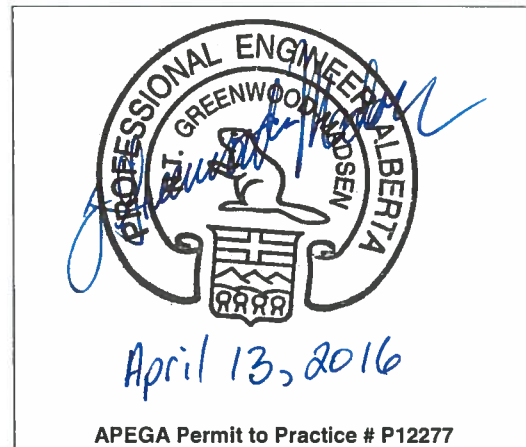


## **APPENDIX E     DFO DISTRIBUTION DEFICIENCY REPORT**



## Distribution Deficiency Report City of Grande Prairie New POD



Approvals		Signature	Date
Revised By	Tom Greenwood-Madsen, P.Eng.		Apr 13, 2016
Manager, Distribution Planning	Matt Sveinbjornson, P. Eng.		Apr 13, 2016

April 13, 2016

# Contents

<b>1 EXECUTIVE SUMMARY .....</b>	<b>1</b>
<b>2 EXISTING TRANSMISSION AND DISTRIBUTION SYSTEM .....</b>	<b>2</b>
2.1 Existing Distribution System .....	2
2.2 Existing Transmission System.....	2
2.2.1 Crystal Lake 722S .....	3
2.2.2 Flyingshot Lake 749S .....	4
<b>3 NEED FOR DEVELOPMENT .....</b>	<b>5</b>
<b>4 ALTERNATIVES.....</b>	<b>6</b>
4.1 Distribution Based Solutions Considered.....	6
4.2 Transmission Alternatives Identified.....	6
4.3 Rejected Alternatives .....	7
4.3.1 Alternative 1: Increase Substation Capacity at Crystal Lake 722S .....	7
4.3.2 Alternative 2: Increase Substation Capacity at Flyingshot Lake 749S.....	7
4.4 Preferred Alternative - Alternative 3: Construct a New POD Substation .....	8
<b>5 CONCLUSION .....</b>	<b>10</b>
<b>APPENDIX A – GRANDE PRAIRIE DISTRIBUTION SYSTEM SLDS.....</b>	<b>13</b>
<b>APPENDIX B – LOAD FORECASTS .....</b>	<b>15</b>
Table B-1 Crystal Lake 722S Load Forecast .....	15
Table B-2 Flyingshot Lake 749S Load Forecast .....	16
Table B-3 Crystal Lake 722S Load Forecast – Alternative 3 .....	17
Table B-4 Flyingshot Lake 749S Load Forecast – Alternative 3.....	18
Table B-5 Hughes 2030S Load Forecast – Alternative 3 .....	18

Revision History:

R0	Original Issue	Honesto Bautista	February 10, 2014
R1	Implementing AESO 2015 NID Submission Comments	Sonya Wallbank	July 30, 2015
R2	Implementing AESO 2016 NID Submission Comments	Tom Greenwood-Madsen	April 13, 2016

## **1 Executive Summary**

Over the last decade, the City of Grande Prairie has experienced significant growth due to strong economic conditions. Growth is expected to continue at a pace tied to economic conditions. ATCO Electric Distribution Division (AE DFO) predicts that by 2016 this increased demand will cause violation of our “POD Capacity Planning Guideline” on four 25 kV feeders and two 25 kV busses in the area.

The existing point-of-delivery (POD) substations in the area, Crystal Lake 722S and Flyingshot Lake 749S, do not have enough capacity to serve the predicted load growth through load shifting alone without violating the planning guideline.

AE DFO considered the following transmission based alternatives to serve the predicted load growth:

- |                             |   |
|-----------------------------|---|
| <b><u>Alternative 1</u></b> | Increase Substation Capacity at Crystal Lake 722S.    |
| <b><u>Alternative 2</u></b> | Increase Substation Capacity at Flyingshot Lake 749S. |
| <b><u>Alternative 3</u></b> | Construct a New POD Substation.                       |

Based on the analysis outlined in this report, Alternatives 1 and 2 are not technically viable and have been rejected. ATCO Electric Distribution Division prefers Alternative 3 to serve the predicted load growth in the City of Grande Prairie.

Further study will be required to determine how to connect the new POD substation to the Alberta Interconnected Electric System.

The requested in-service date for the preferred development is December 1, 2018.

As stated in the System Access Service Request (SASR) submitted to the AESO the requested contract capacity for Demand Service (DTS) at the proposed new (Hughes) POD is 15.5 MW.

## 2 Existing Transmission and Distribution System

### 2.1 Existing Distribution System

The City of Grande Prairie (City) is fed from 16 distribution feeders. A simplified single-line diagram (SLD) of the existing 25 kV distribution system is shown in Figure A-1 in Appendix A.

The ATCO Electric distribution planning *Guideline for Adding 25 kV Breakers* recommends that loading on 25 kV breakers for urban areas not exceed 10 MVA. Loading on rural feeders should not exceed 15 MVA. As shown in Appendix B, four 25 kV breakers serving urban load are forecast to exceed 10 MVA in 2016.

The City's 25 kV distribution system has three interconnection points with Mercer Hill 728S. Mercer Hill 728S is located approximately 12 km north of Crystal Lake 722S; it serves the rural area north of the City of Grande Prairie, including the neighbouring Hamlet of Clairmont. Load growth at Mercer Hill 728S is not the driver of the need for development in the City of Grande Prairie.

### 2.2 Existing Transmission System

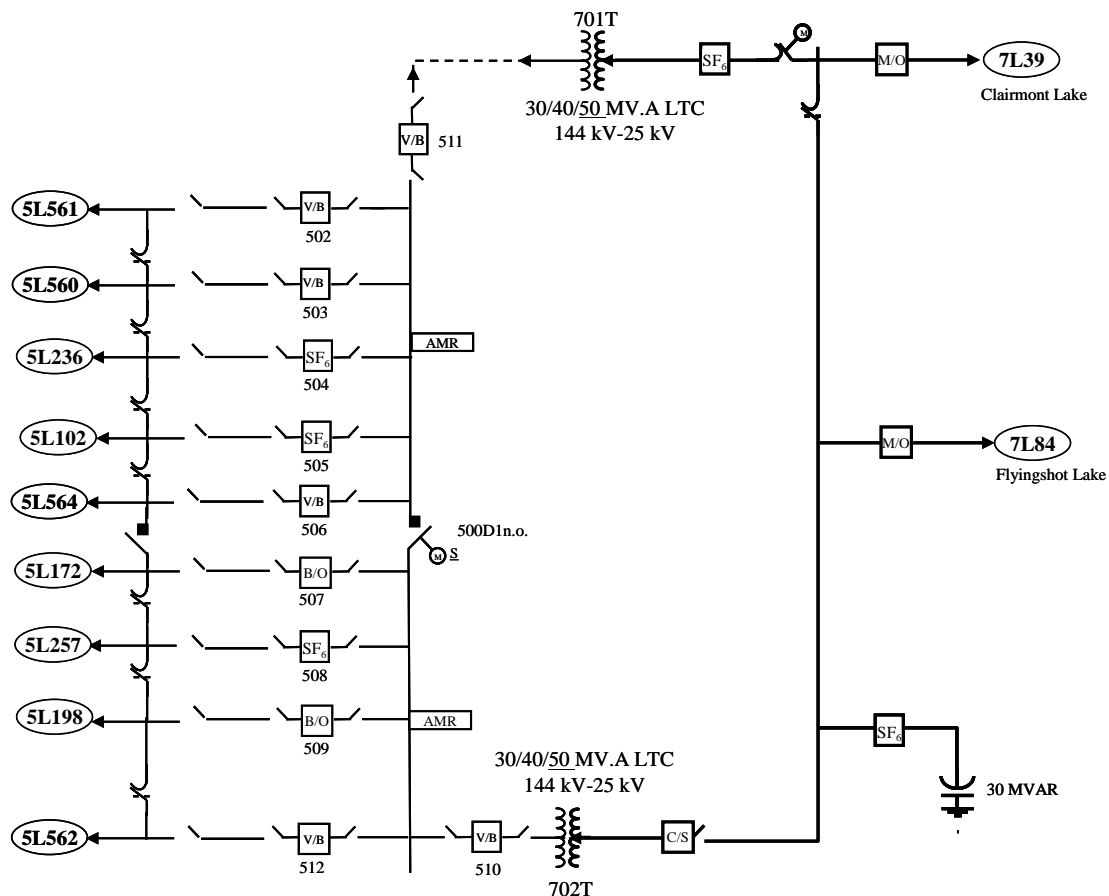
The 16 feeders serving the City emanate from two substations: Crystal Lake 722S and Flyingshot Lake 749S. Crystal Lake 722S is located in the northeast part of the City and Flyingshot Lake 749S is located in the southwest part of the City. The combined peak load of these two substations in winter 2015/2016 was 107.2 MW.

The ATCO Electric distribution planning guideline for *Large Urban Areas* recommends a maximum loading of 33 MVA on a 25 kV bus. As shown in Appendix A, two busses are forecast to exceed 33 MVA in 2016. By 2022, three busses are anticipated to exceed 33 MVA.

### 2.2.1 Crystal Lake 722S

Table B-1, in Appendix B, shows the load forecast for Crystal Lake 722S. The simplified SLD of Crystal Lake 722S is shown in Figure 2.2-1

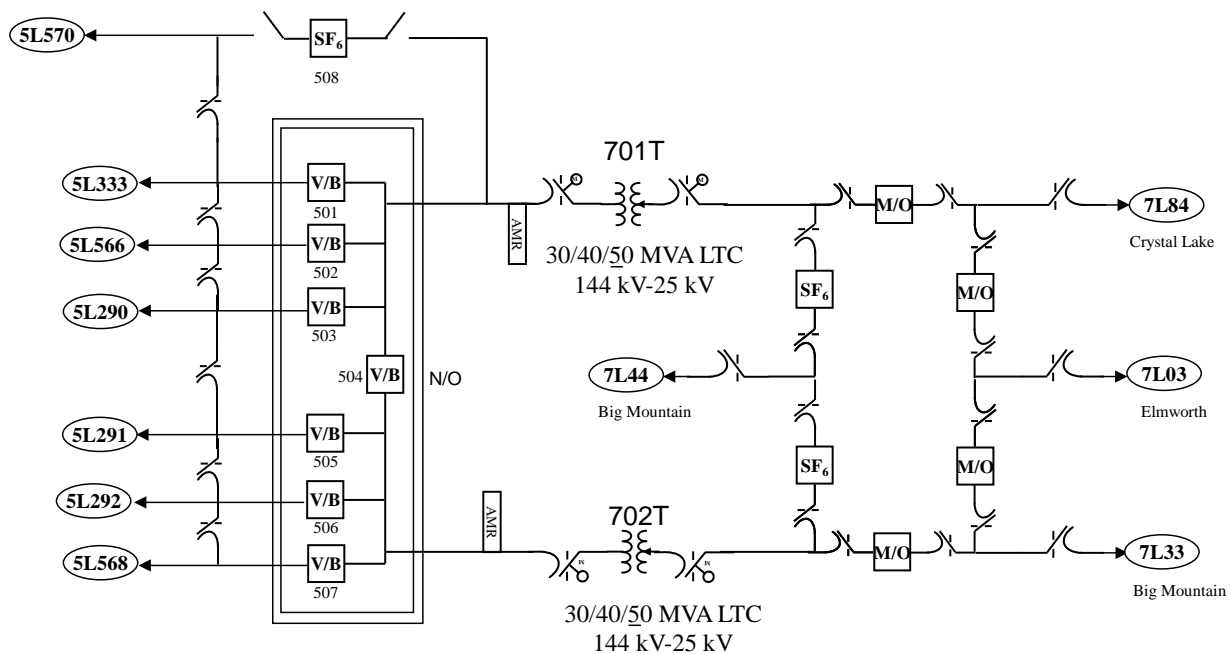
Figure 2.2-1 Crystal Lake 722S Simplified Substation SLD



### 2.2.2 Flyingshot Lake 749S

Table B-2, in Appendix B, shows the load forecast for Flyingshot Lake 749S. The simplified SLD of Flyingshot Lake 749S is shown in Figure 2.2-2.

**Figure 2.2-2 Flyingshot Lake 749S Simplified Substation**





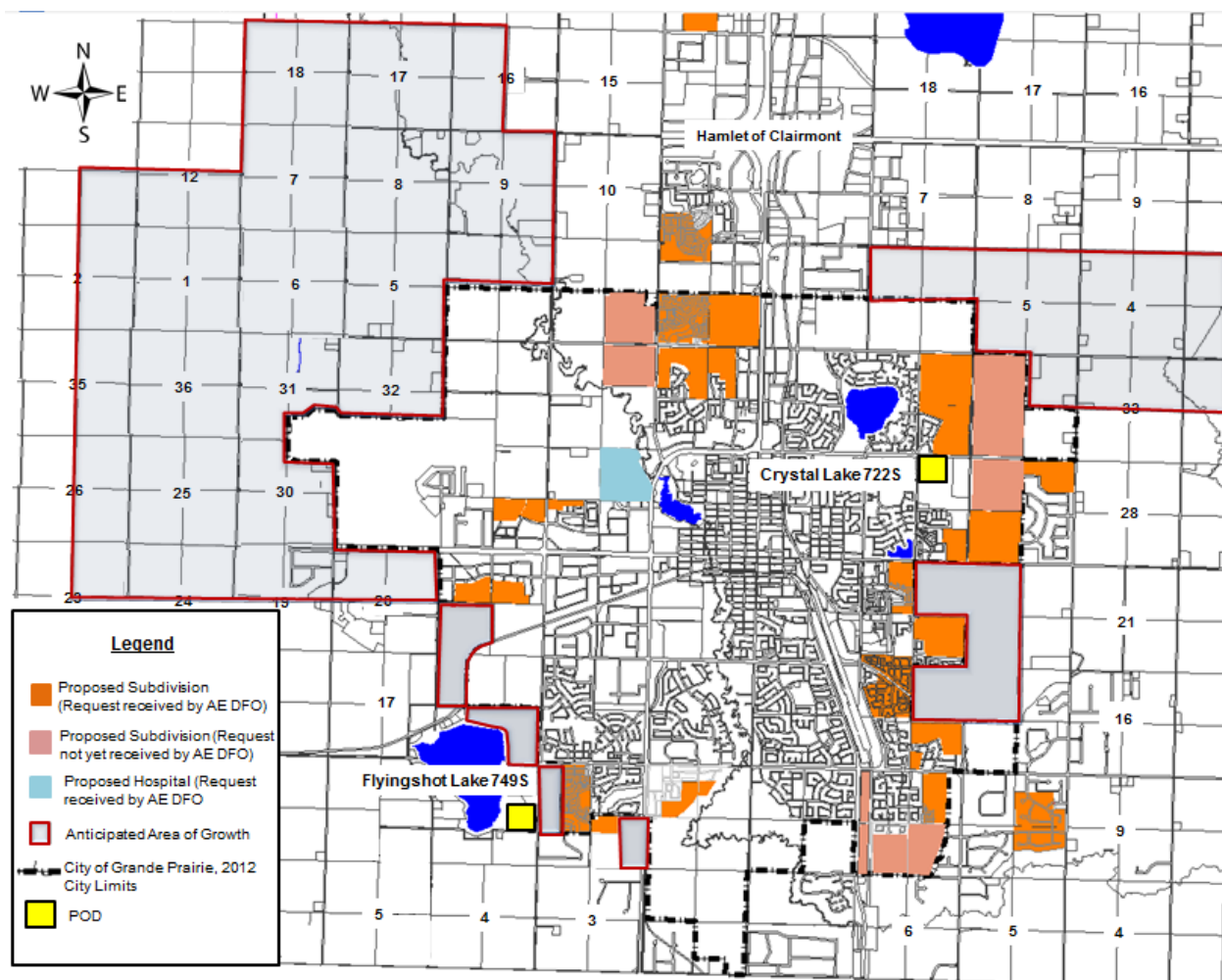
### 3 Need for Development

The need for development is driven by increased electrical demand in the City of Grande Prairie.

The City of Grande Prairie population was 55,032 in 2011, a 16.8% increase over 2006 [1]. The population is projected to reach 109,155 by 2042 [2]. The City is a major trading centre in northwest Alberta and parts of northeast British Columbia.

A number of subdivisions are currently being completed within the City. A new 200-bed regional hospital is under construction, adding 5 MW onto the system in 2019. The Intermunicipal Development Plan adopted by The City of Grande Prairie & The County of Grande Prairie No. 1 anticipates the majority of the future growth of the City will occur northwest of the current City limits [3]. These anticipated areas of growth are shown in Figure 3-1.

**Figure 3-1 Anticipated City of Grande Prairie Area of Future Development**



The Crystal Lake 722S and Flyingshot Lake 749S load forecasts in Tables B-1 and B-2, provided in Appendix B, show the following guideline violations:

- the Crystal Lake 722S-701T transformer is predicted to exceed 33 MVA in 2016;
- the Crystal Lake 722S-702T transformer is predicted to exceed 33 MVA in 2022;
- the Flyingshot Lake 749S-701T transformer reached 33 MVA in 2013 and is predicted to exceed this level again in 2016;
- the Crystal Lake 722S 5L102 feeder is predicted to exceed 10 MVA in 2016;
- the Crystal Lake 722S 5L562 feeder is predicted to reach 10 MVA in 2024;
- the Flyingshot Lake 749S 5L566 feeder has been in excess of 10 MVA for more than five years;
- the Flyingshot Lake 749S 5L570 feeder is predicted to exceed 10 MVA in 2016; and
- the Flyingshot Lake 749S 5L291 feeder is predicted to exceed 10 MVA in 2016.

If additional capacity is not added within the City, guideline violations are anticipated to increase at both substations.

## **4 Alternatives**

### ***4.1 Distribution Based Solutions Considered***

AE DFO considered the distribution based solution of shifting load between the two substations currently serving the City of Grande Prairie: Crystal Lake 722S and Flyingshot Lake 749S. This solution would involve shifting load from the feeders and transformers affected by the violations stated in Section 3 to transformers and feeders that are not approaching capacity. This solution was ruled out because there is not enough excess capacity at either of the existing City of Grande Prairie POD substations to serve the predicted load growth without violating the AE DFO POD Capacity Planning Guideline. Transmission development is needed.

### ***4.2 Transmission Alternatives Identified***

There were several transmission development options identified to accommodate the increased electrical demand forecast for the City of Grande Prairie. These various options can be summed up with three alternatives:

**Alternative 1**      Increase Substation Capacity at Crystal Lake 722S.

**Alternative 2**      Increase Substation Capacity at Flyingshot Lake 749S.

**Alternative 3**      Construct a New POD Substation.

All options include the addition of four 25 kV breakers that will connect new distribution lines to serve the City of Grande Prairie.

### ***4.3 Rejected Alternatives***

#### ***4.3.1 Alternative 1: Increase Substation Capacity at Crystal Lake 722S***

Increasing the substation capacity at Crystal Lake 722S would entail adding an additional 144-25 kV transformer, along with an associated 25 kV bus, plus the necessary 25 kV breakers and feeders. This alternative is not preferred due to physical space constraints associated with routing additional feeders from this location. Nine 25 kV distribution lines already originate from Crystal Lake 722S. The substation is surrounded by existing and proposed subdivisions. Routing additional underground feeders from the substation would be extremely challenging.

Further to this, the lack of diversity in feeder sources creates reliability and operational issues. In the case of a major event affecting all service from Crystal Lake 722S, Flyingshot Lake 749S cannot restore all service and many customers could experience extended outages. Due to the growth in recent years and continued forecast growth, continuing to serve the City from only two substations limits operational flexibility.

For these reasons this alternative has been rejected. No further analysis or load forecasts for this alternative were created.

#### ***4.3.2 Alternative 2: Increase Substation Capacity at Flyingshot Lake 749S***

Flyingshot Lake 749S has seven 25 kV distribution lines, five of which run north from the substation towards the City. This corridor cannot be expanded to accommodate additional feeders.

Increasing the substation capacity at Flyingshot Lake 749S would entail installing an additional 144-25 kV transformer along with an associated 25 kV bus plus the necessary 25 kV breakers and feeders. The new distribution feeders would require a mass utility corridor due to geographic constraints. This corridor would run west and then north towards the area of anticipated growth.

This alternative would have the following limitations:

- The 25 kV circuits required would be longer than those of the preferred solution and therefore will have higher losses, higher line exposure to forced outages, and higher capital cost.
- A utility corridor wide enough to accommodate the four new distribution lines is expected to adversely impact numerous land-owners. In addition, the common

right-of-way would be susceptible to multiple-feeder outages impacting the reliability of all customers served from this corridor.

- This alternative would see the same issues with operational flexibility mentioned for Alternative 1. During a major event affecting all service from Flyingshot Lake 749S, Crystal Lake 722S cannot restore all service and many customers would experience extended outages.

For these reasons this alternative has been rejected. No further analysis or load forecasts for this alternative were created.

#### ***4.4 Preferred Alternative - Alternative 3: Construct a New POD Substation***

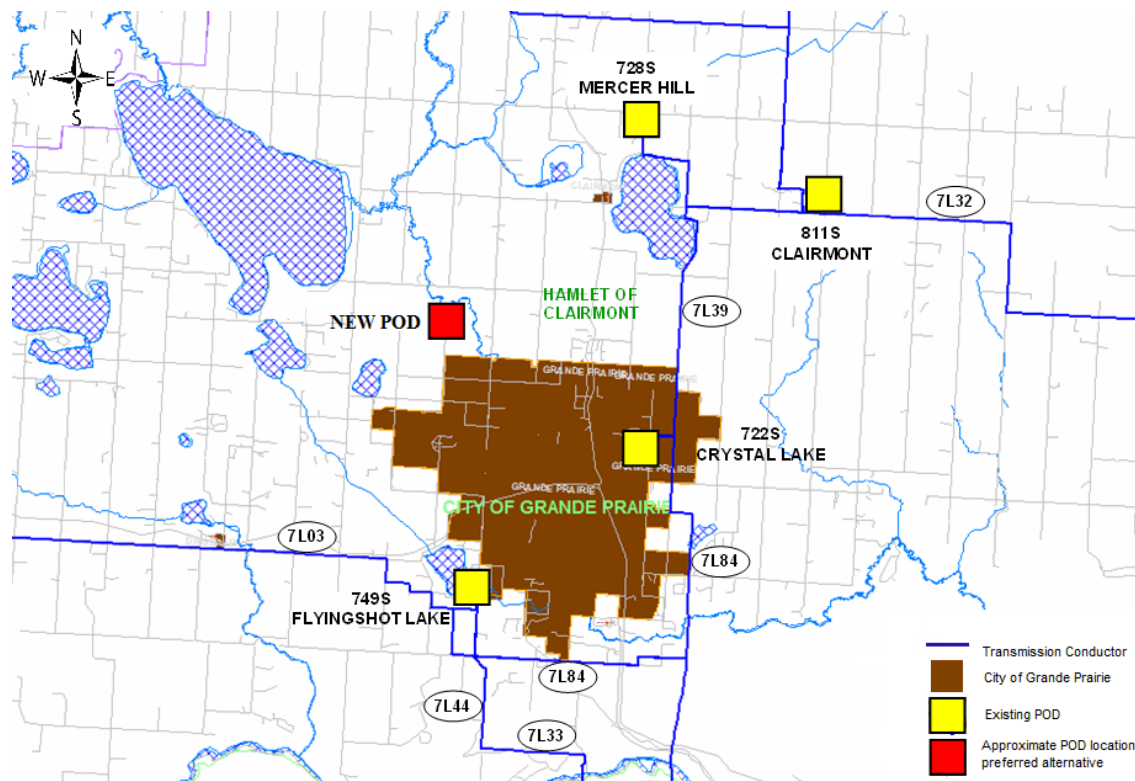
AE DFO's preferred alternative is to build a new POD substation northwest of the City, shown in Figure 4.4-1. This is the only identified alternative that is technically viable and does not violate the AE DFO POD Capacity Planning Guideline.

The preferred option will provide the following benefits:

1. Introducing a third POD to the City increases the operational flexibility and, hence, the ability to restore service during a contingency, creating a more robust and reliable system.
2. Situating the POD in a good position to serve the growth in electrical demand expected northwest of the current city limits.
3. Offloading Crystal Lake 722S and Flyingshot Lake 749S. Avoiding guideline violations and allowing these existing PODs to serve future growth to the northeast and southwest of the city limits.
4. Establishing transmission and distribution right-of-ways prior to residential and commercial development in the northwest, minimizing the impact to land-owners and reducing risk of future regulatory hearings.

Studies will need to be performed to determine how best to connect the new POD to the Alberta Interconnected Electric System. For this development, AE DFO prefers one transformer sized to match the existing units feeding the City of Grande Prairie. It is requested that the development have provisions for a second transformer and 25 kV bus.

Figure 4.4-1 Area Map Showing Preferred Alternative



As shown in Figure A-2, the four 25 kV breakers requested at the new POD substation will serve the City of Grande Prairie.

The specific City loads served by the four new 25 kV feeders will be as follows:

**Feeder 5L5A** will offload the Crystal Lake 722S 5L102 feeder at 108 Street, supplying a number of subdivisions;

**Feeder 5L5B** will offload Flyingshot Lake 5L291 feeder along 116 Street, supplying the airport and surrounding area;

**Feeder 5L5C** will supply the new hospital. The new hospital's back up supply can come from either feeder 5L5A or 5L292; and

**Feeder 5L5D** will head east along 132 Avenue and offload the Crystal Lake 722S 5L236 feeder.

The proposed distribution development includes the following:

- Build approximately 7.2 km of three-phase double circuit line (5L5A / 5L5D) from the proposed POD heading north for 0.8 km, then east along the proposed Highway 43 bypass route, and then south along 108 St.

## **ATCO Electric – 2015 Distribution Deficiency Report City of Grande Prairie – New POD**

---

- Build approximately 6.4 km of three-phase double circuit line (5L5B / 5L5C) from the proposed POD heading east for 1.6 km, then south along 116 St. up to 108 Ave., and terminating at the hospital.

The order of magnitude cost of the distribution project, excluding land cost, is \$0.85 M (\$2013, +/- 50%).

The load forecast for the preferred alternative development is given in Appendix B, Tables B-3, B-4, and B-5.

## **5 Conclusion**

Alternative 3 is the only viable option from a distribution development standpoint. AE DFO prefers this alternative to serve the City of Grande Prairie's increased demand for electricity while providing reliable service.

The requested in-service date for the preferred development is December 1, 2018.

## **ATCO Electric – 2015 Distribution Deficiency Report**

### **City of Grande Prairie – New POD**

---

#### References

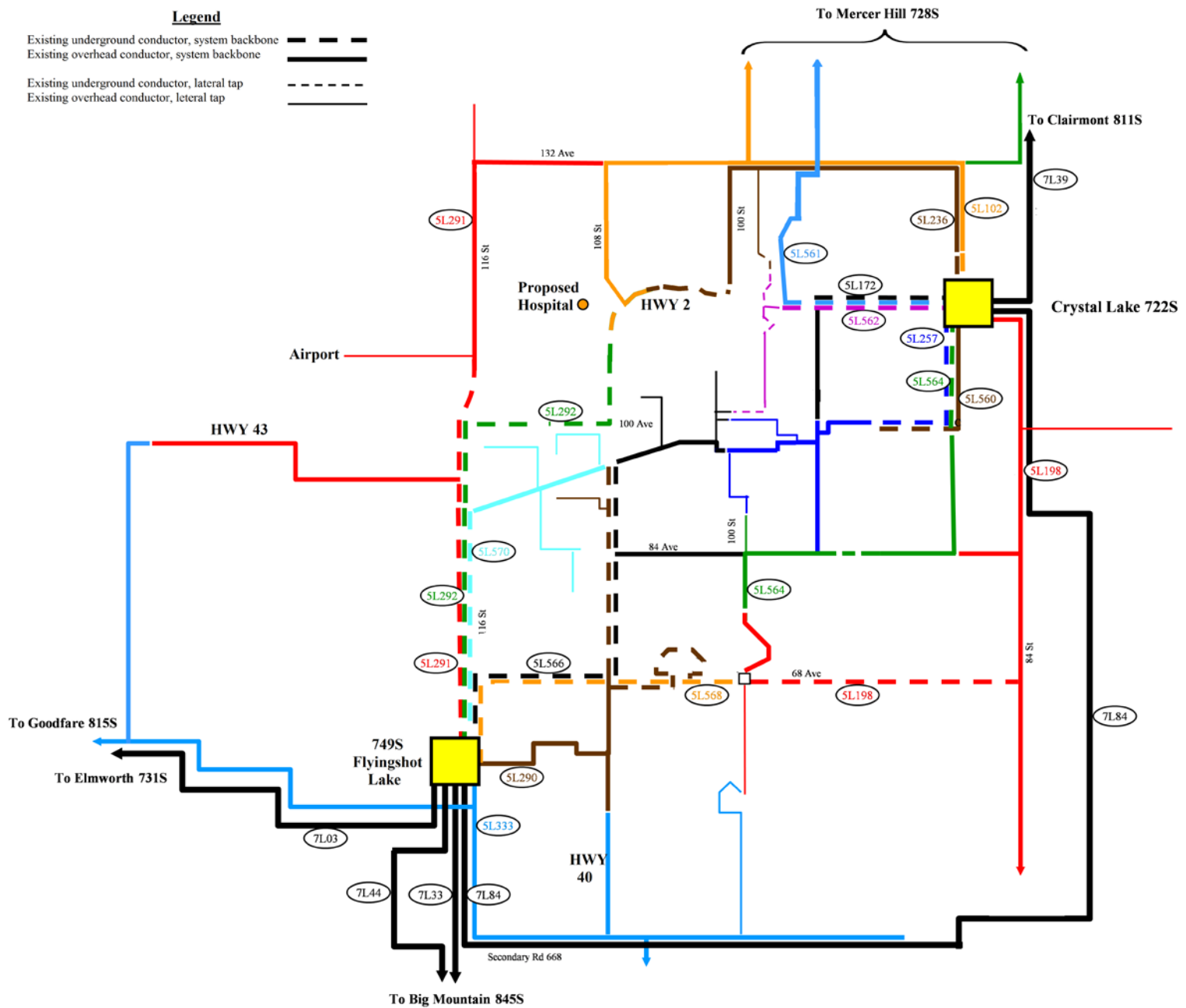
[1] Statistics Canada. "Population and dwelling counts for Canada, provinces and territories, and census subdivisions (municipalities), 2011 and 2006 censuses," 17 Apr. 2015 [Online]. Available: <https://www12.statcan.gc.ca/census-recensement/2011/dp-pd/hlt-fst/pd-pl/Table-Tableau.cfm?LANG=Eng&T=302&SR=1&S=51&O=A&RPP=9999&PR=48> Accessed on: July 7, 2015.

[2] Lovatt Planning Consultants Inc. "City of Grande Prairie, 2008 Growth Study Update," November 2013 [Online]. Available: <http://www.cityofgp.com/modules/showdocument.aspx?documentid=10014> Accessed on: June 26, 2015.

[3] The City of Grande Prairie & The County of Grande Prairie No. 1. "Intermunicipal Development Plan," City Bylaw C-1248, County Bylaw: 2896, Adopted: June 14, 2010. Available: <http://www.countygp.ab.ca/assets/Departments/Planning~Development~Services/Docs/intermunicipal-development-plan.pdf> Accessed on June 29, 2015.

## Appendix A – Grande Prairie Distribution System SLDs

Figure A-1 Simplified SLD of Existing 25 kV Distribution System

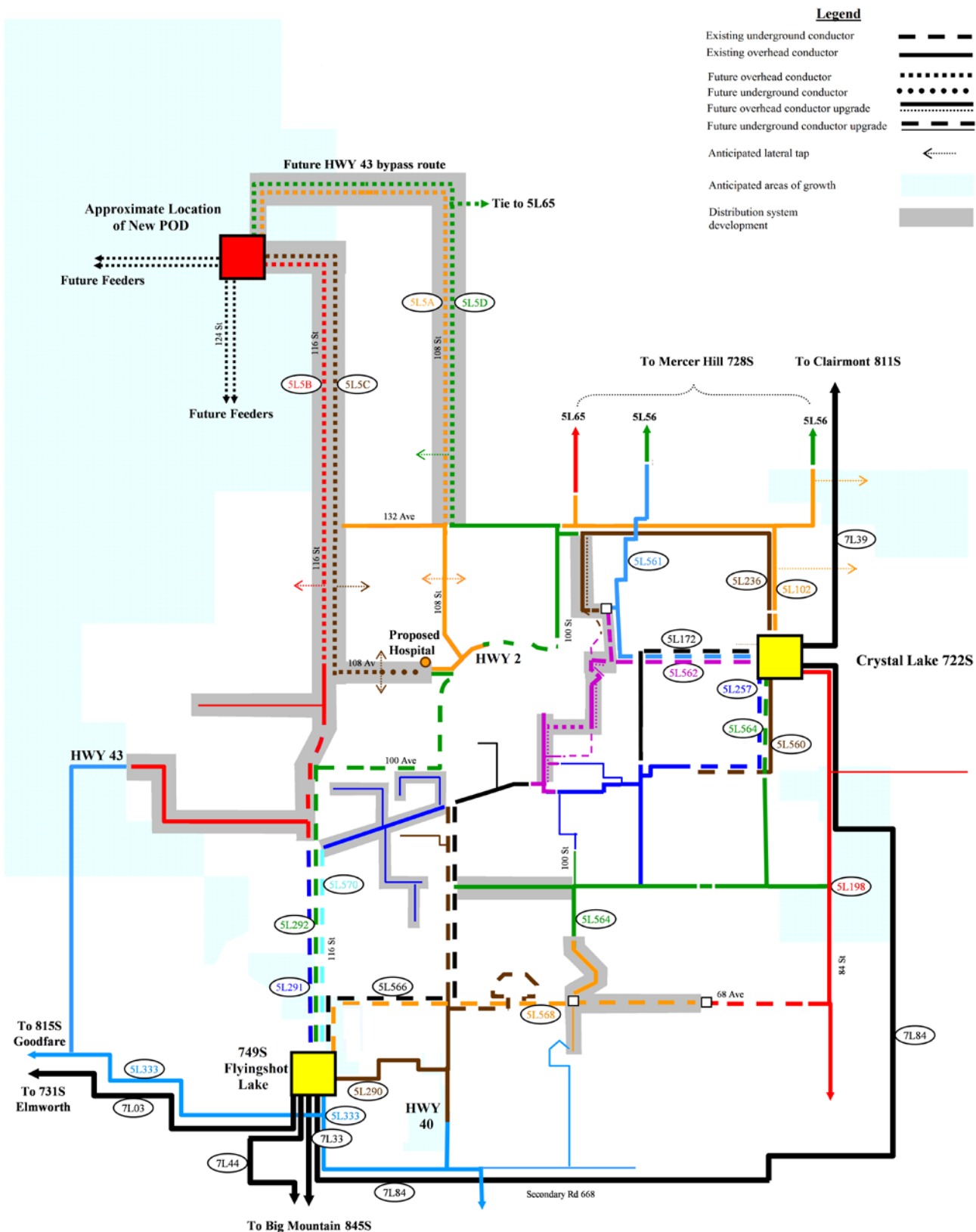




## ATCO Electric – 2015 Distribution Deficiency Report

### City of Grande Prairie – New POD

### Figure A-2 Simplified SLD of 25 kV Distribution System with Preferred Alternative



## Appendix B – Load Forecasts

**Table B-1 Crystal Lake 722S Load Forecast**

Sub No.	Feeder	Capacity	PF	Recorded						Predicted									
				Peak MW	Peak MW	Peak MW	Peak MW	Peak MW	Peak MW	Peak MW	Peak MW	Peak MW	Peak MW	Peak MW	Peak MW	Peak MW	Peak MW	Peak MW	Peak MW
				2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
722S	Crystal Lake	701T	*99%/97%	20.7	28.3	28.7	27.1	32.6	31.8	34.4	39.3	39.8	40.4	40.7	41.0	41.4	41.7	42.0	42.3
	5L102	30/40/50	*99%/97%	10.3	12.2	11.0	11.8	9.9	7.3	10.9	15.8	15.9	16.0	16.1	16.2	16.3	16.4	16.5	16.6
	5L236		*99%/95%	10.7	9.9	7.3	7.0	10.6	11.0	6.0	6.4	6.8	7.1	7.2	7.3	7.4	7.5	7.6	7.8
	5L560		*100%/99%		2.9	3.6	3.9	4.4	3.8	5.2	5.2	5.3	5.3	5.4	5.4	5.5	5.5	5.5	5.6
	5L561		*99%/97%		2.1	1.8	1.9	5.8	7.3	7.5	7.5	7.6	7.6	7.7	7.7	7.8	7.9	7.9	8.0
	5L564		*99%/98%		4.6	5.1	5.5	5.3	5.5	8.4	8.5	8.5	8.6	8.6	8.7	8.7	8.8	8.8	8.9
722S	Crystal Lake	702T	*99%/98%	36.2	34.7	27.6	27.9	30.0	29.4	31.5	31.8	32.1	32.4	32.7	33.0	33.3	33.6	33.9	34.2
	5L172	30/40/50	*99%/98%	9.3	9.5	6.1	6.0	6.3	5.6	6.5	6.5	6.6	6.7	6.7	6.8	6.9	6.9	7.0	7.0
	5L198		*100%/100%	10.6	11.5	12.0	12.9	13.8	12.2	8.4	8.5	8.7	8.8	8.9	9.1	9.2	9.4	9.5	9.6
	5L257		*97%/97%	15.7	14.4	6.9	6.6	7.5	7.5	7.7	7.8	7.9	7.9	8.0	8.1	8.2	8.2	8.3	8.4
	5L562		*97%/98%		2.5	2.5	2.7	0.0	4.7	9.7	9.7	9.8	9.8	9.8	9.9	9.9	9.9	10.0	10.0
722S	Total Station		*99%/97%	56.9	63.0	56.3	55.0	62.5	61.2	65.9	71.1	72.0	72.8	73.5	74.1	74.7	75.3	76.0	76.6

Notes:

\* = power factor before/after load addition.

Growth factor applied to all feeders: Assumed 1.0% of 2014 peak, per year

Power factors for all existing feeders were calculated based on the last recorded peak loads and applied to existing loads going forward.

Power factor for all new load is assumed to be 90%.

A coincidence factor of 0.91 was applied to 701T feeders

A coincidence factor of 0.98 was applied to 702T feeders

Violation of urban feeder loading guideline

Violation of urban bus loading guideline

**Table B-2 Flyingshot Lake 749S Load Forecast**

Sub No.	Feeder	Capacity	PF	Recorded						Predicted									
				Peak MW	Peak MW	Peak MW	Peak MW	Peak MW	Peak MW	Peak MW	Peak MW	Peak MW	Peak MW	Peak MW	Peak MW	Peak MW	Peak MW	Peak MW	Peak MW
749S	Flyingshot Lake	701T	*98%/97%	32.4	31.0	29.9	33.0	33.0	29.9	33.5	34.0	34.4	34.9	35.3	35.7	36.2	36.6	37.1	37.5
	5L290	30/40/50	*98%/97%	11.3	2.2	3.0	3.5	3.5	3.9	4.0	4.1	4.1	4.1	4.2	4.2	4.3	4.3	4.3	4.4
	5L333		*98%/97%	10.4	10.6	10.4	11.3	11.3	10.5	12.6	12.7	12.8	12.9	13.0	13.2	13.3	13.4	13.5	13.6
	5L566		*99%/98%	13.7	11.5	10.7	11.6	11.6	10.5	10.4	10.6	10.9	11.1	11.3	11.6	11.8	12.1	12.3	12.5
	5L570		*97%/97%		9.0	5.8	9.2	9.2	8.3	10.1	10.2	10.3	10.4	10.5	10.6	10.7	10.8	10.9	10.9
749S	Flyingshot Lake	702T	*100%/99%	24.0	16.8	18.3	20.5	20.5	17.1	26.5	26.7	26.9	27.1	27.3	27.5	27.7	27.9	28.1	28.3
	5L291	30/40/50	*100%/100%	6.8	6.5	7.1	8.7	8.7	8.5	10.0	10.1	10.2	10.3	10.4	10.5	10.6	10.6	10.7	10.8
	5L292		*100%/99%	9.7	9.3	9.2	9.9	9.9	6.8	7.6	7.6	7.7	7.8	7.8	7.9	8.0	8.1	8.1	8.2
	5L568		*100%/98%	8.6	3.4	2.0	2.1	2.1	1.8	8.9	9.0	9.0	9.1	9.1	9.2	9.2	9.3	9.3	9.3
749S	Total Station		*99%/98%	56.7	48.0	48.4	53.5	53.5	47.0	60.0	60.7	61.3	62.0	62.6	63.2	63.9	64.5	65.2	65.8

Notes:

\* = power factor before/after load addition.

Growth factor applied to all feeders: Assumed 2.0% of 2014 peak, per year for 5L566 and 5L568

Assumed 1.0% of 2014 peak, per year for all others

Power factors for all existing feeders were calculated based on the last recorded peak loads and applied to existing loads going forward.

Power factor for all new load is assumed to be 90%.

A coincidence factor of 0.9 was applied to 701T feeders

A coincidence factor of 1 was applied to 702T feeders

Note that 5L333 is not an urban feeder

Violation of urban feeder loading guideline

Violation of urban bus loading guideline



**Table B-3 Crystal Lake 722S Load Forecast – Alternative 3**

Sub No.	Feeder	Capacity	PF	Recorded						Predicted									
				Peak MW	Peak MW	Peak MW	Peak MW	Peak MW	Peak MW	Peak MW	Peak MW	Peak MW	Peak MW	Peak MW	Peak MW	Peak MW	Peak MW	Peak MW	Peak MW
722S	Crystal Lake	701T	*99%/84%	20.7	28.3	28.7	27.1	32.6	31.8	39.8	35.0	25.3	25.8	26.2	26.5	26.8	27.1	27.5	27.8
	5L102	30/40/50	*99%/97%	10.3	12.2	11.0	11.8	9.9	7.3	16.8	11.0	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0
	5L236		*99%/98%	10.7	9.9	7.3	7.0	10.6	11.0	6.1	6.5	4.3	4.6	4.8	4.9	5.0	5.1	5.2	5.3
	5L560		*100%/99%		2.9	3.6	3.9	4.4	3.8	5.2	5.2	5.3	5.3	5.4	5.4	5.5	5.5	5.5	5.6
	5L561		*99%/97%		2.1	1.8	1.9	5.8	7.3	7.5	7.5	7.6	7.6	7.7	7.7	7.8	7.9	7.9	8.0
	5L564		*99%/98%		4.6	5.1	5.5	5.3	5.5	8.4	8.5	8.5	8.6	8.6	8.7	8.7	8.8	8.8	8.9
722S	Crystal Lake	702T	*99%/97%	36.2	34.7	27.6	27.9	30.0	29.4	31.4	31.7	29.2	29.5	29.8	30.1	30.4	30.7	31.0	31.3
	5L172	30/40/50	*99%/98%	9.3	9.5	6.1	6.0	6.3	5.6	6.5	6.5	6.6	6.7	6.7	6.8	6.9	6.9	7.0	7.0
	5L198		*100%/100%	10.6	11.5	12.0	12.9	13.8	12.2	8.2	8.4	8.5	8.6	8.8	8.9	9.1	9.2	9.3	9.5
	5L257		*97%/97%	15.7	14.4	6.9	6.6	7.5	7.5	7.7	7.8	7.9	7.9	8.0	8.1	8.2	8.2	8.3	8.4
	5L562		*97%/96%		2.5	2.5	2.7	3.1	4.7	9.7	9.7	6.9	6.9	7.0	7.0	7.1	7.1	7.1	7.1
722S	Total Station		*99%/91%	56.9	63.0	56.3	55.0	62.5	61.2	71.2	66.7	54.4	55.3	55.9	56.6	57.2	57.8	58.4	59.1

Notes:

\* = power factor before/after load addition.

Growth factor applied to all feeders: Assumed 1.0% of 2014 peak, per year

Power factors for all existing feeders were calculated based on the last recorded peak loads and applied to existing loads going forward.

Power factor for all new load is assumed to be 90%.

A coincidence factor of 0.91 was applied to 701T feeders

A coincidence factor of 0.98 was applied to 702T feeders

Violation of urban feeder loading guideline

Violation of urban bus loading guideline

**Table B-4 Flyingshot Lake 749S Load Forecast – Alternative 3**

Sub No.	Feeder	Capacity	PF	Recorded						Predicted									
				Peak MW	Peak MW	Peak MW	Peak MW	Peak MW	Peak MW	Peak MW	Peak MW	Peak MW	Peak MW	Peak MW	Peak MW	Peak MW	Peak MW	Peak MW	Peak MW
749S	Flyingshot Lake	701T	*98%/98%	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
	5L290	30/40/50	*98%/97%	32.4	31.0	29.9	33.0	33.0	29.9	33.5	34.0	25.2	25.7	26.1	26.6	27.0	27.4	27.9	28.3
	5L333		*98%/97%	11.3	2.2	3.0	3.5	3.5	3.9	4.0	4.1	4.1	4.1	4.2	4.2	4.3	4.3	4.3	4.4
	5L566		*99%/99%	10.4	10.6	10.4	11.3	11.3	10.5	12.6	12.7	12.8	12.9	13.0	13.2	13.3	13.4	13.5	13.6
	5L570		*97%/98%	13.7	11.5	10.7	11.6	11.6	10.5	10.4	10.6	7.1	7.4	7.6	7.9	8.1	8.3	8.6	8.8
					9.0	5.8	9.2	9.2	8.3	10.1	10.2	3.9	4.0	4.1	4.2	4.2	4.3	4.4	4.5
749S	Flyingshot Lake	702T	*100%/99%	24.0	16.8	18.3	20.5	20.5	17.1	26.5	26.7	25.8	26.0	26.2	26.4	26.6	26.8	27.0	27.2
	5L291	30/40/50	*100%/99%	6.8	6.5	7.1	8.7	8.7	8.5	10.0	10.1	9.1	9.2	9.2	9.3	9.4	9.5	9.6	9.7
	5L292		*100%/99%	9.7	9.3	9.2	9.9	9.9	6.8	7.6	7.6	7.7	7.8	7.8	7.9	8.0	8.1	8.1	8.2
	5L568		*100%/98%	8.6	3.4	2.0	2.1	2.1	1.8	8.9	9.0	9.0	9.1	9.1	9.2	9.2	9.3	9.3	9.3
749S	Total Station		*99%/98%	56.7	48.0	48.4	53.5	53.5	47.0	60.0	60.7	51.0	51.7	52.3	53.0	53.6	54.2	54.9	55.5

Notes:

\* = power factor before/after load addition.

Growth factor applied to all feeders: Assumed 2.0% of 2014 peak per year for 5L566 and 5L568

Assumed 1.0% of 2014 peak per year for all others

Power factors for all existing feeders were calculated based on the last recorded peak loads and applied to existing loads going forward.

Power factor for all new load is assumed to be 90%.

A coincidence factor of 0.9 was applied to 701T feeders

A coincidence factor of 1 was applied to 702T feeders

Note that 5L333 is not an urban feeder

Violation of urban feeder loading guideline

Violation of urban bus loading guideline



**Table B-5 Hughes 2030S Load Forecast – Alternative 3**

Sub No.	Feeder	Capacity	PF	Recorded						Predicted									
				Peak MW	Peak MW	Peak MW	Peak MW	Peak MW	Peak MW	Peak MW	Peak MW	Peak MW	Peak MW	Peak MW	Peak MW	Peak MW	Peak MW	Peak MW	Peak MW
2030S	Hughes	701T	95%	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
	5L5A	30/40/50	100%									20.1	25.0	25.0	25.0	25.0	25.0	25.0	25.0
	5L5B		96%									3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8
	5L5C		90%									7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6
	5L5D		96%									0.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
												9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2
2030S	Total Station		95%									20.1	25.0	25.0	25.0	25.0	25.0	25.0	25.0

Notes:

A coincidence factor of 0.98 was applied to 701T feeders

Violation of urban feeder loading guideline

Violation of urban bus loading guideline

