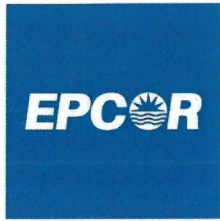


APPENDIX E DFO DISTRIBUTION DEFICIENCY REPORT



EPCOR Distribution & Transmission Inc. (EDTI)

Strathcona Capacity Project

Distribution Deficiency Report



Revision 7.0 – June 5, 2018

| Company | Role | Name | Date | Signature |
|----------------|---------------------|----------------------|-------------|------------------|
| EDTI | Prepared | Trent Loga, P. Eng. | 2018-JUN-5 | |
| EDTI | Approved / Reviewed | Brian Choma, P. Eng. | 2018-JUN-5 | |

APEGA Permit to Practice P07061

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1.0 Executive Summary

As per the Alberta Electric System Operator (AESO) Customer Connection Process (CCP), this Distribution Deficiency Report (DDR) is being submitted in conjunction with the System Access Service Request (SASR) to fulfill the Stage 0 requirements.

EDTI transmission function has identified that the existing 72 kV transmission system that supplies the Strathcona substation POD cannot supply the load in several N-1 contingencies. Specifically, one of the two sources for the Strathcona POD, a high voltage underground cable designated as 72RS5 installed in 1958 with a rated capacity of 60 MVA (summer) and 65 MVA (winter), is overloaded under N-1 contingencies .

The 2017 summer peak at Strathcona POD was 60.2 MVA and the 2017-18 winter peak was 54.1 MVA. The 2020 and 2027 summer peak forecast loads at Strathcona are forecast to be 67.9 MVA and 70.5 MVA, respectively. In the event of a forced outage to either the 240/72 kV transformer at the Lambton terminal substation or the aerial line (72LS24) from Lambton, 72RS5 will be in violation of its thermal limits by 7.9 MVA in 2020 and 10.5 MVA by 2027 in restoring supply to the Strathcona POD.

EDTI's distribution function evaluated the existing distribution system and determined that there is insufficient spare distribution capacity to transfer the excess load (7.9 MVA of load in 2020, 10.5 MVA in 2027) to adjacent PODs. Therefore, no purely distribution solution is available to resolve the deficiency. As a result, EDTI distribution requests a transmission solution be developed to resolve the shortfall.

Additionally, EDTI's transmission function has determined that existing transmission cable 72RS5 is nearing its end-of-life and must be replaced, and has planned to replace this transmission supply with an equivalent supply to the Strathcona substation in 2019¹. EDTI's transmission function has budgeted for this replacement in its 2019 capital maintenance program.² Based on the results of both asset condition assessment and thermal studies, EDTI de-rated the 60 MVA installed capacity of cable 72RS5 in 2015 to a continuous rating of 25 MVA. EDTI transmission's capital maintenance replacement of the line will restore the capacity of the second supply into Strathcona Substation to the original 60MVA.

EDTI's distribution function recommends an incremental increase to the capacity of the planned capital maintenance replacement of 72RS5 as the preferred alternative. This will allow EDTI to serve the load requirements for the Strathcona POD distribution service area that are in excess of the capital maintenance capacity restoration of 60 MVA. This is the only technically viable alternative identified.

The requested in-service date for this proposed development is Q4 2019.

¹ As a Transmission Facility Owner (TFO), EDTI's transmission function is obligated under section 39(1) of the Electric Utilities Act to maintain its transmission facilities in a manner that is consistent with the safe, reliable and economic operation of the interconnected electric system

² AUC Proceeding 23165, Exhibit 23165-X0003.01, section 9.2.4.2 (pdf 1029).

EDTI has submitted a SASR to the AESO and has requested a Demand Transmission Service (DTS) increase to 64.2 MW for the Strathcona POD.

2.0 Existing System

2.1 Existing System

EDTI Strathcona Substation POD is normally supplied by two 72 kV transmission supplies. One source is an aerial line from the Lambton Terminal Substation and the other is an underground cable from the Bellamy/Rossdale Terminal Station (see Figure 2-1). In general, EDTI's 72kV transmission assets are configured in a looped arrangement where there are multiple sources to substations or PODs. Due to operating constraints and potential reliability violations, EDTI operates the system in an open configuration.

Figure 2-1 Existing EDTI Strathcona POD

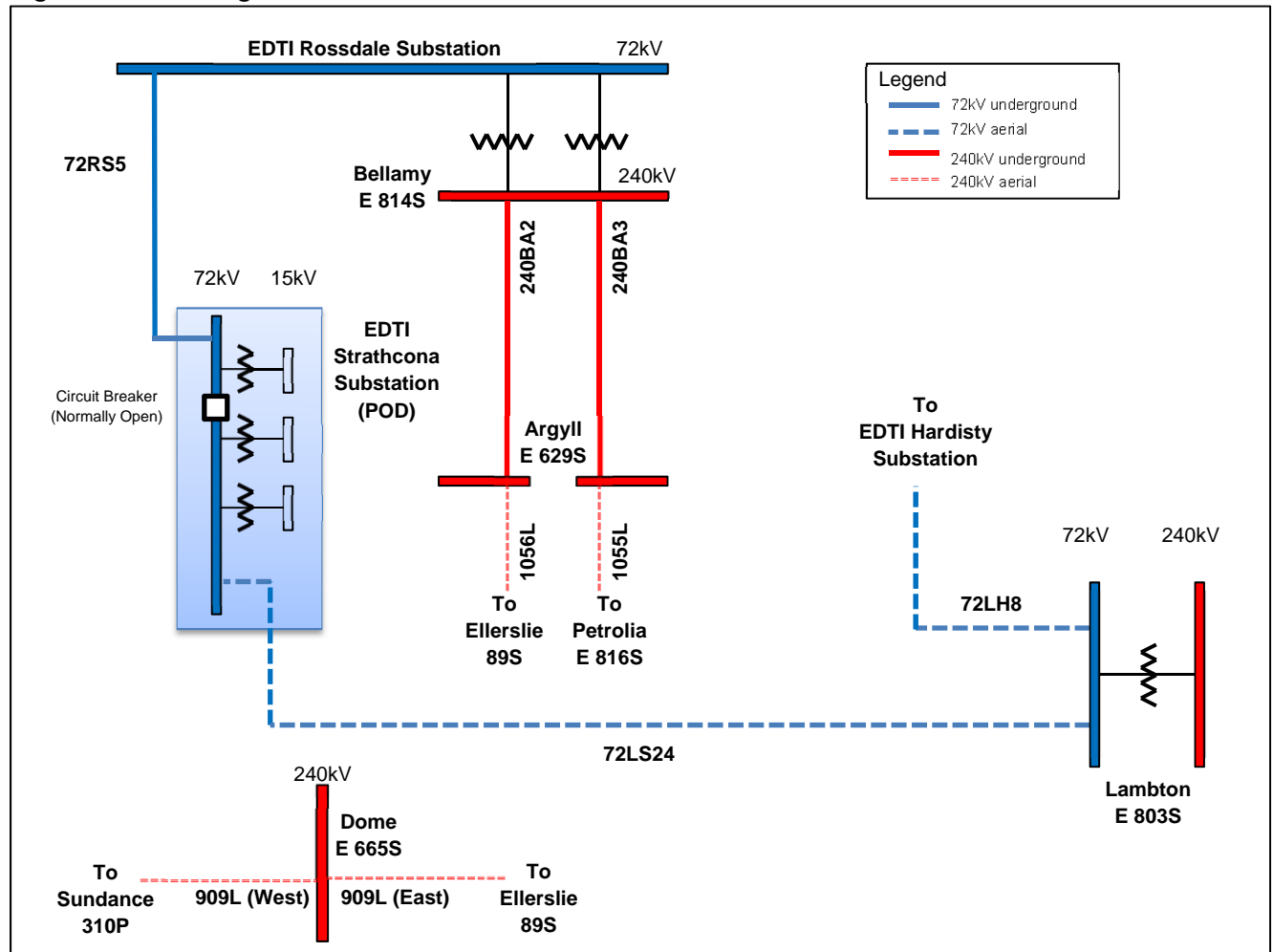


Table 2-1 summarizes the capacities of relevant transmission elements serving the Strathcona POD.

Table 2-1 Existing Strathcona Substation Capacities

| Substation | Strathcona |
|--|---|
| Transformation Installed Capacity | T1, T2, T3: 72/14.4 kV, 30 / 40 MVA |
| 72kV Transmission Capacity (summer/winter) | 72LS24: 90/124 MVA Lambton T3: 80 MVA 72RS5: 60 MVA (summer) / 65 MVA (winter) * * Due to its deteriorated condition and based on careful analysis by a leading expert, and after consulting the AESO, EDTI's Transmission function de-rated the capacity of 72RS5 to 25 MVA. The lower rating was made effective on February 3, 2015. |
| Peak Station Load (15 kV) 2017 Recorded | 60.2 MVA (summer) 54.1 MVA (winter) |
| Firm Transformation (N-1) | 80 MVA |
| Firm Transmission (N-1) | RS5 (original, 1958-2015): 60 MVA RS5 (de-rated, 2015): 25 MVA |

2.2 System Post Life Cycle Replacement of 72RS5

EDTI's transmission circuit 72RS5 has reached its end of life and has been de-rated from 60 MVA to 25 MVA. Circuit 72RS5 is an underground transmission cable. To regain the lost capacity, EDTI's Transmission function is replacing 72RS5 with 60 MVA equivalent capacity circuit to the Strathcona substation in 2019. EDTI's Transmission function has identified the lowest cost solution to replace the 60 MVA capacity of 72RS5 is an aerial transmission line from Dome substation to Strathcona substation.³ Concurrently, through the AESO's Connection Process, the same solution was identified as the preferred solution. Figure 2-2 below depicts the system configuration upon the completion of the EDTI's life cycle replacement project in 2019. This 2019 system configuration is assumed to be the initial, existing configuration for this capacity increase project.

³ Proceeding 23165, Exhibit 23165-X0028, Appendix E-1-T-CBC-14, EDTI Transmission's Capital Business Case for 72RS5 OFPT Cable Life Cycle Replacement, para. 79 (PDF 304).

Figure 2-2 EDTI Strathcona POD Post Life Cycle Replacement of 72RS5

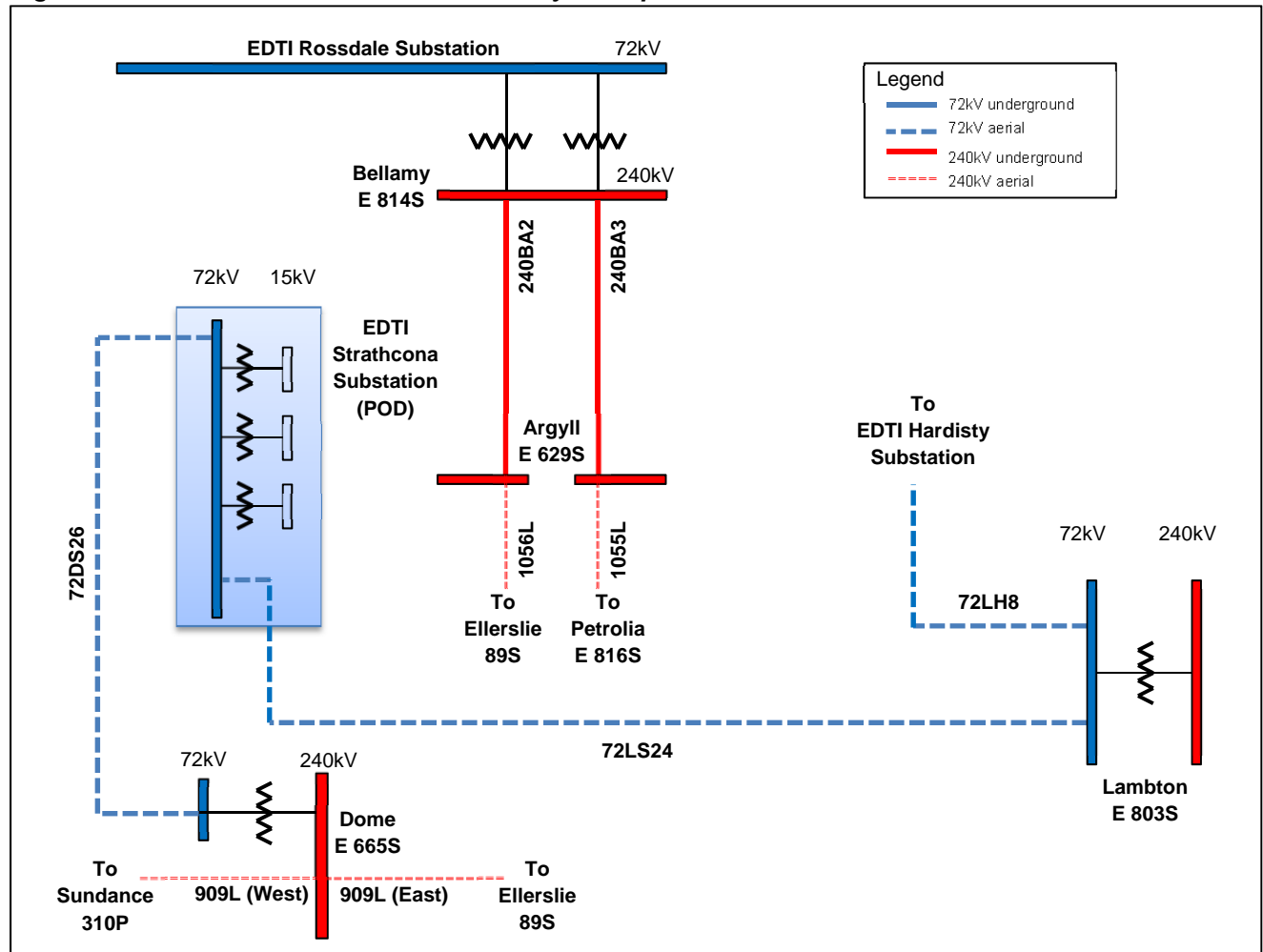


Table 2-2 summarizes the capacities of relevant transmission elements serving the Strathcona POD once the life cycle replacement of 72RS5 is completed by EDTI Transmission in Q4 2019.

Table 2-2 Strathcona Substation Capacities Post 72RS5 Replacement

| Substation | Strathcona |
|--|--|
| Transformation Installed Capacity | T1, T2, T3: 72/14.4 kV 30 / 40 MVA |
| 72kV Transmission Capacity (summer/winter) | 72LS24: 90/124 MVA Lambton T3: 80 MVA 72RS5 (replacement, Q4 2019): 60 MVA |
| Peak Station Load (15 kV) 2017 Recorded | 60.2 MVA (summer) 54.1 MVA (winter) |
| Firm Transformation (N-1) | 80 MVA |
| Firm Transmission (N-1) | RS5 (replacement, Q4 2019): 60 MVA |

3.0 EDTI Distribution Planning Criteria

3.1 POD Loading Policy

The Firm Capacity of a POD is an important parameter that EDTI considers for distribution planning purposes. EDTI defines a POD's firm capacity as the maximum load that the POD can supply without overloading any transmission equipment under an N-1 contingency. N-1 contingencies include, but are not limited to, the loss of a single transmission line supply to a POD or the loss of a single transformer at a POD. The thermal capability of terminal equipment at the POD may further restrict the firm capacity. All PODs should operate at or below their firm capacity.

4.0 Load Forecast

Tables 4-1 and 4-2 below contain actual peak load values for the past 5 years and forecast peak load values for the next 10 years. Note Strathcona summer peak values are historically higher than winter peak values; therefore Strathcona shortfalls in summer are worst case.

Table 4-1 Summer load history and forecast for existing and adjacent substations (MW)

| | A | B | C | D |
|---------|-----------------|--------------|-----------|--------------|
| Year | Strathcona Load | Garneau Load | Dome Load | Lambton Load |
| 2012 A | 68.2 | 76.8 | 99.5 | 76.9 |
| 2013 A | 60.0 | 75.0 | 100.3 | 76.3 |
| 2014 A | 61.9 | 76.8 | 96.5 | 79.0 |
| 2015 A | 58.2 | 76.2 | 91.0 | 78.3 |
| 2016 A | 55.2 | 74.7 | 81.9 | 70.5 |
| 2017 A | 55.1 | 75.4 | 84.9 | 74.4 |
| 2018 F* | 57.6 | 76.3 | 82.0 | 78.3 |
| 2019 F* | 58.1 | 77.4 | 82.0 | 78.2 |
| 2020 F* | 61.8 | 78.4 | 82.5 | 78.3 |
| 2021 F* | 62.1 | 79.5 | 83.4 | 78.4 |
| 2022 F* | 62.4 | 80.5 | 84.7 | 78.6 |
| 2023 F* | 62.8 | 82.0 | 86.1 | 78.9 |
| 2024 F* | 63.0 | 83.4 | 87.5 | 79.2 |
| 2025 F* | 63.3 | 84.9 | 88.8 | 79.4 |
| 2026 F* | 63.7 | 86.3 | 90.0 | 79.6 |
| 2027 F* | 64.2 | 87.7 | 91.2 | 80.3 |

* Forecast values provided for the Strathcona POD in this table are unofficial 2018 forecast results.

Table 4-2 Summer load history and forecast for existing and adjacent substations (MVA)

| | A | B | C | D | E | F | G | H | I | J |
|---------|------------|-----------|---------------------|--------------|---------|-----------|-------|-----------|---------|-----------|
| | Strathcona | | | | Garneau | | Dome | | Lambton | |
| Year | Load | Shortfall | Transfers available | Load at Risk | Load | Shortfall | Load | Shortfall | Load | Shortfall |
| 2012 A | 75.1 | 15.1 | 0.0 | 15.1 | 83.5 | 23.5 | 107.6 | 7.6 | 82.9 | 18.9 |
| 2013 A | 67.2 | 7.2 | 0.0 | 7.2 | 81.2 | 21.2 | 108.4 | 8.4 | 82.5 | 18.5 |
| 2014 A | 68.3 | 8.3 | 0.0 | 8.3 | 82.8 | 22.8 | 104.1 | 4.1 | 85.4 | 21.4 |
| 2015 A | 64.0 | 39.0 | 2.0 | 37.1 | 82.1 | 22.1 | 98.0 | - | 84.1 | 20.1 |
| 2016 A | 60.6 | 35.6 | 4.7 | 30.9 | 80.5 | 20.5 | 88.3 | - | 75.7 | - |
| 2017 A | 60.2 | 35.2 | 4.7 | 30.5 | 81.6 | 21.6 | 91.5 | - | 79.9 | - |
| 2018 F* | 63.3 | 38.3 | 4.7 | 33.6 | 82.2 | 22.2 | 88.3 | - | 84.1 | - |
| 2019 F* | 63.8 | 38.8 | 4.7 | 34.1 | 83.4 | 3.4 | 88.3 | - | 84.0 | - |
| 2020 F* | 67.9 | 7.9 | 4.7 | 3.2 | 84.5 | - | 88.9 | - | 84.1 | - |
| 2021 F* | 68.2 | 8.2 | 4.7 | 3.5 | 85.7 | - | 89.9 | - | 84.2 | - |
| 2022 F* | 68.6 | 8.6 | 4.7 | 3.9 | 86.8 | - | 91.3 | - | 84.4 | - |
| 2023 F* | 69.0 | 9.0 | 4.7 | 4.3 | 88.4 | - | 92.8 | - | 84.8 | - |
| 2024 F* | 69.3 | 9.3 | 4.7 | 4.6 | 89.9 | - | 94.3 | - | 85.0 | - |
| 2025 F* | 69.6 | 9.6 | 4.7 | 4.9 | 91.5 | - | 95.7 | - | 85.3 | - |
| 2026 F* | 70.0 | 10.0 | 4.7 | 5.3 | 93.0 | - | 97.0 | - | 85.5 | - |
| 2027 F* | 70.5 | 10.5 | 4.3 | 6.2 | 94.6 | - | 98.3 | - | 86.3 | - |

* Forecast values provided for the Strathcona POD in this table are unofficial 2018 forecast results. Other PODs are 2017 forecasts

Notes

- 1) Shortfall is defined as the amount of load that the POD cannot supply in an N-1 contingency.
- 2) The Strathcona shortfall is based on rated capacity of the 72RS5 cable or its replacement. From 1958 to 2015 Q1, summer rated capacity was 60 MVA. From 2015 Q1 until completion of life cycle replacement of 72RS5 in 2019 Q4, summer rated capacity is 25 MVA. After 2019 Q4, summer rated capacity is 60 MVA.
- 3) 2012-2017 data are based on actual metered data. 2018-2027 data are based on forecasts.
- 4) Garneau, Dome and Lambton forecast as per EDTI 2017 Distribution Planning forecast.
- 5) In 2015 Q4, Lambton POD transformer capacity increased to 100 MVA, with a POD firm capacity of 90MVA, as per AESO Project P1438, therefore there is no shortfall for Lambton forecasted in the 2016-2027 time period.
- 6) In Feb. 2019, AESO Connection Project P1649 (Phase 1) will increase firm (N-1) capacity at Garneau POD to 80 MVA. In Nov. 2019 AESO Connection Project P1649 (Phase 2) will increase firm (N-1) capacity at Garneau POD to 100 MVA. Dates based on "Final-April-2018-Project-List.xls" published on AESO website.

The following information is provided to explain data irregularities in Tables 4-1 and 4.2:

- The 2012 actual Strathcona load includes an approximate 7.0 MVA temporary (four day) distribution load transfer from Lambton POD. After discounting that temporary 2012 load transfer, Strathcona load from 2012 to 2014 remained relatively unchanged.
- From 2015 to 2016, Strathcona load decreased. This coincided with an observed decrease in peak loading on several Strathcona distribution circuits supplying commercial/retail load areas.
- From 2016 to 2017, Strathcona load again remained relatively unchanged.
- The forecast increase in Strathcona load after 2017 is attributable to load growth at the University of Alberta (U of A) south campus in the south central 15 kV area of Edmonton. Specifically, several new construction projects are expected at U of A South Campus, the largest being the South Campus Arena Project. No Distributed Energy Resources are forecast in the Strathcona POD service area.

- Strathcona Shortfall in column B of Table 4-2 is calculated by subtracting the actual or forecast load provided in column A of Table 4-2 from the N-1 rating of the Strathcona substation provided in Table 2-1 and 2-2. The reason for the large increase in 2015 and decrease in 2020 is that EDTI's Transmission function reduced the rating of cable 72RS5 from 60 MVA to 25 MVA prior to the 2015 summer peak, and plans to complete a life cycle replacement of this cable in Q4 2019, providing a second 60 MVA rated circuit to supply the Strathcona substation for the summer of 2020.

5.0 Deficiency

Under normal operating or N-0, EDTI is in compliance with its POD loading policy at the Strathcona POD. However, during certain N-1 contingencies, POD load in excess of the original 60 MVA installed capacity of 72RS5 will be unsupported. This load is shown as 'Strathcona Shortfall' in table 4-2 above.

The Strathcona 2017 actual load of 60.2 MVA exceeds the original 60 MVA rating of 72RS5 by 0.2 MVA. Similarly, the 2020 and 2027 Strathcona forecast of 67.9 MVA and 70.5 MVA, respectively, will exceed EDTI Transmission's planned 60 MVA replacement of the 72RS5 cable by 7.5 and 10.5 MVA, respectively. Table 5-1 lists the capacities of substations adjacent to the Strathcona POD (Garneau, Dome and Lambton).

Table 5-1 Overview of Existing Substation Capacities

| | | A | B | C |
|---|------------------------------------|---------------------------------------|--|--------------------------------|
| | Substation | Garneau | Dome | Lambton |
| 1 | Installed Transformer Capacity | T1, T2, T3: 72/14.4 kV 30 / 40 MVA | T1, T2: 240/14.4 kV 100/133/167 MVA | T1, T2: 240/14.4 kV 100 MVA |
| 2 | Firm Transformation Capacity (N-1) | 80 MVA (summer) | 167 MVA | 100 MVA (summer) |
| 3 | Firm Transmission Capacity (N-1) | 60 MVA (summer) | 466 MVA | 499 MVA |
| 4 | 14.4 kV Switchgear Capacity (N-1) | 100 MVA | 100 MVA | 90 MVA* |
| 5 | System Minimum Capacity (N-1) | 60 MVA | 100 MVA | 90 MVA |

* The capacity of the Lambton switchgear is limited by the 90 MVA capacity of the 15 kV incomer cable connecting the transformers to the switchgear. Refer to AUC Proceeding 3459, exhibit 0003.00.EDTI-3459, para. 34-35 (PDF 10-11) for explanation of the 90 MVA, N-1 capacity limit at EDTI Lambton substation.

EDTI's distribution system has the capacity to shift load from the Strathcona POD load to adjacent Dome and Lambton PODs during N-1 conditions. This combined capacity for EDTI's existing distribution system is shown in column C of Table 4-2. The specific capacities available on EDTI's distribution system for transfer are approximately 2.1 MVA of load from Strathcona POD to adjacent Dome POD (until 2026) and approximately 2.6 MVA of load to adjacent Lambton POD. Starting in 2027, the Dome POD is forecast to have only 1.7 MVA of spare capacity by 2027. Specifically, in 2027 the Dome substation is forecast to have a peak load of 98.3 MVA (Table 4-2 Column G), however the switchgear capacity at Dome is 100 MVA (Table 5-1, column B, row 5), leaving only 1.7 MVA spare capacity. Consequently the total load that can be shifted away from Strathcona POD in 2027 with the existing distribution system is reduced from 4.7 MVA (2.1 MVA + 2.6 MVA) to 4.3 MVA (1.7 MVA + 2.6 MVA).

5.1 – Summary of Load at Risk

If no action is taken, it is forecast that 3.2 MVA of load will be at risk in 2020 (7.9 MVA – 4.7 MVA transfers), increasing to 6.2 MVA by 2027 (10.5 MVA – 4.3 MVA transfers), even with the replacement of the 60 MVA capacity of 72RS5 by EDTI's transmission function in 2019. Specifically, EDTI is forecasting an 7.9 MVA shortfall during the summer of 2020 at the Strathcona substation under N-1 conditions, and is only able to transfer 4.7 MVA. In the summer of 2027, EDTI is forecasting an 10.5 MVA shortfall and will only be able to transfer 4.3 MVA to adjacent PODs. This load at risk is shown in column D of Table 4-2.

6.0 Alternatives

EDTI initially considered the possibility of a purely distribution alternative to address the deficiency identified above. EDTI has reviewed the capacities of the existing distribution system and substations in the vicinity of the Strathcona POD and determined that there are not enough available load transfers to adjacent POD's to resolve the shortfall.

To address the Strathcona POD capacity shortfall, EDTI's Distribution function identified a second alternative with transmission components. As per Section 2.2 above, EDTI's Transmission function is replacing the original capacity of 72RS5 with a new aerial transmission line from Dome substation to Strathcona substation under capital maintenance work. This capital maintenance has been budgeted for by EDTI's transmission function in its 2019 capital maintenance program, and will restore the 60 MVA capacity of the second supply into Strathcona substation that is lost with the end of life of 72RS5.

However, the 60 MVA capacity restored under capital maintenance is still inadequate to reliably supply the Strathcona POD load, which had a 2017 actual peak of 60.2 MVA and is forecast to have 2020 and 2027 peaks of 67.9 MVA and 70.5 MVA, respectively. Based on the Strathcona load forecast in Table 4-2, this still leaves a shortfall in Strathcona N-1 capacity in 2020 of 3.2 MVA (7.9 MVA – 4.7 MVA) once EDTI transmission completes replacement of 72RS5 in Q4, 2019.

EDTI and the AESO have worked collaboratively to assess the combined proposed capital maintenance project and capacity increase project as part of the AESO connection process to ensure that the lowest overall cost and impact alternative is identified. As such, the total costs of these two projects (ie capacity maintenance/restoration and capacity increase) are shown in the assessment .

EDTI's Transmission function has included the cost of the capital maintenance replacement of 72RS5 in its 2018 - 2019 TFO Tariff Application (Proceeding 23165, Exhibit 3.01, sections 9.2.4.2 and 9.2.1.10), which was filed with the Commission on November 30, 2017. Any costs approved by the Commission for EDTI's transmission function to complete capital maintenance replacement of 72RS5 will be removed from the total cost of the AESO project, once approved.

Consequently, to address the capacity shortfall, the two alternatives discussed above are formally presented below.

Alternative I – Distribution Load Transfers

Under this alternative, EDTI would attempt to mitigate the shortfall by transferring distribution load to adjacent POD's via the existing distribution system. After completing the available load transfers of 1.7 MVA to Dome POD and 2.6 MVA to Lambton POD, there is still load at risk at the Strathcona POD. As demonstrated in Table 6-1, there is insufficient capacity at adjacent POD's to address the forecast loads.

Table 6-1 Summer load history and forecast for existing and adjacent substations (MVA) after available Distribution Load Transfers

| | A | B | C | D | E | F | G | H | I | J |
|---------|------------|-----------|---------------------|--------------|---------|-----------|-------|-----------|---------|-----------|
| | Strathcona | | | | Garneau | | Dome | | Lambton | |
| Year | Load | Shortfall | Transfers available | Load at Risk | Load | Shortfall | Load | Shortfall | Load | Shortfall |
| 2012 A | 75.1 | 15.1 | 0.0 | 15.1 | 83.5 | 23.5 | 107.6 | 7.6 | 82.9 | 18.9 |
| 2013 A | 67.2 | 7.2 | 0.0 | 7.2 | 81.2 | 21.2 | 108.4 | 8.4 | 82.5 | 18.5 |
| 2014 A | 68.3 | 8.3 | 0.0 | 8.3 | 82.8 | 22.8 | 104.1 | 4.1 | 85.4 | 21.4 |
| 2015 A | 64.0 | 39.0 | 2.0 | 37.1 | 82.1 | 22.1 | 98.0 | - | 84.1 | 20.1 |
| 2016 A | 60.6 | 35.6 | 4.7 | 30.9 | 80.5 | 20.5 | 88.3 | - | 75.7 | - |
| 2017 A | 60.2 | 35.2 | 4.7 | 30.5 | 81.6 | 21.6 | 91.5 | - | 79.9 | - |
| 2018 F* | 63.3 | 38.3 | 4.7 | 33.6 | 82.2 | 22.2 | 88.3 | - | 84.1 | - |
| 2019 F* | 63.8 | 38.8 | 4.7 | 34.1 | 83.4 | 3.4 | 88.3 | - | 84.0 | - |
| 2020 F* | 67.9 | 7.9 | - | 3.2 | 84.5 | - | 90.6 | - | 86.7 | - |
| 2021 F* | 68.2 | 8.2 | - | 3.5 | 85.7 | - | 91.6 | - | 86.8 | - |
| 2022 F* | 68.6 | 8.6 | - | 3.9 | 86.8 | - | 93.0 | - | 87.0 | - |
| 2023 F* | 69.0 | 9.0 | - | 4.3 | 88.4 | - | 94.5 | - | 87.4 | - |
| 2024 F* | 69.3 | 9.3 | - | 4.6 | 89.9 | - | 96.0 | - | 87.6 | - |
| 2025 F* | 69.6 | 9.6 | - | 4.9 | 91.5 | - | 97.4 | - | 87.9 | - |
| 2026 F* | 70.0 | 10.0 | - | 5.3 | 93.0 | - | 98.7 | - | 88.1 | - |
| 2027 F* | 70.5 | 10.5 | - | 6.2 | 94.6 | - | 100 | - | 88.9 | - |

* Forecast values provided for the Strathcona POD in this table are unofficial 2018 forecast results. Other PODs are 2017 forecasts

Notes

- 1) Shortfall is defined as the amount of load that the POD cannot supply in an N-1 contingency.
- 2) The Strathcona shortfall is based on rated capacity of the 72RS5 cable or its replacement. From 1958 to 2015 Q1, summer rated capacity was 60 MVA. From 2015 Q1 until completion of life cycle replacement of 72RS5 in 2019 Q4, summer rated capacity is 25 MVA. After 2019 Q4, summer rated capacity is 60 MVA.
- 3) 2012-2017 data are based on actual metered data. 2018-2027 data are based on forecasts.
- 4) Garneau, Dome and Lambton forecast as per EDTI 2017 Distribution Planning forecast.
- 5) In 2015 Q4, Lambton POD transformer capacity increased to 100 MVA, with a POD firm capacity of 90MVA, as per AESO Project P1438, therefore there is no shortfall for Lambton forecasted in the 2016-2027 time period.
- 6) After 2019 Q4, Alternative 1 would permanently transfer 1.7 MVA of Strathcona load to Dome and 2.6 MVA of Strathcona load to Lambton.

EDTI rejects this alternative as it does not resolve the shortfall in the forecast period.

Alternative II – Increase the capacity of the new replacement line (Transmission)

Under this alternative, EDTI and the AESO would coordinate with the planned capital maintenance replacement of 72RS5 by EDTI's Transmission function and increase the capacity of the replacement transmission line between EDTI's Dome and Strathcona substations beyond its planned 60 MVA rating.

EDTI estimates that the total cost of this alternative is \$22.59 million, including:

- \$22.15 million for the life cycle replacement of 72RS5 with a similar 60 MVA capacity line from Dome to Strathcona (proposed by EDTI Transmission as a capital maintenance project), and
- \$0.44 million incremental costs (\$0.10 million to install a higher capacity conductor and \$0.34 million to install a higher capacity transformer) to increase the capacity of the line to meet EDTI Distribution's request for an increase in capacity.

Table 6-2. Cost of Incremental Capacity to Capital Maintenance

| Alternative | II |
|--|---|
| Description | Incremental T-Capacity Increase to T- Capital Maintenance Project |
| Total Distribution Feeders Length (km) | 0.0 |
| Transmission Capacity Added (MVA) | >10.5 |
| Distribution Costs (+/-50%, \$M) | 0.00 |
| Transmission Costs – Tentative capital maintenance allocation (\$M) ⁴ | 22.15 |
| Transmission Costs – Capacity Increase Allocation (\$M) | 0.44 |
| Total Transmission Costs (+20% / -10%, \$M) | 22.59 |
| Total Costs (+20% / -10% \$M) | 22.59 |
| Total Costs Net of Transmission Capital Maintenance (+20% / -10% \$M) | 0.44 |

7.0 Recommendation

EDTI distribution function prefers Alternative 2 be developed to serve the load requirements for the Strathcona POD distribution service area because it is the only technically viable alternative identified.

The requested in-service date for this proposed development is Q4 2019.

EDTI has submitted a SASR to the AESO and has requested a Demand Transmission Service (DTS) increase to 64.2 MW for the Strathcona POD.

⁴ EDTI's transmission function has included this cost for the capital maintenance replacement of 72RS5 in its 2018 - 2019 TFO Tariff Application (Proceeding 23165, Exhibit 3.01, sections 9.2.4.2 and 9.2.1.10), which was filed with the Commission on November 30, 2017. Any costs approved by the Commission for EDTI's transmission function to complete capital maintenance replacement of 72RS5 will be removed from the total cost of the AESO project, once approved.

8.0 Proposed Mitigation Strategy

The preferred alternative of increasing the capacity of the 72RS5 replacement eliminates the Strathcona POD "Load at Risk" identified in Table 4-2, which is the deficiency identified in this DDR. This is demonstrated below in Table 8-1.

Table 8-1 .Preferred Alternative - Post Mitigation Summer Load History And Forecast For Existing And Adjacent Substations (MVA)

| | A | B | C | D | E | F | G | H | I | J |
|---------|------------|-----------|---------------------|--------------|---------|-----------|-------|-----------|---------|-----------|
| | Strathcona | | | | Garneau | | Dome | | Lambton | |
| Year | Load | Shortfall | Transfers available | Load at Risk | Load | Shortfall | Load | Shortfall | Load | Shortfall |
| 2012 A | 75.1 | 15.1 | 0.0 | 15.1 | 83.5 | 23.5 | 107.6 | 7.6 | 82.9 | 18.9 |
| 2013 A | 67.2 | 7.2 | 0.0 | 7.2 | 81.2 | 21.2 | 108.4 | 8.4 | 82.5 | 18.5 |
| 2014 A | 68.3 | 8.3 | 0.0 | 8.3 | 82.8 | 22.8 | 104.1 | 4.1 | 85.4 | 21.4 |
| 2015 A | 64.0 | 39.0 | 2.0 | 37.1 | 82.1 | 22.1 | 98.0 | - | 84.1 | 20.1 |
| 2016 A | 60.6 | 35.6 | 4.7 | 30.9 | 80.5 | 20.5 | 88.3 | - | 75.7 | - |
| 2017 A | 60.2 | 35.2 | 4.7 | 30.5 | 81.6 | 21.6 | 91.5 | - | 79.9 | - |
| 2018 F* | 63.3 | 38.3 | 4.7 | 33.6 | 82.2 | 22.2 | 88.3 | - | 84.1 | - |
| 2019 F* | 63.8 | 38.8 | 4.7 | 34.1 | 83.4 | 3.4 | 88.3 | - | 84.0 | - |
| 2020 F* | 67.9 | - | 4.7 | - | 84.5 | - | 88.9 | - | 84.1 | - |
| 2021 F* | 68.2 | - | 4.7 | - | 85.7 | - | 89.9 | - | 84.2 | - |
| 2022 F* | 68.6 | - | 4.7 | - | 86.8 | - | 91.3 | - | 84.4 | - |
| 2023 F* | 69.0 | - | 4.7 | - | 88.4 | - | 92.8 | - | 84.8 | - |
| 2024 F* | 69.3 | - | 4.7 | - | 89.9 | - | 94.3 | - | 85.0 | - |
| 2025 F* | 69.6 | - | 4.7 | - | 91.5 | - | 95.7 | - | 85.3 | - |
| 2026 F* | 70.0 | - | 4.7 | - | 93.0 | - | 97.0 | - | 85.5 | - |
| 2027 F* | 70.5 | - | 4.3 | - | 94.6 | - | 98.3 | - | 86.3 | - |

* Forecast values provided for the Strathcona POD in this table are unofficial 2018 forecast results. Other PODs are 2017 forecasts

Notes

- 1) Shortfall is defined as the amount of load that the POD cannot supply in an N-1 contingency.
- 2) The Strathcona shortfall is based on rated capacity of the 72RS5 cable or its replacement. From 1958 to 2015 Q1, summer rated capacity was 60 MVA. From 2015 Q1 until completion of life cycle replacement of 72RS5 in 2019 Q4, summer rated capacity is 25 MVA. After 2019 Q4, The preferred alternative will increase summer rated capacity to > 70.5 MVA. See Note 7) below.
- 3) 2012-2017 data are based on actual metered data. 2018-2027 data are based on forecasts.
- 4) Garneau, Dome and Lambton forecast as per EDTI 2017 Distribution Planning forecast.
- 5) In 2015 Q4, Lambton POD transformer capacity increased to 100 MVA, with a POD firm capacity of 90MVA, as per AESO Project P1438, therefore there is no shortfall for Lambton forecasted in the 2016-2027 time period.
- 6) In Feb. 2019, AESO Connection Project P1649 (Phase 1) will increase firm (N-1) capacity at Garneau POD to 80 MVA. In Nov. 2019 AESO Connection Project P1649 (Phase 2) will increase firm (N-1) capacity at Garneau POD to 100 MVA. Dates based on "Final-April-2018-Project-List.xls" published on AESO website.
- 7) As stated above in Note 2), the Strathcona shortfall is based on rated capacity of the 72RS5 cable or its replacement. After 2019 Q4, The preferred alternative will increase the capacity of the 72RS5 life cycle replacement by at least 10.5 MVA, from 60 MVA to at least 70.5 MVA.

Revision History

| Revision | Issue Date | Author | Change Tracking |
|----------|-----------------|---|--|
| 1 | April 13, 2015 | Brian Choma Steve Swystun | <ul style="list-style-type: none"> Original Submission |
| 2 | April 20, 2015 | Brian Choma Steve Swystun | <ul style="list-style-type: none"> Rewording of status of 72RS5 and other changes suggested by AESO. |
| 3 | March 4, 2016 | Brian Choma Steve Swystun | <ul style="list-style-type: none"> Updates to forecast tables. DTS changed Clarified option of 72RS5 cable replacement |
| 4 | October 4, 2017 | Brian Choma Trent Loga | <ul style="list-style-type: none"> Updated actual loads up to 2016. Updated forecast loads to 2027 with most recent EDTI forecast |
| 6 | May 15, 2018 | Trent Loga Brian Choma Mark Bensted | <ul style="list-style-type: none"> Updated actual loads up to 2017. Preliminary 2018 forecasts for Strathcona substation added. Accounted for impact of EDTI transmission function 72RS5 capital maintenance on Strathcona POD N-1 capacity |
| 7 | June 5, 2018 | Trent Loga Brian Choma Mark Bensted | <ul style="list-style-type: none"> Updated Table 5-1 and Alternative I to reflect Lambton substation firm capacity of 90 MVA. |