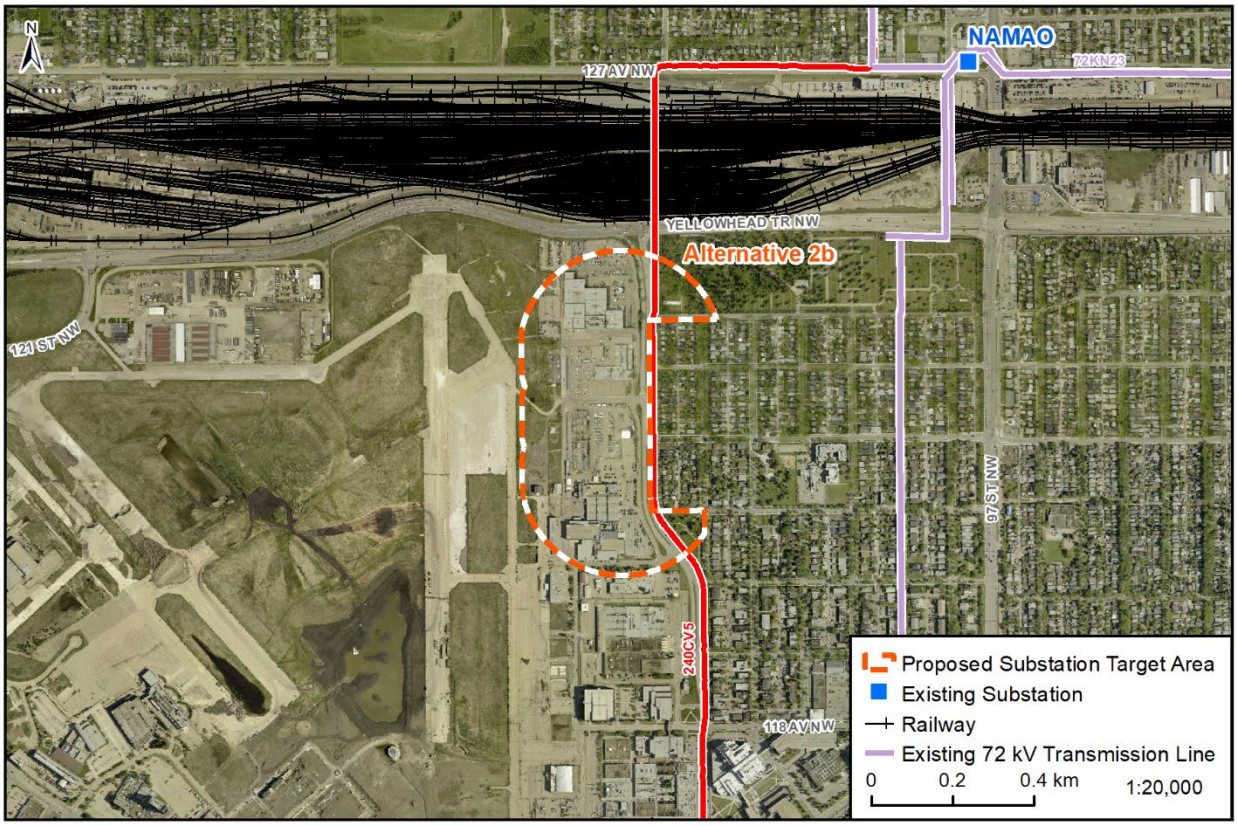


Figure 8 – Alternative 2b proposed substation target area

3.3 System improvement alternatives

The Clover Bar to Hardisty and the Rossdale to Garneau components are common to most of the alternatives and are discussed in detail below.

3.3.1 Common component – Clover Bar to Hardisty

The Clover Bar to Hardisty component (Figure 9) is common to all alternatives and, as a result, does not influence one alternative as being less impactful or less viable than another. A prominent environmental feature in the study area is the North Saskatchewan River Valley (NSRV). The existing underground circuits are primarily located in residential areas but with both circuits crossing the NSRV at two separate locations. Another prominent feature in the study area is the Transportation Utility Corridor (TUC) which is a public corridor with lands set aside specifically for electric transmission lines[9].

[9] Transportation Utility/Corridor (TUC) Program Policy, Alberta Infrastructure – Properties Division, April 2004

The positive consideration to this component is the eventual removal of four 72 kV circuits within the NSRV riverbed if a route utilizing the TUC is considered. A negative consideration to this component is the additional line length that would be added if relocated to the TUC.

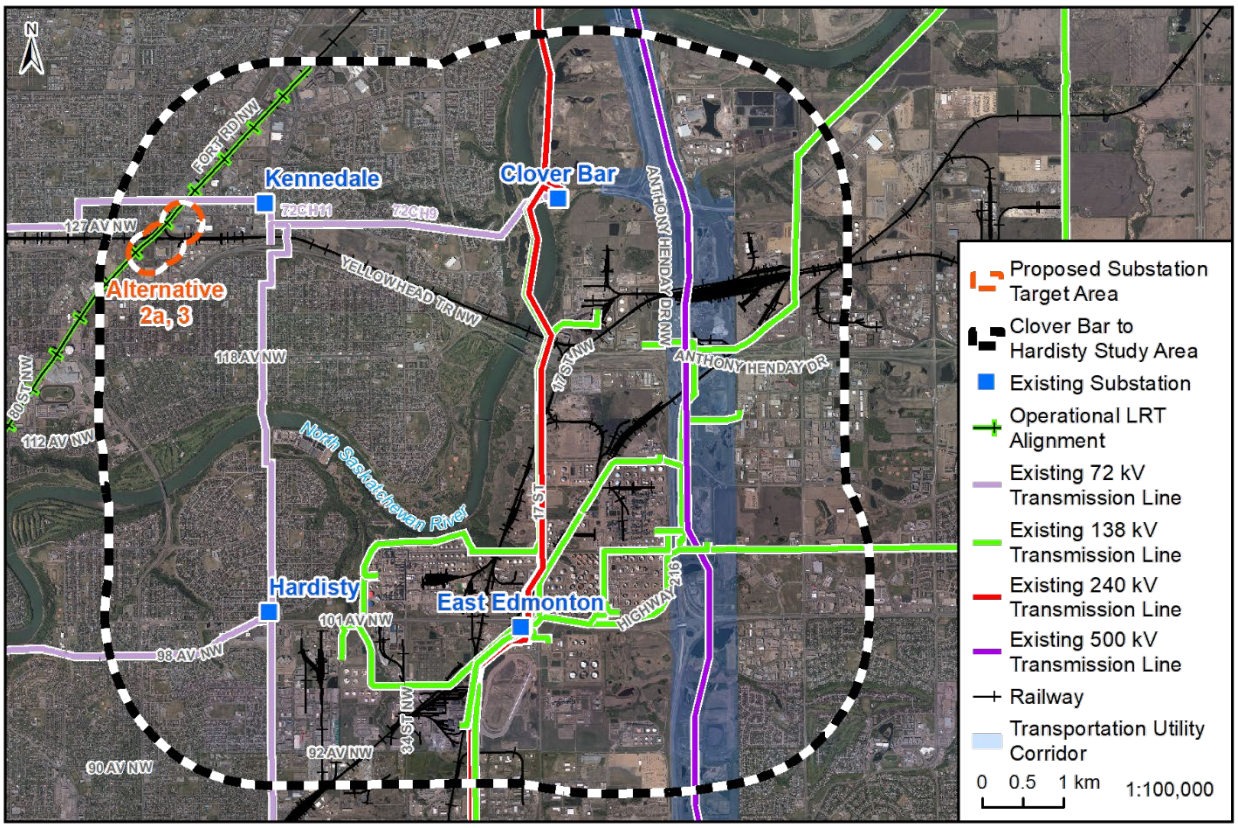


Figure 9 – Clover Bar to Hardisty study area

3.3.2 Common component – Rossdale to Garneau

The Rossdale to Garneau component (Figure 10) is common to all alternatives and, as a result, does not influence one alternative as being less impactful or less viable than another. This component has potentially the highest environmental impacts due to the necessity to cross the NSRV as well as the level and type of stakeholder consultation that will be involved and the anticipated feedback that will be received. Existing underground 72 kV circuits are located along two separate rights-of-way between these two substations with portions within residential and urban nature/recreational areas.

The positive consideration to this component could be the removal of two 72 kV circuits out of environmentally sensitive areas of the NSRV and into the transportation corridor along Walterdale hill.

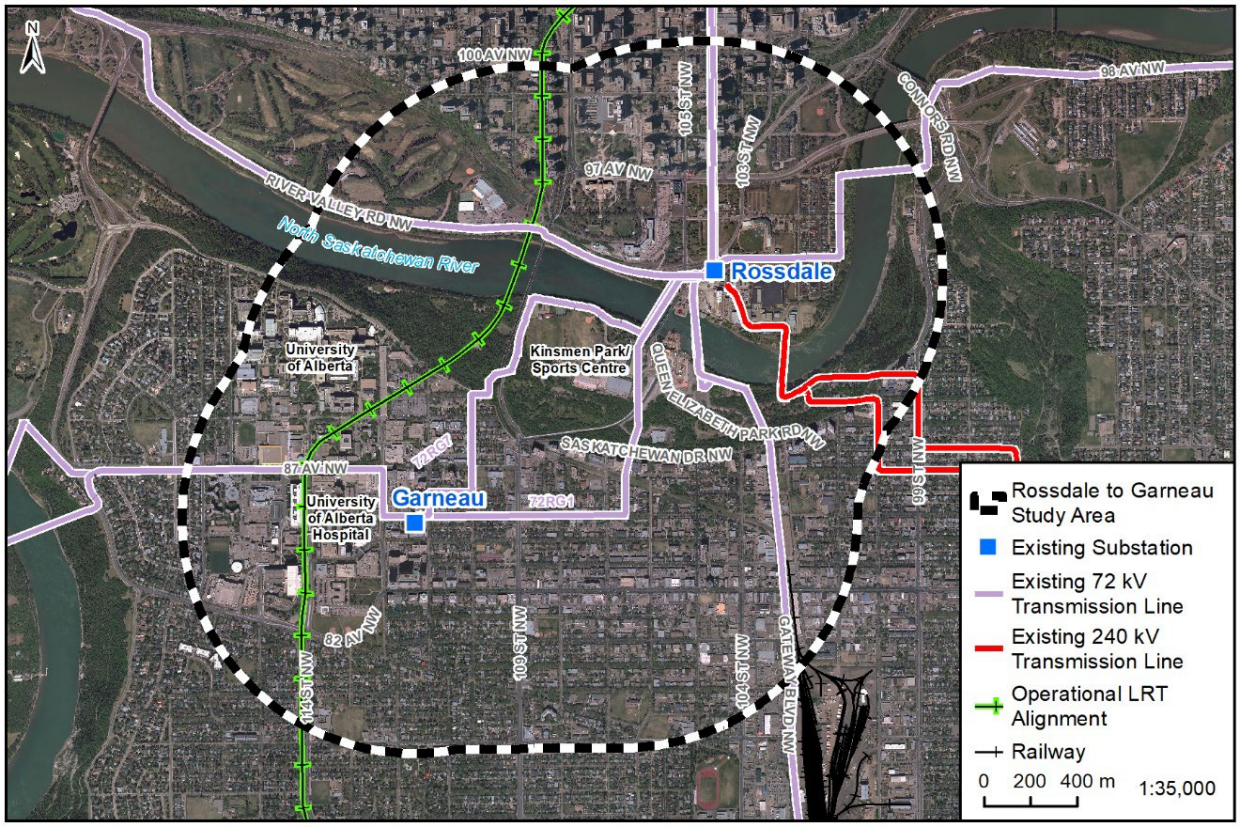


Figure 10 – Rossdale to Garneau study area

3.3.3 Alternative 1a and 1a (i)

Alternative 1a (Figure 11) considers replacing the existing 72 kV circuits between several substations with a higher thermal rating while maintaining the 72 kV voltage. Alternative 1a (i) is similar but involves increasing the voltage to 138 kV. As a result, the conceptual routes that were developed for this assessment were used for both alternatives.

The 72 kV circuits exist between the following substations (see Appendix A for detailed maps):

- Clover Bar to Kennedale;
- Clover Bar to Hardisty (common component, see section 3.3.1 above); and
- Rossdale to Garneau (common component, see section 3.3.2 above).

There are numerous developed roads and corridors within the Alternative 1a study area, all of which provide potential siting opportunities for the various components. A transmission line within a transportation corridor of some form within urban environments will generally have lower overall impacts when compared to other areas as the roadway is considered an existing disturbed utility corridor where the grouping of similar facilities results in more of an incremental impact. Siting within these corridors also avoids the need to acquire private land easements and typically has lower impacts to the environment and most other areas. It should be noted that

some of these corridors do cross through lands zoned residential, which has the potential to pose higher levels of associated impacts than corridors or other areas that do not. Therefore, depending on the amount of physical space available and other siting constraints, undergrounding these new circuits may be more likely for routing in these areas.

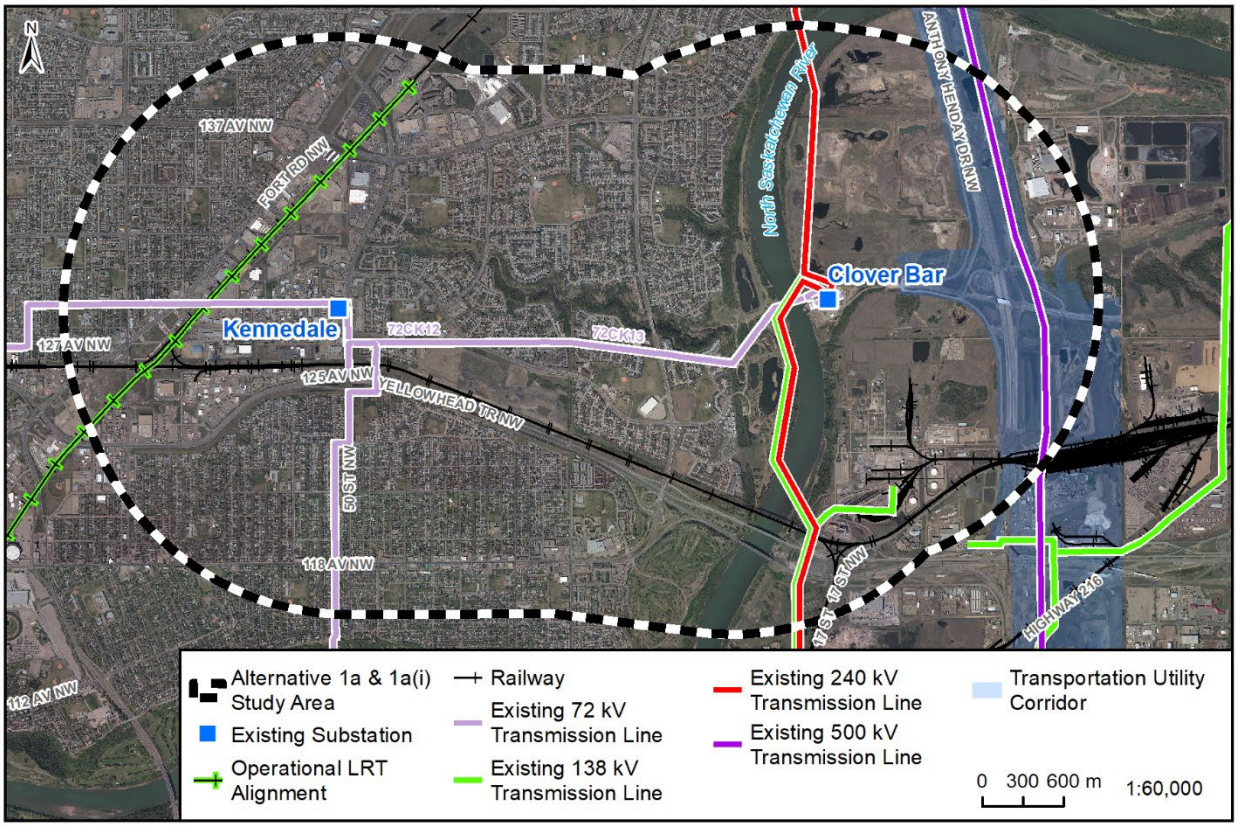


Figure 11 – Alternative 1a & 1a(i) study area

There are certain key features that will need to be considered for the Clover Bar to Kennedale component. The Clover Bar substation is situated in a location which makes bringing in new or replacement circuits challenging as shown in Figure 12. Challenges include:

- The presence of little or no space available to accommodate an overhead facility into the substation, making an overhead configuration unfeasible due to:
  - The presence of existing underground 72 kV transmission lines (see Appendix B for Clover Bar substation layout);
  - The presence of the 72kV relay control and oil pump building supplying the five existing 72 kV oil pipe-type cables which must remain operational;
  - Increasing the existing 72 kV transmission lines into Capital Power Corporation peakers to 240 kV connections is not feasible due to high costs;
  - The lands surrounding Clover Bar substation are not owned by EDTI;
- The substation is located less than 50 m from the eastern edge of the North Saskatchewan River (NSR);

- There are five 72 kV circuits which exit the substation and head west across the NSR lying on the bottom of the riverbed;
- The five 72 kV circuits are encased in oil filled pipe conduits, and this type of technology is no longer viable due to potential environmental risks;
- An overhead circuit out of Clover Bar, across the river is not technically feasible due to the presence of the existing 240 kV and 138 kV overhead circuits located on the western edge of the river;
- Any underground options for the 72 kV circuits will have to use HDD technology or micro-tunneling in order to get under the river which are costly options; and
- Hermitage Park is located directly west of the substation across the NSR and is a reclaimed aggregate extraction site with remaining gravel deposits which would make HDD or micro-tunnelling potentially even costlier than typical long-distance HDD or micro-tunnelling.

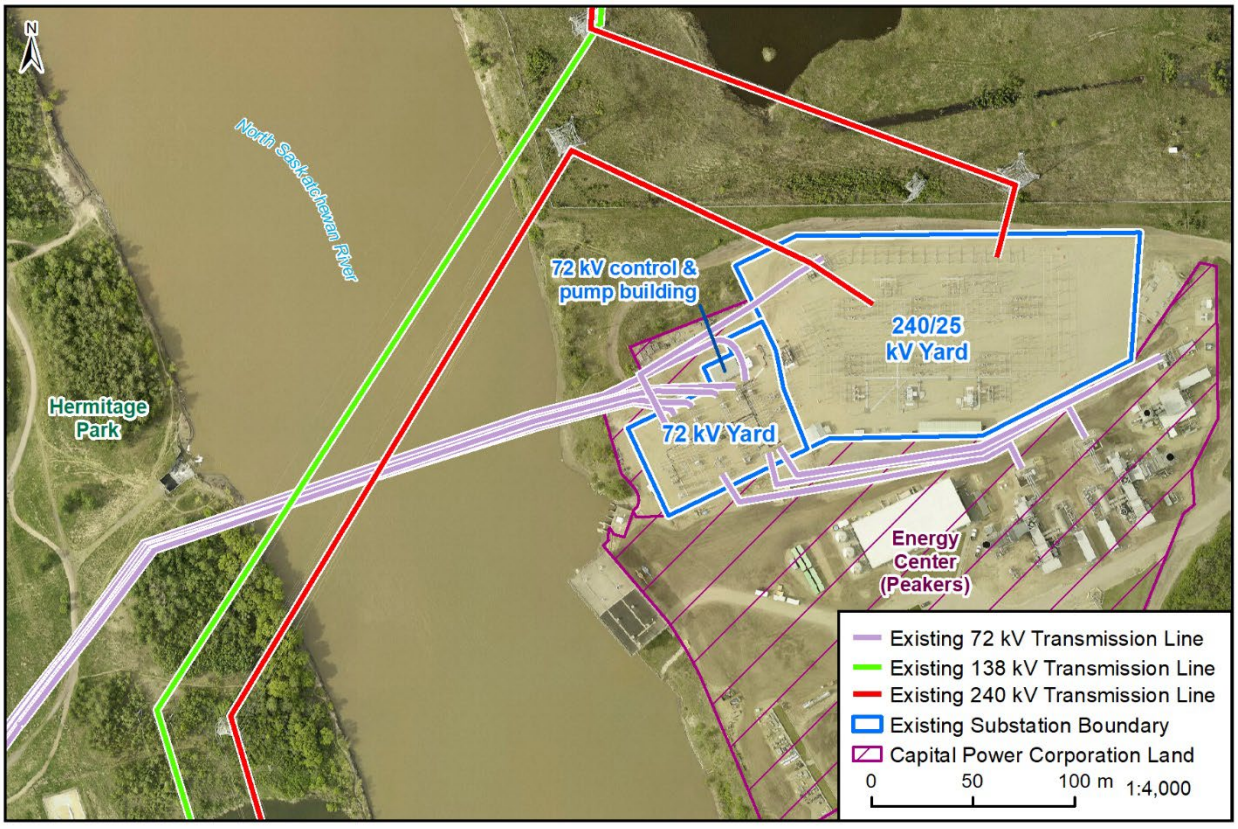


Figure 12 – Clover Bar substation constraints

Alternative 1a (i) considers upgrading the circuits from 72 kV to 138 kV. If the 72 kV voltage must be maintained at these substations to maintain existing service while construction occurs, this alternative will require an expansion at each substations to accommodate 138 kV transformer(s) and associated switchgear. The substations are located in densely developed areas with existing commercial and residential developments up to the substation property

boundary. Based on aerial imagery, it appears that there is not sufficient space available or suitable space adjacent to these substations for any required expansion. The need to acquire and prepare the lands for any expansion to the substations will result in a level of increased impacts and costs that would make this alternative less preferable to others, including 1a.

3.3.4 Alternative 1b and 1b (i)

Alternative 1b (Figure 13) considers replacing the existing 72 kV circuits between several substations with a higher thermal rating while Alternative 1b (i) considers increasing the voltage to 138 kV.

The alternative's component 72 kV circuits exist between the following substations (see Appendix A for detailed maps):

- Jasper to Woodcroft;
- Namao to Woodcroft;
- Namao to Kennedale;
- Clover Bar to Kennedale;
- Clover Bar to Hardisty (common component, see section 3.3.1 above); and
- Rossdale to Garneau (common component, see section 3.3.2 above).

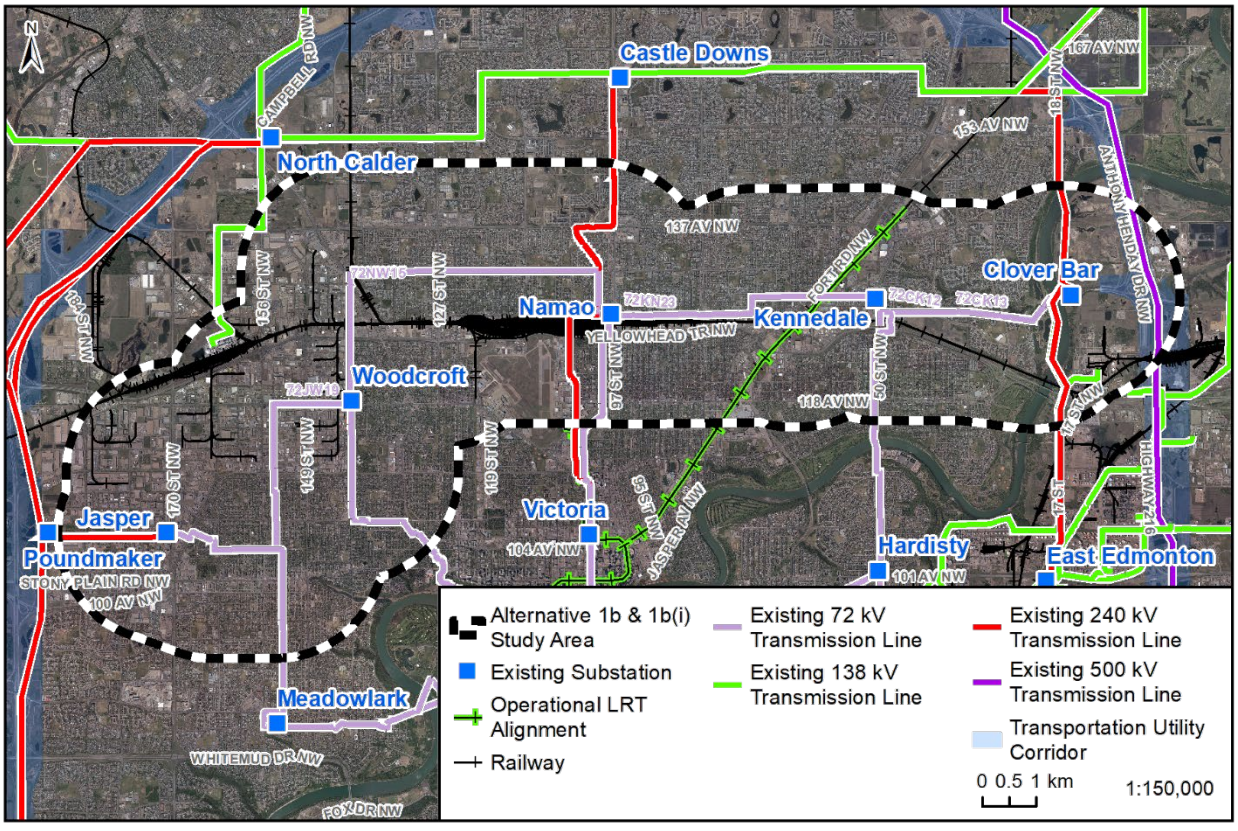


Figure 13 – Alternative 1b & 1b(i) study area

Similar to Alternative 1a, there are numerous developed roads and corridors within the Alternative 1b study area, all of which provide potential siting opportunities for the various components. A transmission line within a transportation corridor of some form within urban environments will generally have lower overall impacts when compared to other areas as the roadway is considered an existing disturbed utility corridor where the grouping of similar facilities results in more of an incremental impact. Siting within these corridors also avoids the need to acquire private land easements and typically has lower impacts to the environment and most other areas. It should be noted that some of these corridors do cross through lands zoned residential, which has the potential to pose higher levels of associated impacts than corridors or other areas that do not. Therefore, depending on the amount of physical space available and other siting constraints, undergrounding for at least a portion of these new circuits may be more likely for routing in these areas.

Similar to Alternative 1a (i), Alternative 1b (i) considers upgrading the circuits from 72 kV to 138 kV. If the 72 kV voltage must be maintained at these substations to maintain existing service while construction occurs, this alternative will require an expansion at each substation to accommodate 138 kV transformer(s) and switchgear. The substations are located in densely developed areas with adjacent development existing up to the substation property boundary. Based on aerial imagery, it appears that there is not sufficient space available or suitable adjacent space to these substations for any required expansion. The need to acquire and prepare the lands for any expansion to the substations will result in a level of increased impacts and costs that would make this alternative less preferable to others, including 1b.

3.3.5 Alternative 2a

Alternative 2a (Figure 14) considers a new 240/72 kV substation, a new double-circuit 240 kV transmission line to the existing 915L, a new single-circuit 240 kV transmission line to Victoria substation, and new single-circuit 72 kV transmission lines from the new substation to the existing Kennedale and Namao substations.

The alternative's component 72 kV circuits exist between the following substations (see Appendix A for detailed maps):

- Kennedale and Namao;
- Clover Bar to Hardisty (common component, see section 3.3.1 above); and
- Rossdale to Garneau (common component, see section 3.3.2 above).

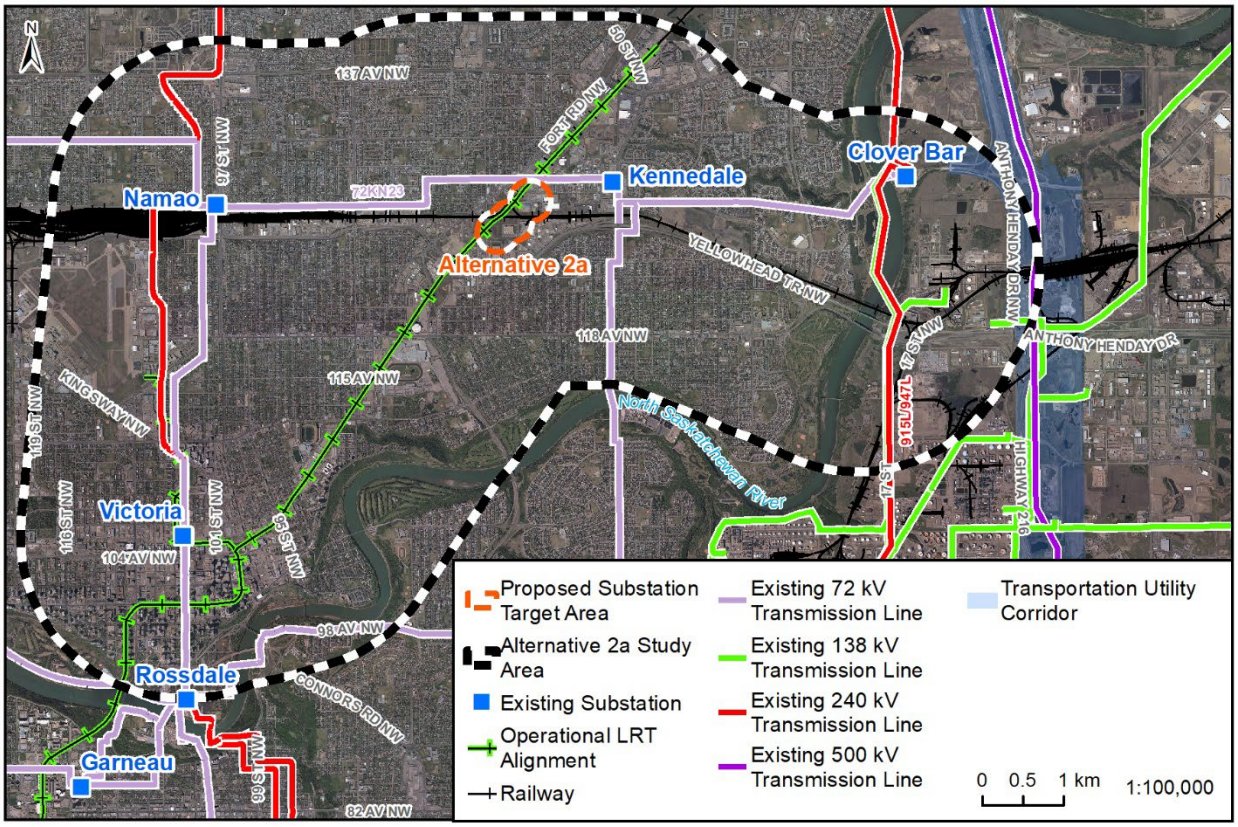


Figure 14 – Alternative 2a study area

This alternative considers a new 240/72 kV substation in the vicinity of 66 Street and the LRT Capital line. Connecting this new substation via a new 240 kV double-circuit in-out interconnection to the existing transmission line 915L is a distance of about 5 km. A route for an overhead transmission line is possible as the majority of the transmission line could be located within the Yellowhead Trail corridor and other transportation corridors. Technically the most likely location to interconnect with transmission line 915L is at an existing corner structure located within the southern portion of Hermitage Park next to the Yellowhead Trail.

Another component to this alternative is a new single-circuit 240 kV circuit from the new substation to the existing Victoria substation, a distance of about 6 km. A route for this transmission line is largely possible along the existing LRT line which has a mixed-use pathway/railway corridor running parallel to the LRT tracks; however, as this corridor doesn't go to Victoria substation, the route could follow other existing transportation corridors such as 106 Avenue to terminate in Victoria substation. Portions of this routing may be driven to an underground configuration given the limited physical space closer to Victoria substation and proximity to the LRT and other land uses present. Generally, overhead siting constraints appear to increase as potential routing moves south from the new substation towards the existing Victoria substation.

All of the 72 kV components for this alternative are variations of Alternative 1a and 1b. As a result, the anticipated impacts associated with these alternatives is similar to those described in sections 3.3.3 and 3.3.4.

3.3.6 Alternative 2b

Component 2b (Figure 15) considers a new 240/72 kV substation at a non-specific location south of the existing Namao substation and a 240 kV in-out interconnection to the existing transmission line 240CV5. This component also considers a new 72 kV circuit from the new 240 kV substation to the existing Namao substation and a new 72 kV circuit between the Castle Downs and Kennedale substations.

The alternative's component 72 kV circuits exist between the following substations (see Appendix A for detailed maps):

- Kennedale and Namao;
- Clover Bar to Hardisty (common component, see section 3.3.1); and
- Rossdale to Garneau (common component, see section 3.3.2).

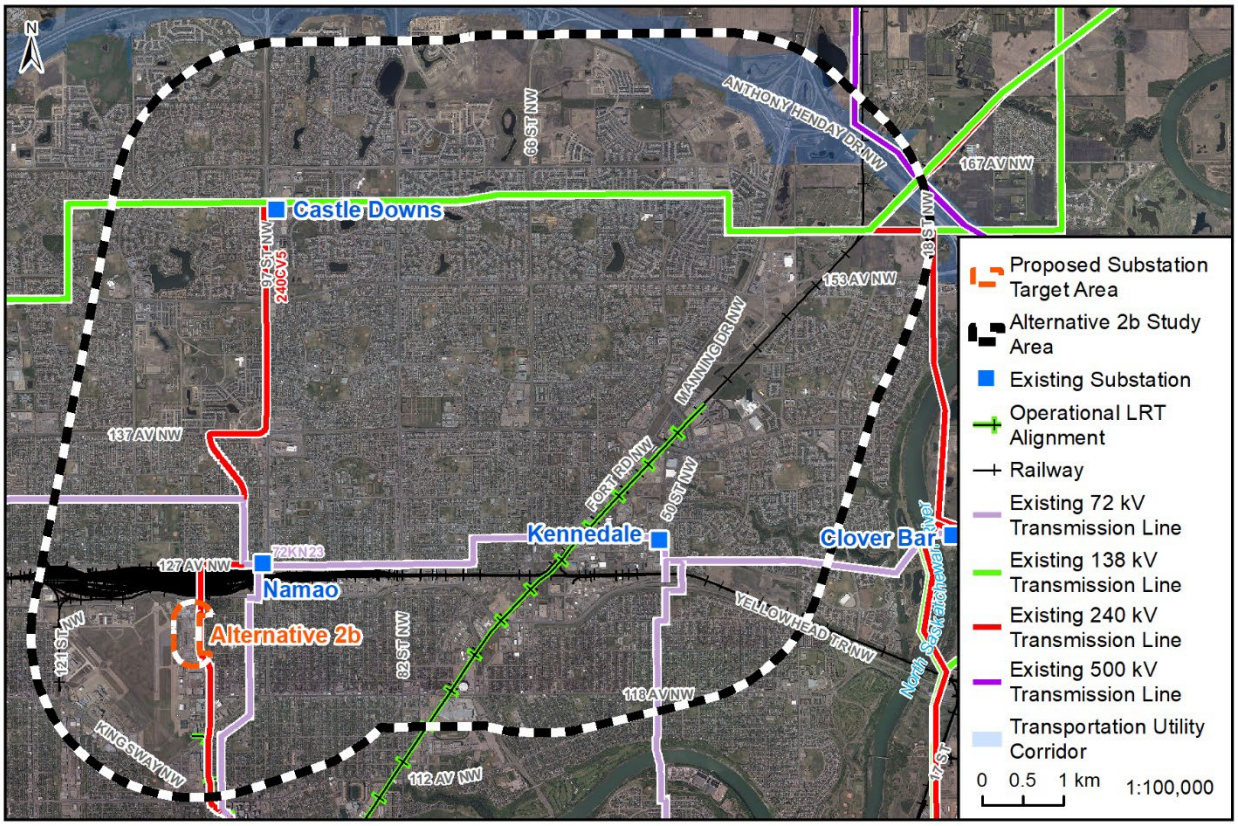


Figure 15 – Alternative 2b study area

There are viable locations available to site a new 240/72 kV substation at a location south of Namao substation. Connecting this new substation to the existing circuit 240CV5 is considered to have a lower impact as viable locations for the new substation appear to exist in close proximity to this existing underground circuit. Additionally, at the Castle Downs substation, there is limited land available to expand the substation fence line to accommodate the additional 240/72 kV transformer with commercial/residential developments built adjacent to the substation.

All of the 72 kV components for this alternative are variations of the 72 kV components of Alternative 1a and 1b. As a result, anticipated impacts associated with these alternatives is similar to those described in sections 3.3.3 and 3.3.4.

3.3.7 Alternative 3

Alternative 3 (Figure 16) considers a new 138/72 kV substation in the vicinity of 66 Street and the LRT line. Components of this alternative include interconnections with the new substation via new 138 kV single-circuit transmission lines connecting to 726L and 761L with distances of approximately 5.75 km and 5 km, respectively. There appear to be viable route options for the 138 kV interconnections to the existing 138 kV transmission lines 726L and 761L. However, it would appear that bringing these two circuits into the new substation via a double-circuit line is not likely (due to the geographic location of possible connection points) which would have an increased overall impact to this alternative. Further, these connections to the existing 138 kV transmission lines would be a tap connection, which is not a preferred operations method.

An additional component includes a new 72 kV circuit from the new substation to Kennedale substation, a new 72 kV circuit to Namao substation, and a replacement of the existing 72 kV circuit between Kennedale and Namao substations.

The alternative's component 72 kV circuits exist between the following substations (see Appendix A for detailed maps):

- Kennedale and Namao;
- Clover Bar to Hardisty (common component, see section 3.3.1 above); and
- Rossdale to Garneau (common component, see section 3.3.2 above).

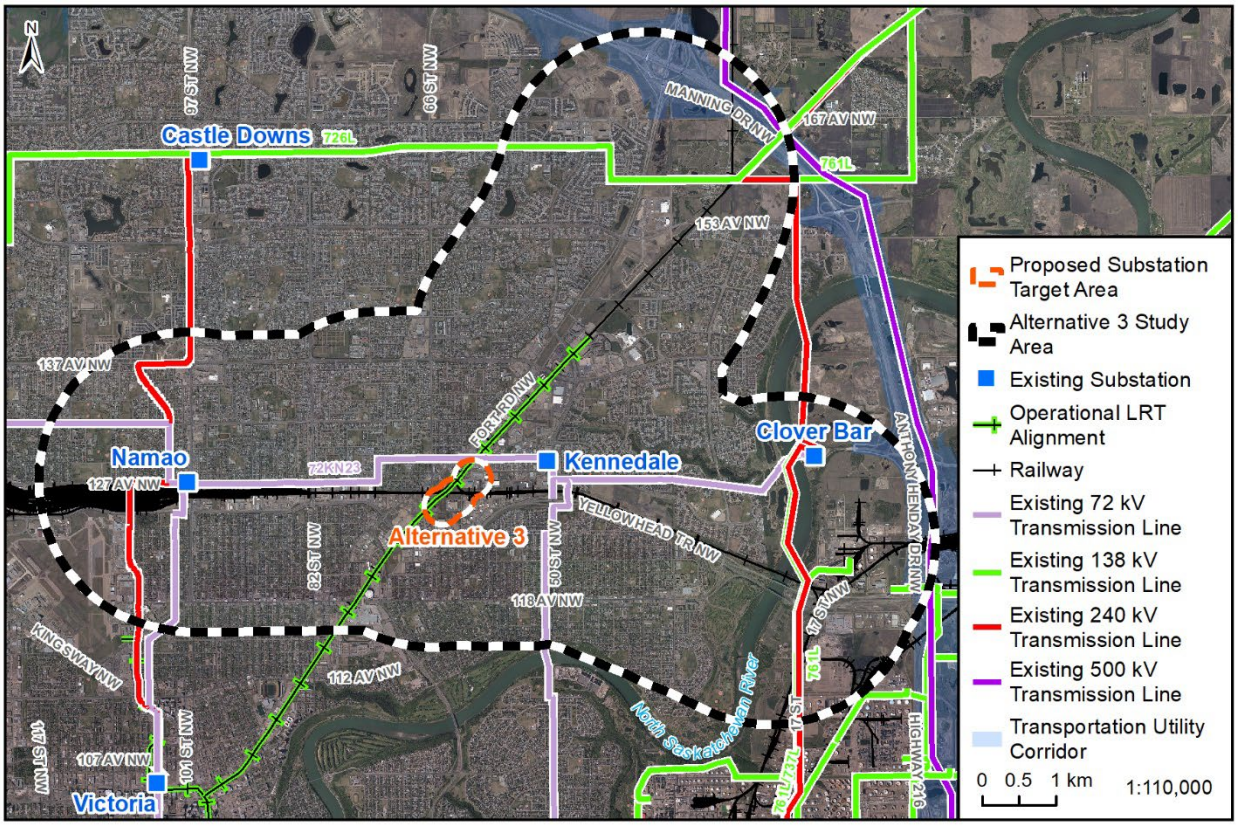


Figure 16 – Alternative 3 study area

All of the 72 kV components of this alternative are combinations of the 72 kV components of Alternative 1a and 1b. As a result, anticipated impacts associated with these alternatives is similar to those described in sections 3.3.3 and 3.3.4.

3.3.8 Alternative 4

Alternative 4 (Figure 17) considers a new 240/72/15 kV substation, a new double-circuit 240 kV transmission line to the existing 915L, a new single-circuit 240 kV transmission line to Victoria substation, two (2) new single-circuit 72 kV transmission lines from the new substation to the existing Namao substation, a new single-circuit 72 kV transmission line from the existing East Industrial to Hardisty substations, and an expansion and upgrade to the existing 240 kV East Industrial substation to 240/72 kV.

The 72 kV circuits that currently exist between substations for this alternative's components are as follows (see Appendix A for detailed maps):

- Kennedale to Namao;
- Clover Bar to Kennedale;
- Clover Bar to Namao;
- Victoria to Namao;

- Namao to Woodcroft;
- Clover Bar to Hardisty; and
- Rossdale to Garneau (common component, see section 3.3.2 above).

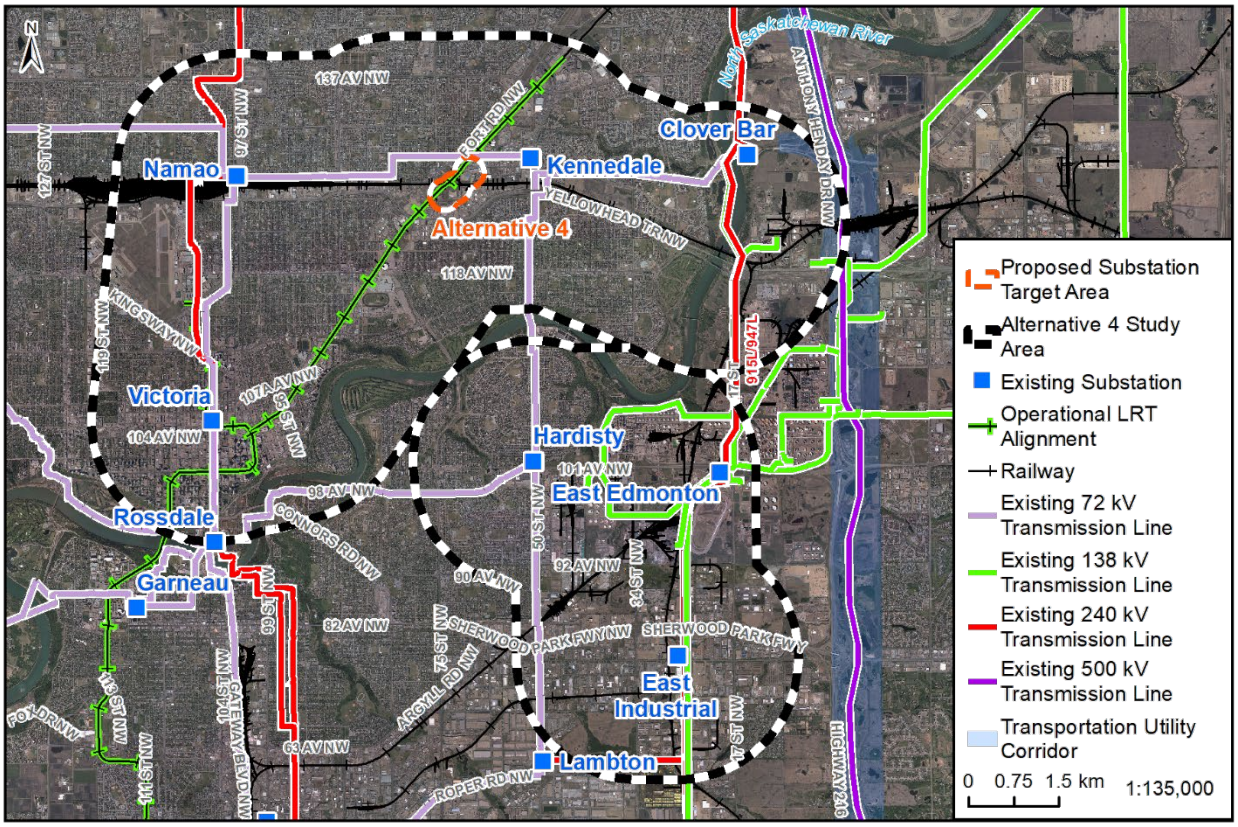


Figure 17 – Alternative 4 study area

This alternative has the same findings as Alternative 2a for the common components they share. However, Alternative 4 includes the de-commissioning of the Kennedale substation, which requires the re-routing of the existing 15 kV distribution circuits to other existing substations and the proposed new substation. All 15 kV distribution circuit routes will be determined by EDTI. These circuits are primarily re-terminations and are expected to be minor in nature, as such these are not considered in this evaluation.

Of specific note, Alternative 4 would have a “net” consideration in the end-of-life de-commissioning and elimination of eight (8) existing 72 kV oil filled underground transmission line pipes crossing the North Saskatchewan River (72CH9 x 2, 72CH11 x 2, 72RH7, 72CK12, 72CK13, and 72CH10). Overall, eleven (11) Oil Filled Pipe Type (OFPT) cables would be eliminated (72CH9 x 2, 72CH11 x 2, 72RH7, 72CK12, 72CK13, 72CH10, 72RG1, 72RG7, and 72KN23). All of the de-commissioning construction activities are considered to be short-term in nature and these short-term impacts would be offset by the removal of the longer-term considerations that would typically be considered to be more beneficial.

The East Industrial to Hardisty component considers adding a new single-circuit 72 kV line between these two substations to improve the reliability of the electrical system as the existing 72 kV source supply to the Hardisty substation from the Clover Bar substation is nearing end-of-life and would be de-commissioned as a component of this alternative. Further, this component is primarily located within industrial land use districts that are considered more compatible with the build-out of the transmission system. The positive consideration to this component is the eventual removal of two 72 kV circuits within the NSRV riverbed.

3.3.9 Alternative 5

Alternative 5 (Figure 18) considers an upgrade to the existing Kennedale substation from the existing feed-through 72 kV bus configuration to a 72 kV ring bus with the installation of a new 72 kV breaker and associated equipment, all within the existing substation footprint.

The 72 kV circuits that currently exist between substations for this alternative's components are as follows (see Appendix A for detailed maps):

- Clover Bar to Hardisty (common component, see section 3.3.1 above); and
- Rossdale to Garneau (common component see section 3.3.2 above).

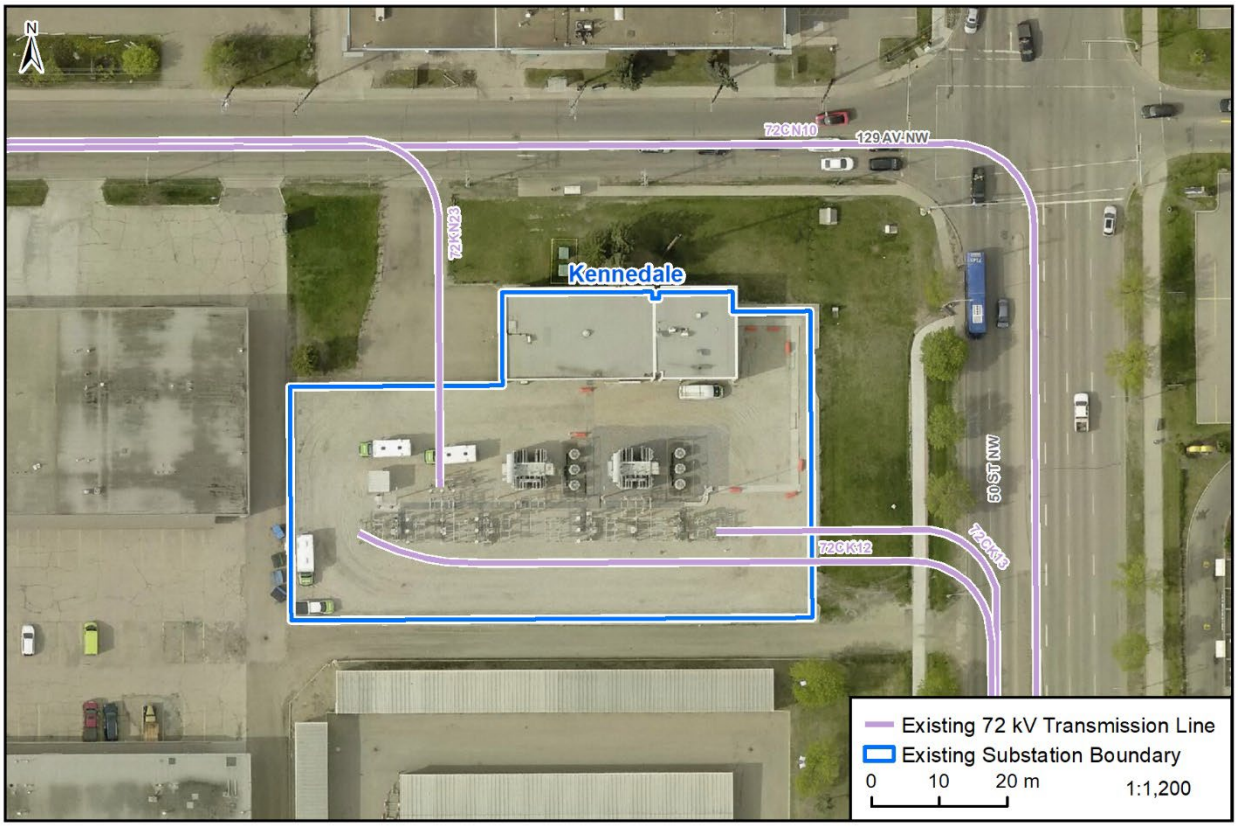


Figure 18 – Alternative 5 study area

This alternative has the same findings as Alternatives 2a and 4 for the common components they share. However, Alternative 5 includes upgrading the Kennedale substation to a 72 kV ring bus configuration, which will provide improved short-term operational options for post-contingency switching to mitigate the thermal overloading of 72CK12 between the existing Clover Bar and Kennedale substations. The positive consideration to this component is that the ring bus configuration will defer the land use effects of reliability-driven Kennedale related transmission upgrades based on the existing distribution load forecast. It should however be noted that this alternative does not address any pending life cycle replacement needs at the Kennedale substation, or on the 72CK cables, for which projects (with associated land use effects) will still be required.

The negative consideration to this alternative is the overall absence of the land use “trade offs” and overall system improvements associated with the other longer-term electrical system reliability configurations within the transmission system for the area. There is no incorporated reduction or elimination of the need for the eventual replacement of other existing transmission facilities as they reach end of life status associated with the other alternatives. Further, the impacts associated with siting the required transmission facilities will likely increase over time as the city continues to grow and develop, meaning there is a potential reduction to overall environmental and land use impacts if the developments occur sooner.

3.4 Metrics analysis

Summarized results of the metrics analysis shown in Table 1 below appear to indicate that proximity to “residential” land use districts will pose one of the higher anticipated impacts posed by all of the alternatives. Of all the alternatives and their variations, from a land use impact perspective, Alternative 1 (1a, 1a (i), 4 and 5 have the potential to pose lower levels of overall residential impact given it involves the shortest overall aggregate line length.

Of the remaining alternatives, they all appear to have relatively equal or comparable levels of potential residential impacts with Alternative 2b posing the highest.

Table 1 shows a detailed breakdown of metric results for components with each alternative.

Table 1 – Relative environmental and land use effects for alternative options

		Alternative option study area								
		1a & 1a (i) Route Option 1*	1a & 1a (i) Route Option 2*	1b & 1b (i) Route Option 1	1b & 1b (i) Route Option 2	2a	2b	3*	4*	5
Total conceptual circuit length including common components (km)*		36.2	39.2	53.7	56.6	55.1	46.3	50.1	33.2	28.4
Land use within alternative option study area (%)	Commercial	4	4	6	6	6	5	5	5	5
	Direct control	6	6	6	6	7	5	6	6	6
	Hydrology	4	4	1	1	3	1	2	3	4
	Industrial	16	16	20	20	22	5	13	27	30
	Public utility	2	2	2	2	2	3	2	2	2
	Residential	39	39	43	43	33	59	49	35	26
	Special district	3	3	8	8	7	10	9	9	4
	Parks & recreation	17	17	12	12	15	11	13	13	15
	Transportation utility corridor	7	7	2	2	5	1	3	1	8

Notes:
** Sum of percentages do not add up to 100% due to rounding*
** Conceptual routes that are double-circuit have had their circuit lengths doubled.*

It is important to note that this assessment of technical Alternatives utilized high-level, conceptual routes for each sub-component configuration to complete a desktop-based assessment that included expertise and experience with available information for the Project area. The comparison of Alternative options using conceptual routes followed typical steps and procedures derived from applicable legislation and planning guidance documents, such as EDTI's Siting Methodology[10]. As per the conceptual route development stage, there was no engagement with stakeholders to solicit specific input regarding the potential impacts associated with each Alternative nor were there any field-level assessments undertaken. The desktop assessment approach used high-level representative routing as a means to provide a comparison of the indicative potential impacts for all the Alternatives. Future trade-offs such as avoiding lifecycle replacement projects, or the ability to take outages and replace facilities where they are (i.e., no new siting or lands required), or the long-term system reliability benefits, between each Alternative is also difficult to quantify with any degree of certainty given the limitations described above).

[10] EPCOR Distribution & Transmission Inc., Siting Methodology – Summary of Route and Site Determination Approach for Proposed Overhead Transmission Facilities

4 Potential impacts

There are several issues and related constraints that exist when considering overhead routing within the Project study area:

- All the existing substations which connect the 72 kV circuits under consideration are located within primarily mixed residential, industrial, and commercial areas with limited or no undeveloped land available to accommodate site expansions;
- All the existing 72 kV circuits are within a transportation corridor or in a URW and are located in highly developed residential and commercial areas with some existing circuits located in green spaces, parks, or the NSRV;
- The existing 72 kV circuits cannot be taken out of service during their replacement; therefore, a new alignment will have to be found. As a result, any proposed routing would likely be limited to following existing transportation corridors, such as roads, alleys and railways, or other public corridors. This is due to the general lack of physical space, or undeveloped lands in the areas available within the study areas for the alternatives;
- Components that consider replacing existing 72 kV circuits with 138 kV circuits will require expansions at all the termination point substations;
- Residents, the city of Edmonton and other stakeholders may scrutinize an overhead route more vs. an underground route;
- The Garneau community is unique when compared to other residential communities. It is one of the oldest neighborhoods in Edmonton and has acknowledged historical importance as a community. It is defined as a “Central Core” neighborhood[11], with any proposed development being subject to consideration of the Garneau Area Redevelopment Plan (GARP)[12]; and
- Other historical sites may exist within the NSRV which could affect routing options.

The Project study area is highly developed in nature and varied land uses contribute to a number of siting constraints, both common and unique, across the urban environment. Each of these are discussed below as they relate to the seven major aspects formerly outlined in AUC Rule 007 but reconfirmed in recent Decisions, the most recent and applicable being the Fort McMurray West 500 kV Transmission Project Decision[13].

4.1 Agricultural impacts

The Project study area is located in the middle of the city of Edmonton in a developed urban setting. Therefore, agricultural impacts are not a factor in the assessment of the alternatives.

[11] City of Edmonton. The Way We Grow – Municipal Development Plan Bylaw 15100. June 23, 2010.
[12] City of Edmonton. Garneau Area Redevelopment Plan Bylaw 6221. May 25, 1982.
[13] AUC Decision 21030-D02-2017 – Fort McMurray West 500 kV Transmission Project, paragraph 391

4.2 Residential impacts

Residential impacts are typically considered as one of the more important factors in route development for transmission lines in urban areas.

The potential for residential impacts are present to some degree for each of the Alternatives. Residential impacts may include general proximity to residential areas, right-of-way acquisitions on private land, construction concerns (e.g., dust, noise, access, etc.), as well as the numerous values and concerns routinely raised by stakeholders that can be correlated to where they live (e.g., health, property value, impact to development plans, etc.). The recent proceeding for the West Edmonton Transmission Upgrade Project (Alberta Utilities Commission ("AUC") Proceeding ID 23943) provides a useful example of the perceived impacts of an aerial transmission line on residential properties[14].

All of the Alternatives have potential for residential impacts; however, a more detailed siting analysis will be required to more accurately determine or quantify the risk and severity levels. Without the more detailed siting assessment typically undertaken for the preparation of a facility application, it is difficult to provide clearer or more detailed residential impact conclusions. Once an Alternative is selected by the AESO, a detailed siting analysis will be undertaken and will include extensive stakeholder engagement, field surveys, detailed engineering, and other important factors. Given the varied complexity of electrical configurations proposed for each Alternative and the associated existing substations being located within or adjacent to highly developed residential areas, proximity of the proposed new transmission facilities to residences may be difficult to avoid. However, EDTI's Siting Methodology is designed to collectively consider and minimize the potential for impacts, including residential, by targeting initial route selection within more compatible areas, such as transportation corridors, utility corridors, commercial, industrial, and park land use districts. A compatibility matrix is used to identify land use districts more compatible for routing corridors for further assessment in the route development process, thus avoiding or minimizing use of residential neighbourhoods where possible. This siting methodology and approach has been successfully used on other transmission projects in Alberta, including the recent EDTI West Edmonton Transmission Upgrade Project[15], and the Strathcona Capacity Increase Project[16], which were both reviewed and approved by the AUC.

4.3 Environmental impacts

Similar to residential impacts, potential environmental impacts are commonly raised as a key consideration by stakeholders. Environmental concerns can range from specific sites on a landowner's property to large, landscape-level features holding local and regional environmental

[14] AUC Decision 23943-D01-2020 – West Edmonton Transmission Upgrade Project, March 12, 2020.
[15] AUC Decision 23943-D01-2020 – West Edmonton Transmission Upgrade Project,
[16] AUC Decision 23641-D01-2019 – Strathcona Capacity Increase and New Transmission Line 72DS26

value, such as the NSRV or Hermitage Park. Varying degrees of potential environmental impacts exists for any of the alternatives.

It is important to note that while not specifically referenced within the context of the NID Specification for the Project, both of the common components currently include existing circuits that contain oil filled pipe conduits which cross the NSR. Any alternative that results in the removal of all or a portion of these oil filled pipe conduits will have an environmental net benefit, resulting in a reduction in associated land use and environmental impacts when they are decommissioned. This is particularly applicable to Alternative 2a, which has the potential to provide an entirely new 240 kV source for the Edmonton downtown area, enabling the gradual replacement and decommissioning of current legacy 72 kV sources which pose higher levels of comparable impacts.

4.4 Cost

No consideration of cost has been made as part of this assessment; however, the overall length of each alternative has been considered, which typically has a direct correlation to costs (i.e.: longer facility equates to higher costs).

4.5 Electrical considerations

The electrical considerations generally relate to constraints that would impede or prevent the technical requirements that the Project is intended to meet. Conceptual routes that were developed along existing roadway/utility corridors were based on the assumptions that sufficient space exists, or that common mitigation practices could be employed to reduce or eliminate issues (i.e.: induction, electrical interference, etc.).

There are several constraints at the Clover Bar substation that need to be considered. An overhead line at Clover Bar is not technically feasible due to the presence of little or no space available to accommodate an overhead facility into the substation. The existing 72 kV circuits are contained in pipe conduits laying on the riverbed of the NSR. The alternative for an underground circuit is a lengthy horizontal direct drilling (HDD) or micro-tunnelling under the NSR and Hermitage Park which tend to be costly options.

Directly across the NSR from the Clover Bar substation is an existing overhead double-circuit 240 kV and single-circuit 138 kV transmission lines located in Hermitage Park. The presence of these overhead circuits makes an overhead 72 kV circuit technically challenging and costly.

Components that consider upgrading a circuit from 72 kV to 138 kV will require an expansion to the substation to accommodate a transformer and associated switchgear, as does adding a third 240/72 kV transformer to Clover Bar substation in Alternative 1b. At this high-level assessment, it would appear that there is insufficient space at the existing substations for this type of expansion.

Maskwa makes no assessment of the electrical capacity (or value) each alternative would add to the EDTI transmission system, although longer term implications to current system facilities (i.e.: decommissioning of oil filled underground circuits, establishing a new 240 kV source for

the downtown area), would pose potential reductions in environmental and land use impacts that should be collectively considered between the alternatives in order to allow for a fair comparison. The consideration of these factors and the associated siting impacts is clearly stated in the Alberta Transmission Regulation[17] and other sources listed in section 2.2.2.

4.6 Visual impacts

No consideration of visual impacts has been made. However, it is generally acknowledged that building any type of overhead facility that was not present previously will create visual impacts. The visual impacts of an underground solution would be limited to the initial construction activities, but otherwise pose very little visual impact over the life of the facility. The common siting approach of utilizing corridors also serves to reduce potential visual impacts by combining the new facility with other existing linear developments, making any resulting impacts more incremental in nature.

Visual impacts refer to sight-line features, which would apply primarily to overhead transmission lines given that underground transmission lines typically only pose short-term visual impacts during construction. The assessment of Alternatives in the ELUEA was the result of identifying conceptual representative routes for each sub-component and by completing a desktop-based assessment of those routes. A complete assessment of the visual impacts of each Alternative, or a definitive comparison of the visual impacts of the Alternatives, is not possible without the completion of a detailed routing and siting analysis (including the determination of underground/aerial segments) as required in the preparation of a facility application. Each of the Alternatives has the potential for visual impacts, primarily if the proposed new transmission facilities are aerial in greenfield areas with no other existing overhead configurations or linear developments present (e.g., transmission lines, distribution lines, streetlights, fibre optic lines, etc.).

However, EDTI's Siting Methodology is designed to mitigate the potential for visual impacts by initially selecting routing corridors where existing linear infrastructure developments are present or where the addition of transmission facilities would align with current and future land uses. This would include identifying routes that present an opportunity to co-locate new transmission facilities on or adjacent to existing overhead configurations, thus posing an incremental visual impact vs. a new impact. Further, the siting methodology is designed to avoid or mitigate visual concerns, such as avoiding routes within areas where visual impacts tend to be more of a consideration. An example would include parks, where visual impacts tend to be a concern from stakeholders. Visual impacts may also be mitigated through the use of an underground configuration during the more detailed siting stages when additional information is acquired that better identifies and quantifies the impacts present, including feedback from stakeholders. For example, Alternative 2A, the sub-component where potential routing includes locating within and following the existing LRT Capital line transportation corridor to the Victoria substation will likely

[17] Alberta Electrical Utilities Act, Transmission Regulation 86/2007, October 30, 2019, Section 15.1 and 38(a)(iii)

include underground due to expected issues and concerns related to the denser residential areas and limited physical space within the corridor as well as the size of required 240 kV aerial structures.

4.7 Special considerations

There are other areas with special considerations that will pose additional routing constraints. An example of this are the Indigenous sensitivities and concerns as it relates to the presence of historical resources within the NSRV and in proximity to the Rossdale substation.

Another consideration would be any of the alternatives that include the eventual decommissioning of existing underground 72 kV circuits, which are older oil filled pipe conduits, pose potential environmental risk. Some of the technical components, as in Alternative 2a, would serve to facilitate the possible eventual decommissioning of these circuits, which would result in a net benefit (environmental gain) and reduction in the overall impacts of the electrical alternative as a whole. The amount of underground cable that can/will be salvaged varies with each alternative.

Another important consideration, while not directly related to environmental and land use impacts, is the replacement of existing circuits with higher capacity circuits. In addition to providing better flexibility for future operations and maintenance of the transmission system, higher capacity facilities also provide the opportunity to reduce future environmental and land use impacts. Siting new transmission facilities typically become increasingly difficult over time, so there is merit in maximizing new facilities to address expected system needs in order to reduce or avoid the need for additional facilities as much as possible. This consideration is specifically outlined in the Alberta Transmission Regulation[18].

4.8 Environmental and land use effect summary

In Addition, there are a number of key features (e.g., hospitals, schools, parks, etc.) throughout the Project area that may influence the routing/location of new transmission facilities during the detailed routing and siting phase of project development. However, at this time, Maskwa and EDTI are not aware of any other key land use features beyond those identified in the Environmental and Land Use Effects Assessment (“ELUEA”) as part of the desktop assessment that would preclude or substantially modify any of the Alternatives and the associated conclusions and recommendations. Other potential land use features and their impacts on routing/siting will be identified during the more detailed route development stages as will any required mitigations.

Not considering the long-term system future trade-offs, Table 2 summarizes the immediate environmental and land use effects and how they compare between each of the Alternative options. Note that the Rossdale-Garneau and Clover Bar – Hardisty components are not

[18] Alberta Electrical Utilities Act, Transmission Regulation 86/2007, October 30, 2019, Section 15.1 and 38(a)(iii)

referred to in the table as the components are common to all Alternatives with the exception of Alternative 4.

Table 2 – Environmental and land use effects summary

Alternative	Environmental effects	Land use effects	ELUEA Effects rank
Alternative 1a & 1a(i)	Clover Bar substation on banks of North Saskatchewan River Valley (“NSRV”), potential route options would need to be buried beneath river. Potential route options would need to cross through Hermitage Park.	Numerous developed roads and corridors provide potential siting opportunities and avoids the need to acquire private land easements. Potential Clover Bar substation expansion limited as lands surrounding substation are not owned by EDTI. Other substation expansion locations located in densely developed areas. Potential for underground route options with corridors in residential areas. Potential to pose lower levels of overall residential impacts as it involves the shortest overall aggregate line lengths.	High
Alternative 1b & 1b(i)	Clover Bar substation on banks of NSRV, potential route options would need to be buried beneath river. Potential route options would need to cross through Hermitage Park.	Numerous developed roads and corridors provide potential siting opportunities and avoids the need to acquire private land easements. Clover Bar substation location poses challenges for new or replacement circuits. Other substation expansion locations located in densely developed areas. Potential for underground route options with corridors in residential areas.	High
Alternative 2a	Possible eventual de-commissioning of existing oil-filled pipe conduits. Potential 915L interconnect location within Hermitage Park.	Numerous developed roads and corridors provide potential siting opportunities and avoids the need to acquire private land easements. Sub-component electrical configurations located in highly developed dense areas. Potential use of LRT Capital corridor and combination of overhead/ underground configuration. Potential for increased overhead configurations. Longer overall aggregate line lengths.	Low
Alternative 2b	No river crossings required	Numerous developed roads and corridors provide potential siting opportunities and avoids the need to acquire private land easements. Potential for new substation to be located on EDTI owned land rather than private or public lands. Castle Downs substation expansion located in densely developed areas.	High
Alternative 3	No river crossings required	Numerous developed roads and corridors provide potential siting opportunities and avoids the need to acquire private land easements. Connection of 726L and 761L as new double-circuit transmission line not likely due to geographic location of connection points. More likely to result in single circuit.	High
Alternative 4	De-commissioning of the existing Kennedale substation End-of-life de-commissioning and elimination of eight (8) existing 72 kV oil filled pipe conduits crossing the NSRV. Elimination of eleven (11) oil-filled pipe type cables. Eventual de-commissioning and removal of two (2) 72 kV circuits within the NSRV between the East Industrial and Hardisty substations.	Numerous developed roads and corridors provide potential siting opportunities and avoids the need to acquire private land easements. Potential use of LRT Capital corridor and combination of overhead/ underground configuration. Potential for increased overhead configurations. Sub-component electrical configurations located in highly developed dense areas. Longer overall aggregate line lengths. Primarily located within industrial land use districts that are considered more compatible with the buildout of a transmission system	Low
Alternative 5	No river crossings required	No expansion required at Kennedale substation	Low

5 Summary

The ELUEA concludes there are no known locations at this time within the Project study area where a transmission line would be prohibited. All the alternative components are located in lands primarily zoned residential, industrial, and commercial. Conceptual routes are generally located within some form of a corridor, which aligns with industry standard siting practices as well as established EDTI siting methodologies. Many of the potential impacts between alternatives are generally considered to be similar given the accuracy of the conceptual routing and the available data sources being assessed. Any alternative identified as having higher impacts over another is largely due to the overall aggregate line length of the components of that alternative and any associated offsets involving the re-purposing or decommissioning of existing facilities.

One challenge in comparing the alternatives is that some appear to consider primarily short-term development needs and others appear to include longer-term developments as well. This makes it difficult to conduct an equal comparison from an environmental and land use impact perspective, as some of the alternatives may pose higher levels of short-term impacts when compared to others but may actually provide material reductions in impacts when longer-term development benefits are also considered.

The intent of this assessment was to identify and compare the type and levels of potential impacts associated with the alternatives considered as part of the Project and to identify the alternative posing lower overall levels of environmental and land use impacts. The general conclusions are:

- All overhead alternatives/components are viable with the exception of overhead 72 kV options between the Clover Bar and Kennedale substations due to the presence of existing overhead circuits and little or no space available. The new 240 kV circuit into Victoria substation may have to consider underground options due to the limited availability of space;
- All alternatives will potentially impact residential, commercial, industrial, and environmental land use districts to varying degrees;
- When collectively considering all of the areas of impact, an overhead solution may pose a higher overall level of impact when compared to an underground solution, with the exception of cost. While typically this would result in the underground solution being identified as the lower impact solution, the magnitude of the increased costs associated with an underground solution must also be factored in, which aligns with EDTI's siting methodology and practices. EDTI's general practice is to initially consider overhead facilities, then be driven to an underground solution by siting and technical constraints, which typically occurs during the more detailed facility application stage of route development;

- In the absence of stakeholder input and detailed siting information, it is difficult to confirm if the additional cost for an underground solution outweighs the new or incremental impacts that would result with an overhead solution in all, or portions of the technical alternatives being considered. Although, some potential guidance can be drawn from the fact that there are few overhead transmission lines in the area and that all transmission lines to date, including an existing 72 kV transmission line between the Rossdale and Garneau substations, have been underground. It is likely that at least portions of eventual routing will involve or consider underground configurations, regardless of the technical alternative chosen. This is particularly true for routing within or immediately adjacent to residential areas where there is lack of physical space or existing overhead facilities that can be replaced and/or overbuilt; and
- Of the 240 kV options, Alternative 2a will have a higher overall impact than 2b due the need for the additional 240 kV circuit from the new substation to Victoria substation.

Any recommendation to use an underground solution would be based on the collective consideration of the numerous types and levels of impacts typically posed by an overhead solution (in all of the impact categories, except cost). Additional studies (such as detailed siting, environmental due diligence work, engineering, etc.) around the use of an overhead solution is needed to confirm the presence and level of potential impacts and the subsequent feasibility of an underground versus an overhead configuration in specific locations. It should be noted that route development for an underground facility is also approached somewhat differently than an overhead facility, considering the added complexity of subsurface facilities, construction and maintenance requirements and other considerations unique to underground configurations. While high-level assumptions can be made based on the consideration of available information and the application of professional siting judgement, it is difficult to determine or confirm with any degree of accuracy where and when underground versus an overhead configuration would occur for most of the alternatives. These types of determinations would be made during the more detailed siting efforts typically carried out as part of the Facility Application development process. For the purposes of this assessment, Maskwa has assessed conceptual routes developed for each of the alternatives using EDTI's siting methodology and practice as it applies to underground configurations to provide general indications where underground would be more likely to occur.

While not directly related to environmental or land use impacts, it is important to recognize that siting transmission facilities within a growing urban environment does not get easier with time. It is only prudent to strive to maximize the usage of new facilities to account for future load growth and thereby reduce or eliminate the need or timing for another facility at a future date. This is a key issue that is considered for every NID and is certainly a factor for this Project. For example, for Alternatives 1a (i) and 1b (i), the consideration of upgrading from 72 kV to 138 kV would appear to be a prudent decision from this perspective. Further, in a recent decision (Decision

23981-D01-2019) [19], the AUC indicated agreement with this system planning principle, indicating that rebuilding a 69 kV circuit to 138 kV standards is reasonable as stated below:

> *"With respect to the proposed use of 138-kV structures, the Commission finds that this is a prudent approach when compared to using 69-kV structures, whether steel monopoles or wood poles. The available evidence does not support that the use of 69-kV structures has any added benefits in the circumstances of this application, while the use of standardized 138-kV structures creates efficiencies in repairing or restoring the lines, as indicated by Mr. Campbell."*

This philosophy should be considered for all the technical alternatives.

[19] ENMAX Power Corporation, Home Road Transmission Lines 69-15.62L/21.61L Replacement Project October 16, 2019.

6 Recommendations

At this level of assessment, the overall findings confirm that all of the alternatives are viable from an environmental and land use effects perspective.

For Alternatives 1a and 1b, there are numerous siting opportunities for either 72kV or 138 kV configurations in each of the components.

For Alternatives 2a and 2b, each alternative considers a new centrally located major 240 kV source substation within the city. Alternative 2a would have higher overall short-term impacts resulting from the need for a new 240 kV circuit between a new substation and Victoria substation; however, it is likely to have the higher longer-term electrical system benefit as it would be connected to new higher capacity 240 kV circuits and would serve to reduce or eliminate the need for replacement of other existing transmission facilities as they reach end of life status. Alterative 2b has an overall higher potential residential impact than 2a. Similar to Alternatives 2a and 2b, Alternative 3 considers a new centrally located 138 kV source substation within the city. This alternative does not appear to have any beneficial lower impacts compared to Alternatives 2a and 2b.

For Alternatives 2a and 4, each alternative considers a new centrally located major 240 kV source substation within the city. Both alternatives would have higher overall short-term impacts resulting from the need for a new 240 kV circuit between a new substation and Victoria substation; however, it is likely to have the higher longer-term electrical system benefit as it would be connected to new higher capacity 240 kV circuits and would serve to reduce or eliminate the need for replacement of other existing transmission facilities as they reach end of life status. Alternative 4 has approximately the same overall potential residential impact as Alternative 2a.

Although Alternative 5 has lower impacts to residential land use districts and has a smaller aggregate line length than Alternative 2a and Alternative 4, the overall absence of electrical system reliability components make Alternative 5 less desirable from a longer-term system configuration and prudent system planning perspective when compared to the other two alternatives.

In summary, Maskwa finds that Alternative 4 would pose the lowest overall levels of impacts and highest net benefit.

Maskwa appreciates the opportunity to provide professional support services to EDTI and looks forward to answering any questions or concerns in relation to this report.

Ryan Desrosiers, RFP, MCIP

VP Planning and Permitting

Hudson Foley, RPFT

VP Regulatory and Business Development

APPENDIX A Existing Circuit Detailed Maps

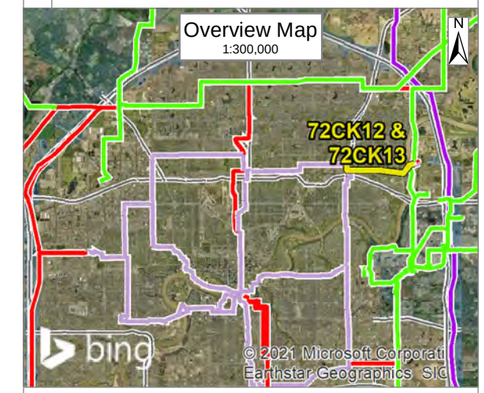
EPCOR

City of Edmonton Transmission Reinforcement Project

Alternative 1a & 1a(i)
Clover Bar to Kennedale Substations
Circuit 72CK12 & 72CK13

Legend

- Existing Circuit to be Upgraded
- Existing Substation
- Existing 72 kV Transmission Line
- Existing 138 kV Transmission Line
- Existing 240 kV Transmission Line
- Existing 500 kV Transmission Line
- Light Rail Transit - Operational
- Railway



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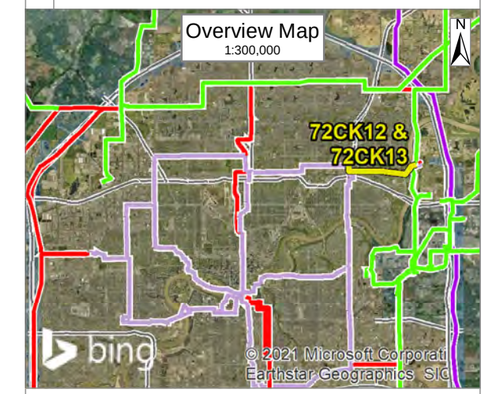
EPCOR

City of Edmonton Transmission Reinforcement Project

Alternative 1b & 1b(i)
Clover Bar to Kennedale Substations
Circuit 72CK12 & 72CK13

Legend

- Existing Circuit to be Upgraded
- Existing Substation
- Existing 72 kV Transmission Line
- Existing 138 kV Transmission Line
- Existing 240 kV Transmission Line
- Existing 500 kV Transmission Line
- Light Rail Transit - Operational
- Railway



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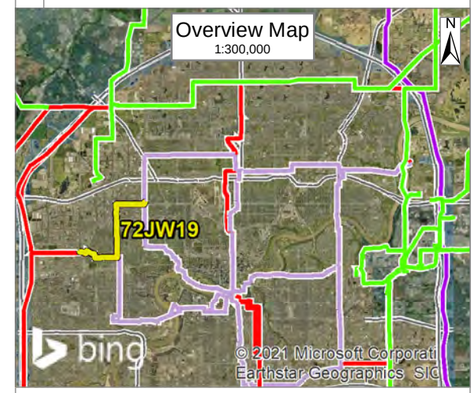
EPCOR

City of Edmonton Transmission Reinforcement Project

Alternative 1b & 1b(i)
Jasper to Woodcroft Substations
Circuit 72JW19

Legend

- Existing Circuit to be Upgraded
- Existing Substation
- Existing 72 kV Transmission Line
- Existing 138 kV Transmission Line
- Existing 240 kV Transmission Line
- Existing 500 kV Transmission Line
- Railway



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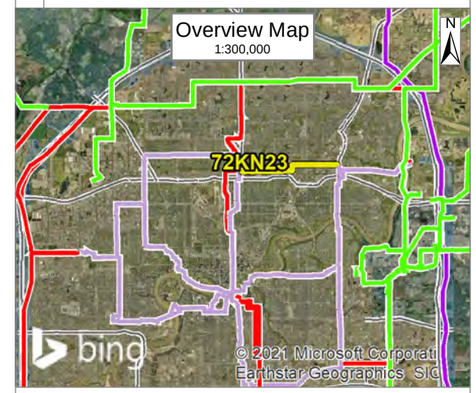
City of Edmonton Transmission Reinforcement Project

Alternative 1b & 1b(i)
Namao to Kennedale Substations
Circuit 72KN23

Legend

- Existing Circuit to be Upgraded
- Existing Substation
- Existing 72 kV Transmission Line
- Existing 138 kV Transmission Line
- Existing 240 kV Transmission Line
- Existing 500 kV Transmission Line
- Light Rail Transit - Operational
- Railway



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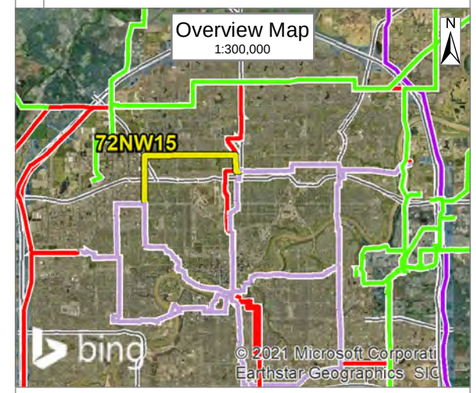
EPCOR

City of Edmonton Transmission Reinforcement Project

Alternative 1b & 1b(i)
Namao to Woodcroft Substations
Circuit 72NW15

Legend

- Existing Circuit to be Upgraded
- Existing Substation
- Existing 72 kV Transmission Line
- Existing 138 kV Transmission Line
- Existing 240 kV Transmission Line
- Existing 500 kV Transmission Line
- Light Rail Transit - Conceptual
- Light Rail Transit - Operational
- Railway



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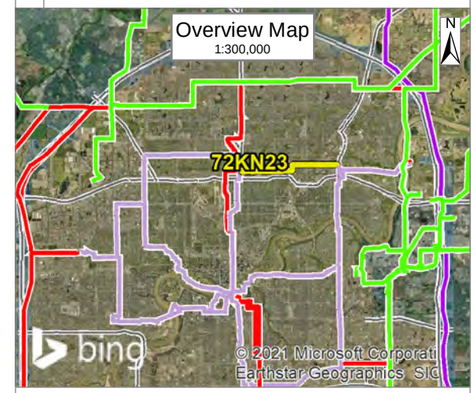
City of Edmonton Transmission Reinforcement Project

Alternative 2a
Namao to Kennedale Substations
Circuit 72KN23

Legend

- Existing Circuit to be Upgraded
- Existing Substation
- Existing 72 kV Transmission Line
- Existing 138 kV Transmission Line
- Existing 240 kV Transmission Line
- Existing 500 kV Transmission Line
- Light Rail Transit - Operational
- Railway



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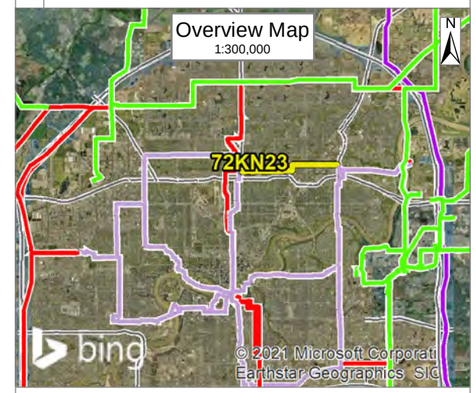
City of Edmonton Transmission Reinforcement Project

Alternative 2b
Namao to Kennedale Substations
Circuit 72KN23

Legend

- Existing Circuit to be Upgraded
- Existing Substation
- Existing 72 kV Transmission Line
- Existing 138 kV Transmission Line
- Existing 240 kV Transmission Line
- Existing 500 kV Transmission Line
- Light Rail Transit - Operational
- Railway



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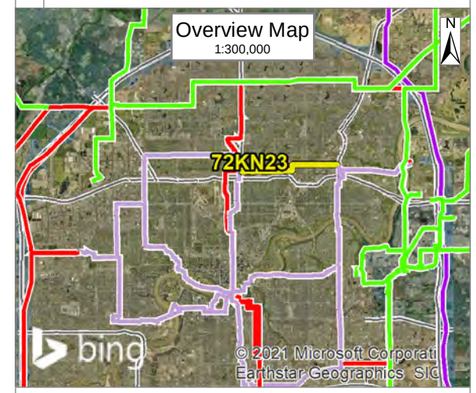
City of Edmonton Transmission Reinforcement Project

Alternative 3
Namao to Kennedale Substations
Circuit 72KN23

Legend

- Existing Circuit to be Upgraded
- Existing Substation
- Existing 72 kV Transmission Line
- Existing 138 kV Transmission Line
- Existing 240 kV Transmission Line
- Existing 500 kV Transmission Line
- Light Rail Transit - Operational
- Railway



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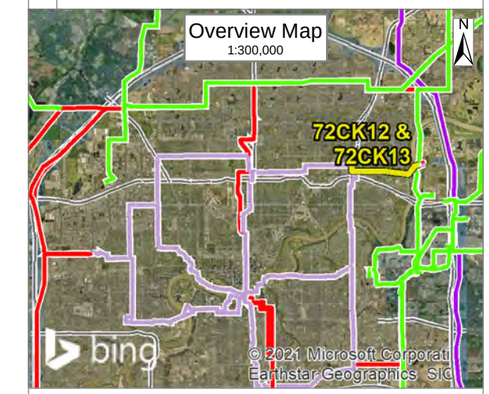
City of Edmonton Transmission Reinforcement Project

Alternative 4
Clover Bar to Kennedale Substations
Circuit 72CK12 & 72CK13

Legend

- Existing Circuit to be Upgraded
- Existing Substation
- Existing 72 kV Transmission Line
- Existing 138 kV Transmission Line
- Existing 240 kV Transmission Line
- Existing 500 kV Transmission Line
- Light Rail Transit - Operational
- Railway



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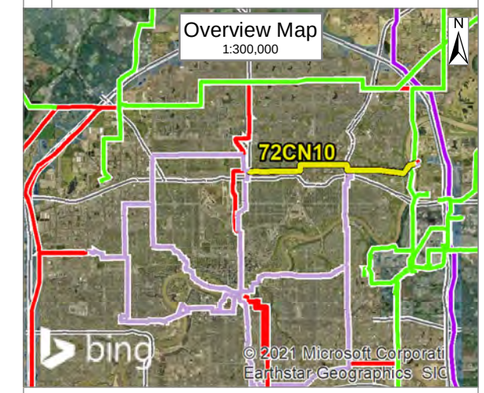
City of Edmonton Transmission Reinforcement Project

Alternative 4
Clover Bar to Namao Substations
Circuit 72CN10

Legend

- Existing Circuit to be Upgraded
- Existing Substation
- Existing 72 kV Transmission Line
- Existing 138 kV Transmission Line
- Existing 240 kV Transmission Line
- Existing 500 kV Transmission Line
- Light Rail Transit - Design
- Light Rail Transit - Operational
- Railway
- Transportation Utility Corridor



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City of Edmonton Transmission Reinforcement Project

Alternative 4
Namao to Kennedale Substations
Circuit 72KN23

Legend

- Existing Circuit to be Upgraded
- Existing Substation
- Existing 72 kV Transmission Line
- Existing 138 kV Transmission Line
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- Light Rail Transit - Operational
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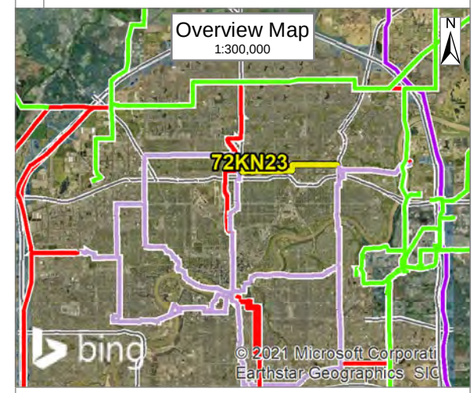

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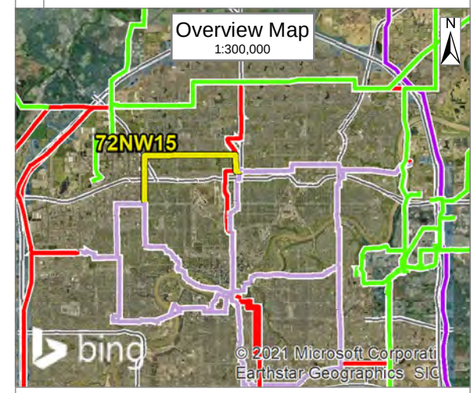
City of Edmonton Transmission Reinforcement Project

Alternative 4
Namao to Woodcroft Substations
Circuit 72NW15

Legend

- Existing Circuit to be Upgraded
- Existing Substation
- Existing 72 kV Transmission Line
- Existing 138 kV Transmission Line
- Existing 240 kV Transmission Line
- Existing 500 kV Transmission Line
- Light Rail Transit - Conceptual
- Light Rail Transit - Operational
- Railway



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MASKWA ENVIRONMENTAL CONSULTING

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Produced By: Maskwa Environmental Consulting Ltd.	Map Creator: C. Beaumont
Map Date: December 23, 2021	Map #: MEC-EPCOR-CETR-026

Coordinate System: Calgary 3TM WGS 1984 W114
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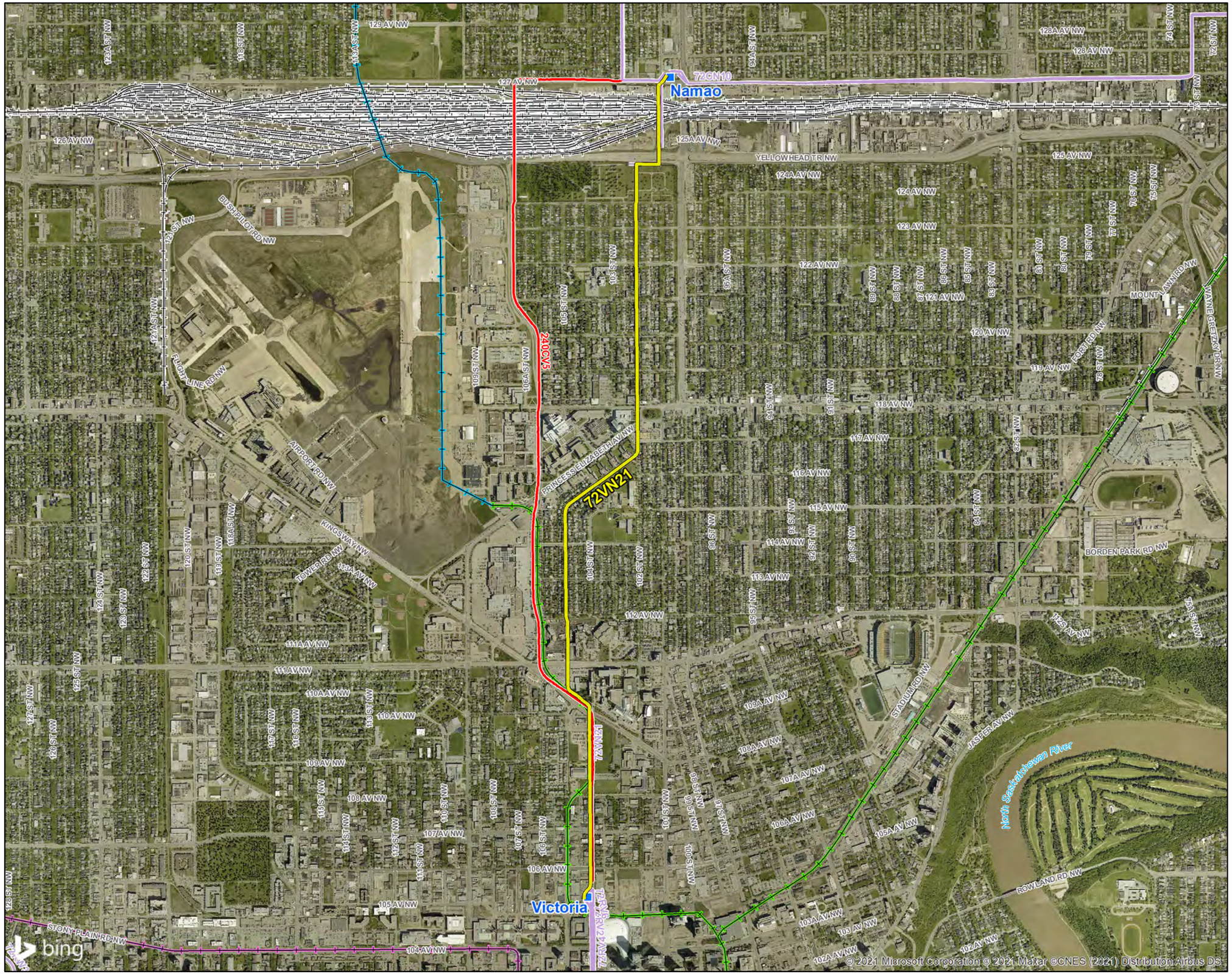


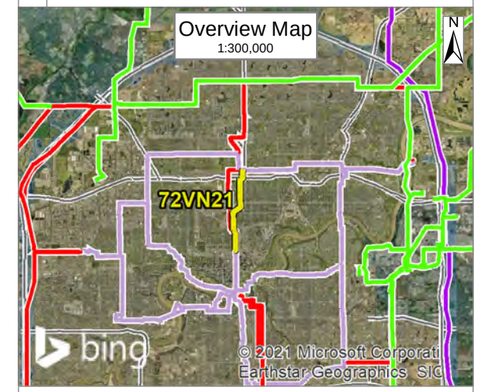
EPCOR

City of Edmonton Transmission Reinforcement Project

Alternative 4
Victoria to Namao Substations
Circuit 72VN21

Legend

- Existing Circuit to be Upgraded
- Existing Substation
- Existing 72 kV Transmission Line
- Existing 138 kV Transmission Line
- Existing 240 kV Transmission Line
- Existing 500 kV Transmission Line
- Light Rail Transit - Conceptual
- Light Rail Transit - Design
- Light Rail Transit - Operational
- Railway



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Coordinate System: Calgary 3TM WGS 1984 W114
Path: \\Svmaskwa01\gis\Client\EPCOR\CETR\003_Mapping\20211222_ExistingRoutes_AppendixA\

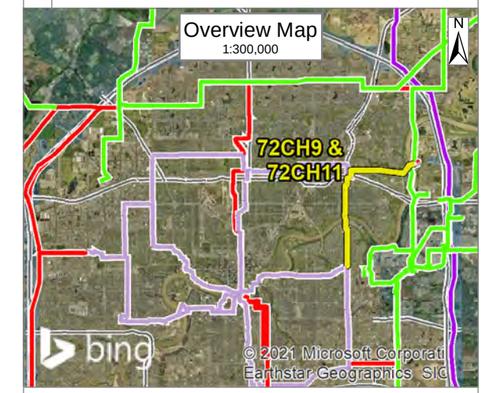
EPCOR

City of Edmonton Transmission Reinforcement Project

Alternative 5 (Common Components)
Clover Bar to Hardisty Substations
Circuit 72CH9 & 72CH11

Legend

- Existing Circuit to be Upgraded
- Existing Substation
- Existing 72 kV Transmission Line
- Existing 138 kV Transmission Line
- Existing 240 kV Transmission Line
- Existing 500 kV Transmission Line
- Light Rail Transit - Operational
- Railway
- Transportation Utility Corridor



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Coordinate System: Calgary 3TM WGS 1984 W114
Path: \\Svmaskwa01\gis\Client\EPCOR\CETR\003_Mapping\20211222_ExistingRoutes_AppendixA\

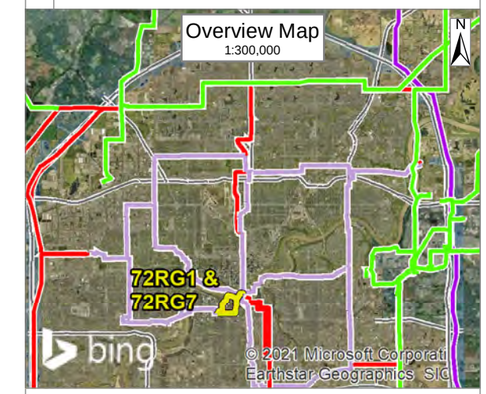
EPCOR

City of Edmonton Transmission Reinforcement Project

Alternative 5 (Common Components)
Rossdale to Garneau Substations
Circuit 72RG1 & 72RG7

Legend

- Existing Circuit to be Upgraded
- Existing Substation
- Existing 72 kV Transmission Line
- Existing 138 kV Transmission Line
- Existing 240 kV Transmission Line
- Existing 500 kV Transmission Line
- Light Rail Transit - Operational



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MASKWA ENVIRONMENTAL CONSULTING

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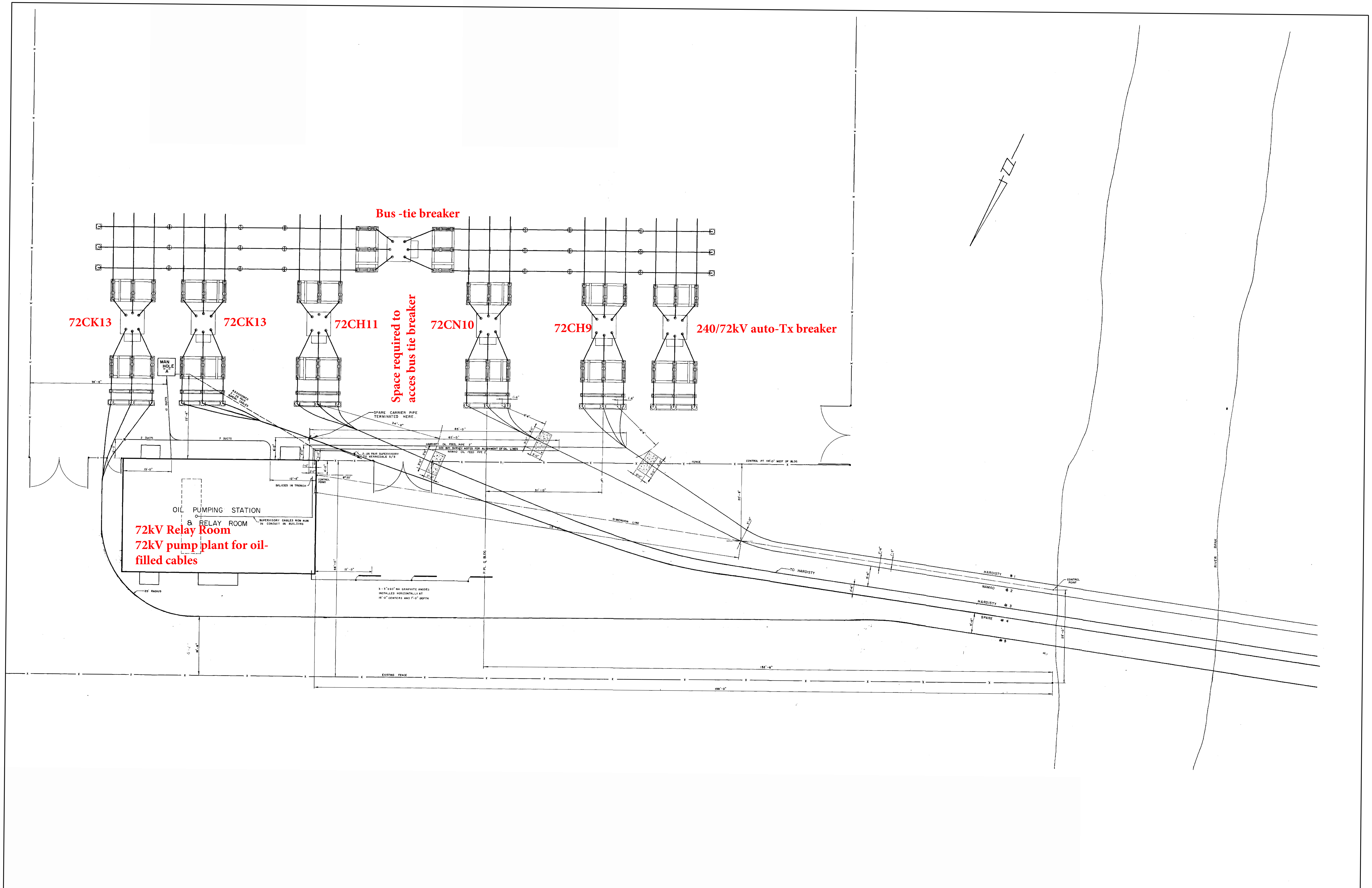
APPENDIX B Clover Bar Substation Layout



REF. DWG. 10891, 30226

	REVISIONS			
	DETAILS	DATE	BY	APP'D
1.	AS NOTED	4-8-70	J.F.	J.R.
2.	ADDED 3 GRAPHITE ANODES	16-2-71	VR	J.R.R.
3.	WEST BAY ABANDONED	12-5-71	VR	J.R.R.
4.	RELOCATED CIR. 5 & 6	18-8-71	RR	J.R.R.
5.	RELOCATE CABLES 3 & 4 AS PER SURVEY; REMOVE #6	14-7-72	JT	J.R.R.
6.	RELOCATED SUPERV. CABLES	7-11-74		

EDMONTON POWER

TITLE: CLOVER BAR GENERATING STATION
EXISTING & PROPOSED
72 KV CABLE ROUTES

DRAWN BY | CHECKED BY | SCALE 1/8" = 1'-0" | DATE 12-1-70 | DRAWING NO. 63-S-22-E

20191220 15:42 pkstroem