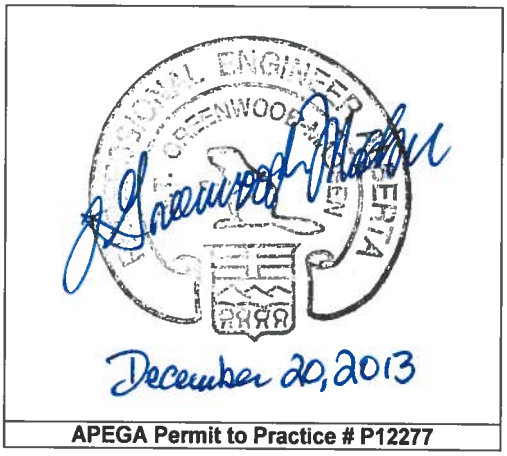
APPENDIX F DFO DISTRIBUTION DEFICIENCY REPORT

Project Appropriation # 58965

709S Vegreville Substation
Distribution Deficiency Report



APEGA Permit to Practice # P12277

Approvals		Signature	Date
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Revised: October 07, 2013

Summary

ATCO Electric Distribution Division has received a request to connect a new pump station at LSD NW 31-50-13-W4M. The proposed pump station is located 25km southeast of 709S Vegreville substation. The initial requested peak load is 15 MW with a mid 2015 in service date and an ultimate peak load of 20 MW forecasted for 2017.

The requested load addition surpasses the 41.6 MVA capacity of the transformer at 709S Vegreville. Neighboring substations are not in a position to serve this magnitude of load and new transmission facilities will be required to make the connection.

Background

709S Vegreville substation is located at LSD SW 7-52-14-W4M. South of the town of Vegreville along Highway 16, this substation is centrally located in a major rural community serving a variety of customers. The majority of these customers are either residential or farm connections however over half of the demand on 709S Vegreville substation is from industrial customers.

Type	Total Customers	Total kW	% of Total kW
Residential(1)	617	900	3.11%
Commercial(2)	281	1700	5.88%
St.Ltg(3)	88	2	0.01%
REA(4)	1760	4800	16.60%
Farm(5)	890	2990	10.34%
Industrial(6)	81	17800	61.54%
Trans(7)	11	700	2.42%
Sen.Ltg(8)	88	2	0.01%
Others(9)	16	30	0.10%
TOTAL Customer Count	3832	28924	100%

Table 1 – Customer types served from 709S Vegreville Substation (Jan. 2011 data without 25 kV line losses)

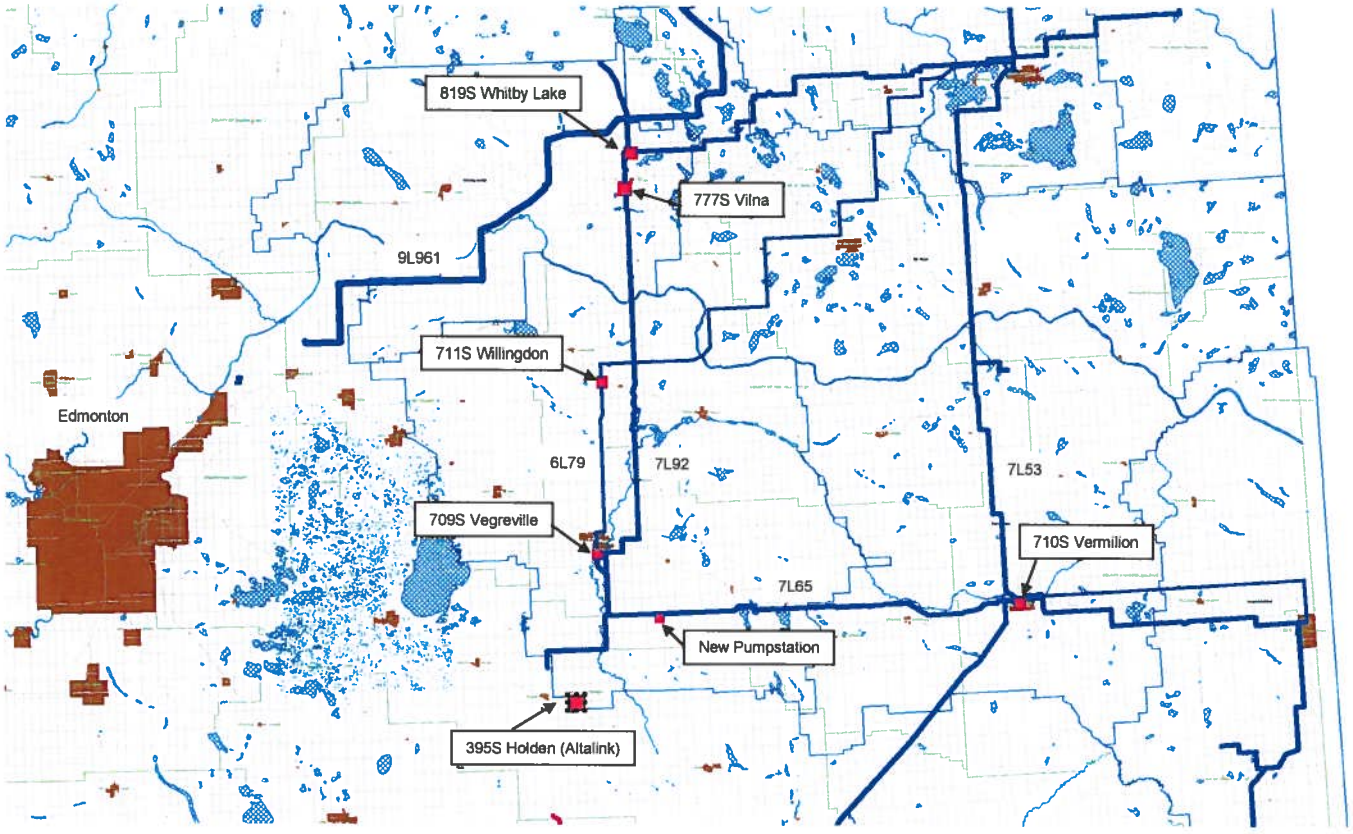

Figure 1 – 709S Vegreville Substation and area map

709S Vegreville substation is connected to, 7L77 a 144 kV transmission line sourced from AltaLink's 385S North Holden substation, 7L65 a 144 kV transmission line connected to 710S Vermilion substation, and 7L92 a 144 kV transmission line connecting 777S Vilna and 819S Whitby Lake substation. The 72 kV line 6L79 to 711S Willingdon is scheduled to be removed from service as part of another project.

Due to transmission network constraints identified in this area, the AESO is currently working on a long term plan to mitigate any transmission criteria violations. The resulting plan could affect the connection of this load.

709S Vegreville substation has four transformers: 701T, 702T, 603T, and 604T.

701T is currently rated 25/33/41.7 MVA 144kV-25 kV. 701T is connected to 501VR regulator rated at 25/33/41.6 MVA and is the normal supply source for the distribution system connected to the substation.

The 702T transformer is rated 18.75/25/33 MVA 144kV-72kV and is connected to two 6/8 MVA 72kV-25kV transformers 603T and 604T. The 603T and 604T transformers are energized spares disconnected from the 25kV bus and will be tied to the 25kV bus in an event where the 701T transformer fails or is required to be isolated.

Transformers 603T and 604T are at the end of their operating life and are scheduled for replacement.

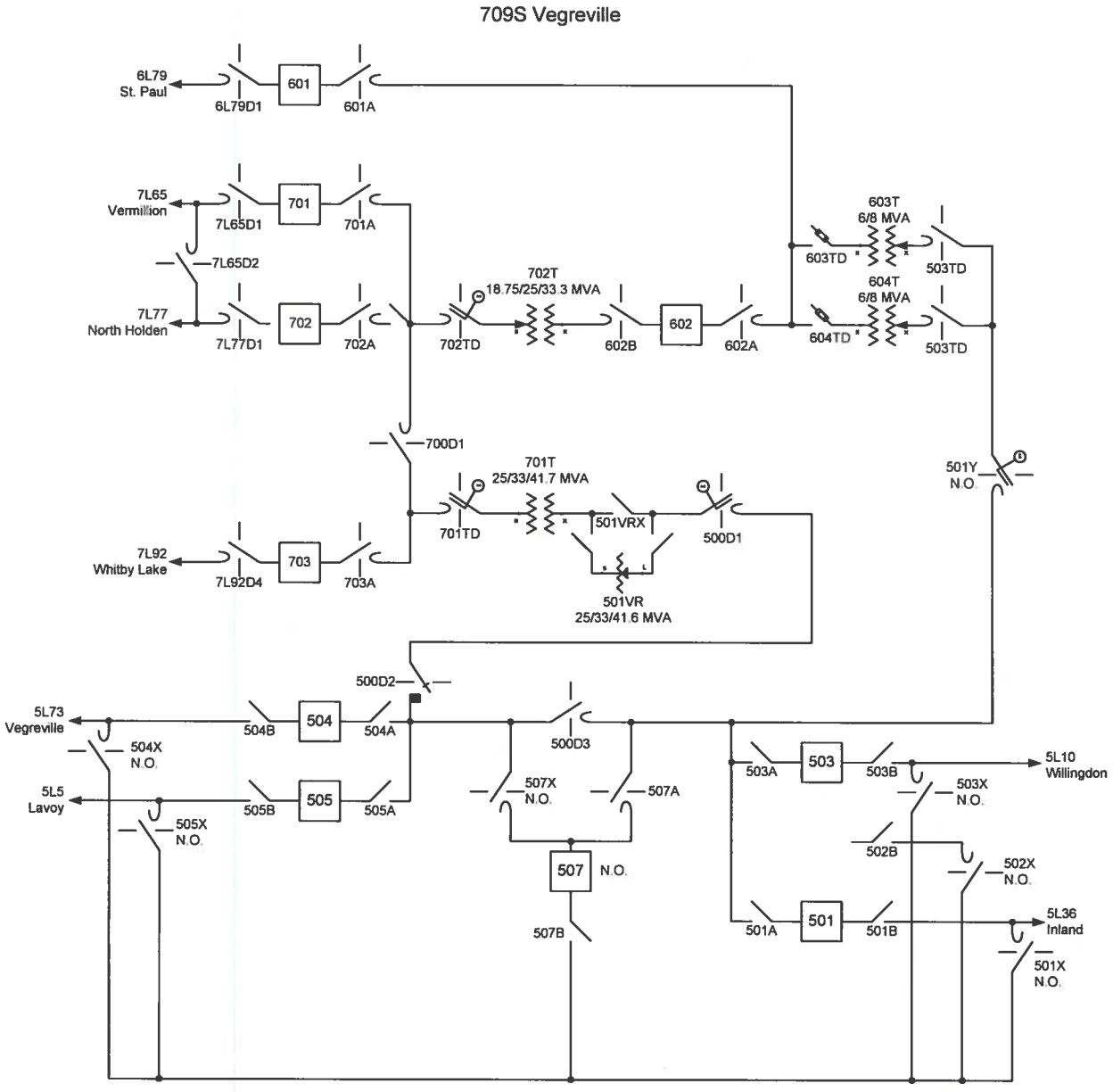

Figure 2 – Simplified SLD of Existing 709S Vegreville

The customer plans to connect 4 X 6500 HP pumps at their pump station with a peak load of 15 MW. The in service date for this load addition is July 2015. An additional 6500 HP pump is scheduled to come on line in 2017 for an ultimate peak load of 20 MW.

The identified load additions are listed below:

- 15 MW, pump station load additions in 2015 (4 X 6500 HP pumps, one operating as a spare)
- 5 MW, pump station load additions in 2017 (1 X 6500 HP pump)

These loads and incremental growth could put a total of 55 MVA on 709S Vegreville substation by 2022.

Vegreville Substation 709S

	Actual				
Year	2007/2008	2008/2009	2009/2010	2010/2011	2011/2012
5L36	2075	2048	2032	9045	13419.98
5L10	5498	6093	6109	6889	5915.06
5L73	8706	10494	10351	9563	10020.28
5L05	2976	3234	3147	3036	3959.3
Substation Total (kVA)	17972	19891	19596	24161	31317
Remaining Reg Capacity (kVA)	23328	21409	21704	17139	9983
Remaining Xmer Capacity (kVA)	23328	21409	21704	17139	9983

Table 2 – 709S Vegreville Substation Historical Data

Vegreville Substation 709S

	Forecast										
Year	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
5L36	13420	13823	14225	14628	15030	15433	15836	16238	16641	17043	17446
5L10	5915	6310	6537	6714	6892	7069	7247	7424	7602	7779	7957
5L73	10100	10200	10301	10401	10501	10601	10701	10802	10902	11002	11102
5L05	3959	3999	4038	4078	4118	4157	4197	4236	4276	4316	4355
Pump Station Load Additions				13333	13333	17778	17778	17778	17778	17778	17778
Substation Total (kVA)	31392	32273	32996	46207	46884	51738	52415	53092	53768	54445	55122
Remaining Reg Capacity (kVA)	10208	9327	8604	-4607	-5284	-10138	-10815	-11492	-12168	-12845	-13522
Remaining Xmer Capacity (kVA)	10308	9427	8704	-4507	-5184	-10038	-10715	-11392	-12068	-12745	-13422

- A coincident factor has been applied to the new loads
- Power factor for the new loads assumed to be 0.9

Table 3 – 709S Vegreville Substation Load Forecast with no capacity upgrades

The 2011/2012 winter peak loading on 709S Vegreville substation was 31.4 MVA. The remaining 9.9 MVA of transformer capacity at 709S Vegreville is unable to serve the requested 15 MW load addition in 2015.

The ATCO Electric substations surrounding 709S Vegreville are not options to supply capacity for the new load addition. The distances are too great for these substations to supply the ultimate forecasted loads. Thermal loading limits and voltage regulator violations make it impossible to serve the new loads in the vicinity of 709S Vegreville substation via distribution lines from adjacent POD facilities.

Alternatives

Since the existing distribution system cannot serve the requested load additions ATCO Electric has examined the following two alternatives.

Alternative 1: 709S Vegreville Substation Capacity Upgrade and 25 kV Lines

Add a new 30/40/50 MVA LTC transformer and two 25 kV feeder breakers to 709S Vegreville substation. Build two new 25 kV feeders from 709S Vegrevlle substation to the new pump station.

Project Description

709S Vegreville Substation upgrade

- 709S Vegreville Substation transformer will be upgraded to a 30/40/50 MVA LTC transformer.
- Install two new 25 kV breakers
- Install associated protection and metering

New 25 kV line to TransCanada Heartland Pump Station

- Install two feeders, each 25km in length of 3x477 MCM conductor
- Install one set of 3x300A Voltage Regulators on each new 25kV line 8.3km and 16.6km from 709S Vegreville Substation
- Install two 25kV – 6.9 kV 15 MVA transformers at customer
- Install two VFI's at customer site
- Install primary metering at the customer site

It is not recommended to pursue this option for this pumpstation for the following reasons:

- There is a high possibility of overvoltage occurring during a load rejection situation
- Express industrial feeders where a single large customer is nearby, load can go as high as 23 MVA. 25km is not considered to be nearby.
- High line losses associated with feeder length

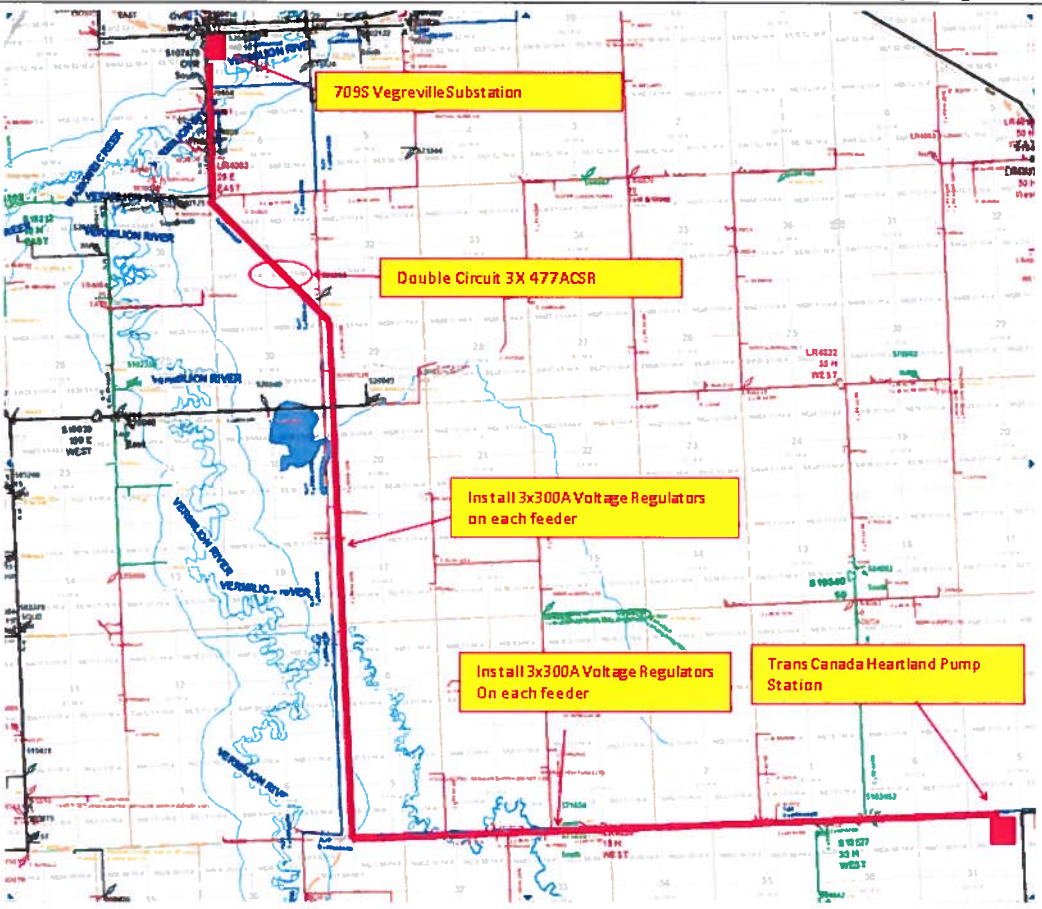

Figure #1 Proposed New 25 kV line routing from 709S Vegreville Substation to TransCanada Pump Station

Alternative 2: Build a new Pump Station POD Substation

Tap transmission line 7L65 to connect a new POD substation. Build a new POD substation at the new pump station consisting of a 20/26.6/33.3 MVA, 144 to 6.9 kV, LTC transformer connected to the customer's facilities via a 6.9 kV breaker.

Project Description

Transmission Line Scope

- Install three 144 kV line gangswitches
- Build approximately 150 m of 144kV single-circuit transmission line using 266kcmil conductor with same rating as the existing line 7L65.

Transmission Scope at New Customer Pump Station POD Substation

- Install one 144 kV breaker c/w ganged disconnect switch
- Install one 20/26.6/33.3 MVA, 144 to 6.9 kV Δ/Y LTC transformer
- Install grounding resistor. Size to be defined by Pump Station Customer.
- Install one 6.9 kV breaker c/w disconnect switches

Recommendation

Alternative 1 has been rejected as an option because it will not meet power quality standards due to high voltages during load rejection as well as high flicker levels during motor starting. In addition this Alternative will have higher losses due to 25 kV feeder length. Therefore ATCO Electric Distribution Division is recommending that a new transmission facility as described in alternative 2 be built to supply the requested pump station loads.