APPENDIX G DFO AND TFO RESPONSES

EDTI-AESO-2019APR09-001
Reference: EDTI TFO

Request:

Provide historic information for outages including time, date, duration and cause for each event, and the age of the equipment if applicable for each of the following:

- Garneau substation transformers T1, T2 and T3;
- Jasper substation transformer T1;
- Transmission cables 72RG1, 72RG7, 72MG16 and 72JM18; and
- 72 kV bus outages at the Garneau and Jasper substations.

Response:

Historical outage information is provided below in Table EDTI-AESO-2019APR09-001-1 including time, date, duration and cause for each event. This data includes outages from 2014-2018. EDTI's systems do not track transmission outages automatically; EDTI has therefore assembled the list of historical outages and their causes from its multiple system operation logging sources and manual switching orders. Note that the bus outages shown in Table EDTI-AESO-2019APR09-001-1 are breaker operations grouped by individual breaker. As such, many breaker operations coincide with associated cable or transformer outages. EDTI did not experience a complete 72kV bus outage at these stations during the 2014-2018 period.

Table EDTI-AESO-2019APR09-001-1
Historical Outages

	Station	A Asset	B Start Date	C Start Time	D End Date	E End Time	F Duration (HRS:MIN)	G Reason
1	Garneau	T1	10.MAR.2014	10:06	10.MAR.2014	13:56	3:50	Relay OP Checks
2			27.OCT.2014	10:30	27.OCT.2014	14:03	3:33	Replace Leaking Oil Line
3			25.APR.2015	9:16	27.APR.2015	18:13	58:57	Faulted CT
4			01.OCT.2015	9:52	01.OCT.2015	22:45	12:53	Protection Cut Overs
5			28.MAY.2016	7:33	28.MAY.2016	12:36	5:03	Relay OP Checks
6			15.OCT.2017	6:11	15.OCT.2017	21:33	15:22	DFR Installation
7			16.APR.2018	9:10	20.APR.2018	11:02	97:52	Doble Testing
8		T2	11.MAR.2014	8:17	11.MAR.2014	13:13	4:56	Relay OP Checks
9			11.APR.2015	8:38	11.APR.2015	22:53	14:15	Switchgear Maintenance
10			24.SEP.2015	8:06	25.SEP.2015	20:01	35:55	Protection Cut Overs
11			28.MAY.2016	12:40	28.MAY.2016	15:26	2:46	Relay OP Checks
12			01.JUN.2016	5:02	01.JUN.2016	7:34	2:32	Repair Gas Relay
13			12.OCT.2017	22:52	13.OCT.2017	13:57	15:05	DFR Installation
14			30.APR.2018	7:19	04.MAY.2018	8:53	49:34	Doble Testing
15		T3	26.MAY.2014	9:27	29.MAY.2014	11:36	74:09	RTU Upgrades
16			18.APR.2015	7:50	18.APR.2015	18:14	10:24	Switchgear Maintenance
17			17.OCT.2015	8:23	18.OCT.2015	11:10	26:47	Protection Cut Overs
18			27.FEB.2016	7:38	27.FEB.2016	14:46	7:08	Relay Maintenance
19			29.MAY.2016	8:01	29.MAY.2016	11:25	3:24	Repair Gas Relay
20			14.OCT.2017	6:31	14.OCT.2017	21:15	14:44	DFR Installation
21			23.APR.2018	10:52	26.APR.2018	8:17	69:25	Doble Testing
22	Garneau	72RG1	02.FEB.2016	8:26	02.FEB.2016	15:52	7:26	Relay Repairs/Maintenance
23			15.JUL.2018	8:31	15.JUL.2018	14:18	5:47	Doble Testing – Weekend Only
24	Garneau	72RG7	7.APR.2014	7:04	12.APR.2014	16:00	128:56	De-Gasification
25			28.SEP.2014	7:20	28.SEP.2014	14:57	7:37	Doble Testing
26			18.OCT.2014	8:20	18.OCT.2014	11:26	3:06	Doble Testing
27			17.FEB.2016	8:40	17.FEB.2016	11:30	2:50	Relay Maintenance
28			9.DEC.2017	8:05	09.DEC.2017	15:34	7:29	DFR Replacement – Saturday Only
29			13.Jun.2018	4:52	13.Jun.2018	12:07	7:14	Relay Failure – 72RG7 Trip
30	Jasper	T1	31.MAR.2014	9:58	05.APR.2014	14:57	124:59	Replace JDS15, JDS16 & JDS21
31			16.DEC.2014	9:32	18.DEC.2014	15:48	54:16	Temperature Monitor Install
32			19.OCT.2015	8:11	23.OCT.2015	15:06	102:55	Replace JAB5
33			06.SEP.2016	11:00	09.OCT.2016	17:32	78:32	Bushing Replacement
34			03.APR.2017	9:38	07.APR.2017	14:33	100:55	Relay OP Checks
35	Jasper	72JM18	10.MAR.2014	7:47	18.MAR.2014	14:35	198:48	Relay Upgrade
36			20.MAY.2014	10:32	24.JUN.2014	13:00	842:28	De-Gasification
37			10.OCT.2014	9:36	10.OCT.2014	15:09	5:33	Doble Testing
38			26.JAN.2015	9:08	28.JAN.2015	17:45	56:37	Relay Maintenance
39			23.OCT.2017	7:34	28.OCT.2017	16:23	128:49	Replace MDS1
40	Meadowlark	72MG16	11.FEB.2014	13:22	11.FEB.2014	14:36	1:14	Relay Op Checks
41			11.MAY.2016	9:41	11.MAY.2016	15:31	5:50	Doble Testing
42			19.OCT.2017	8:25	20.OCT.2017	14:17	29:52	DFR Installation
43			07.FEB.2018	9:36	07.FEB.2018	11:05	1:29	Measure MDS9 Disconnect
44			12.FEB.2018	9:38	16.FEB.2018	12:55	51:17	Relay OP Checks
45			05.NOV.2018	7:03	11.NOV.2018	16:09	153:06	Replace MDS9 Disconnect
46	Garneau (72kV Bus)	G721	10.MAR.2014	10:06	10.MAR.2014	13:56	3:50	Relay OP Checks
47			27.OCT.2014	10:30	27.OCT.2014	10:56	0:26	Replace leaking oil line
48			27.OCT.2014	13:53	27.OCT.2014	14:03	0:10	Replace leaking oil line
49			25.APR.2015	9:16	27.APR.2015	18:13	56:57	Faulty CT on G2 feeder
50			25.JUN.2015	19:44	25.JUN.2015	21:27	1:43	Reconfigure system for U of A cable testing
51			01.OCT.2015	9:52	01.OCT.2015	10:45	0:53	Protection cut overs
52			11.MAY.2016	9:47	11.MAY.2016	10:08	0:21	Doble Testing
53			11.MAY.2016	15:11	11.MAY.2016	15:29	0:18	Doble Testing
54			28.MAY.2016	7:33	28.MAY.2016	12:36	5:03	Relay OP Checks
55			15.Oct.2017	6:12	15.Oct.2017	15:01	8:48	Repair MDS8
56			19.Oct.2017	8:25	20.Oct.2017	14:19	29:53	Repair MDS8
57			20.Dec.2017	7:30	20.Dec.2017	7:48	0:17	Measure MDS9 Disconnect
58			21.Dec.2017	11:22	21.Dec.2017	11:26	0:04	Measure MDS9 Disconnect
59			07.Feb.2018	9:35	07.Feb.2018	9:44	0:08	Doble Testing
60			07.Feb.2018	10:52	07.Feb.2018	11:00	0:08	Doble Testing
61			12.Feb.2018	9:37	15.Feb .2018	13:08	75:30	Relay OP Checks
62			15.Feb.2018	13:10	15.Feb.2018	13:14	0:03	Relay OP Checks
63			15.Feb.2018	13:16	15.Feb.2018	13:32	0:15	Relay OP Checks

	A	B	C	D	E	F	G
	Station	**Asset**	**Start Date**	**Start Time**	**End Date**	**End Time**	**Duration (HRS:MIN)**	**Reason**
64			15.Feb.2018	13:40	16.Feb.2018	12:55	23:15	Relay OP Checks
65			16.Apr.2018	9:10	16.Apr.2018	9:45	0:34	Measure MDS9 Disconnect
66			19.Apr.2018	15:38	19.Apr.2018	15:57	0:18	Measure MDS9 Disconnect
67			05.Nov.2018	7:03	05.Nov.2018	7:24	0:21	Replace CVT fuses at Meadowlark
68			10.Nov.2018	13:33	10.Nov.2018	13:39	0:06	Replace CVT fuses at Meadowlark
69			06.Mar.2019	9:04	06.Mar.2019	10:16	1:12	DFR Installation
70			06.Mar.2019	13:25	06.Mar.2019	13:43	0:18	DFR Installation
71	Garneau (72kV Bus)	G722	10.MAR.2014	10:06	10.MAR.2014	13:56	3:50	Relay OP Checks
72			07.APR.2014	7:07	07.APR.2014	7:17	0:10	De-Gasification
73			11.APR.2014	14:37	11.APR.2014	14:47	0:10	De-Gasification
74			28.SEP.2014	7:42	28.SEP.2014	7:51	0:09	Doble Testing
75			28.SEP.2014	14:32	28.SEP.2014	14:39	0:07	Doble Testing
76			18.OCT.2014	8:21	18.OCT.2014	8:45	0:24	Doble Testing
77			18.OCT.2014	11:22	18.OCT.2014	11:30	0:08	Doble Testing
78			27.OCT.2014	10:30	27.OCT.2014	10:56	0:26	Replace leaking oil line
79			27.OCT.2014	13:54	27.OCT.2014	14:03	0:09	Replace leaking oil line
80			25.APR.2015	9:17	27.APR.2015	18:14	56:57	Faulty CT on G2 feeder
81			01.OCT.2015	10:45	01.OCT.2015	19:53	9:08	Protection cut overs
82			17.FEB.2016	8:37	17.FEB.2016	11:30	2:53	Relay Maintenance
83			28.MAY.2016	7:33	28.MAY.2016	12:36	5:03	Relay OP Checks
84			15.Oct.2017	6:13	15.Oct.2017	15:01	8:48	DFR Installation
85			09.Dec.2017	8:02	09.Dec.2017	15:36	7:34	DFR Installation – Saturday only
86			16.Apr.2018	9:10	16.Apr.2018	9:45	0:34	Doble Testing
87			19.Apr.2018	15:39	19.Apr.2018	15:57	0:18	Doble Testing
88			13.Jun.2018	4:52	13.Jun.2018	12:07	7:14	Relay Failure – 72RG7 Trip
89	Garneau (72kV Bus)	G723	12.MAR.2014	9:21	12.MAR.2014	10:42	1:21	Relay OP Checks
90			07.APR.2014	7:07	07.APR.2014	7:17	0:10	De-Gasification
91			11.APR.2014	14:37	11.APR.2014	14:47	0:10	De-Gasification
92			26.MAY.2014	9:30	29.MAY.2014	11:34	74:02	RTU Upgrades
93			28.SEP.2014	7:42	28.SEP.2014	7:51	0:09	Doble Testing
94			28.SEP.2014	14:32	28.SEP.2014	14:39	0:07	Doble Testing
95			18.OCT.2014	8:21	18.OCT.2014	8:45	0:24	Doble Testing
96			18.OCT.2014	11:23	18.OCT.2014	11:30	0:07	Doble Testing
97			18.APR.2015	8:48	18.APR.2015	18:13	9:25	Switchgear Maintenance
98			25.JUN.2015	19:44	25.JUN.2015	21:27	1:43	Reconfigure system for U of A cable testing
99			17.OCT.2015	8:24	18.OCT.2015	11:08	26:44	Protection cut overs
100			17.FEB.2016	8:37	17.FEB.2016	11:30	2:53	Relay Maintenance
101			27.FEB.2016	7:39	27.FEB.2016	14:25	6:46	Relay Maintenance
102			29.MAY.2016	8:03	29.MAY.2016	11:21	3:18	Gas Relay Repair
103			14.Oct.2017	6:31	14.Oct.2017	15:08	8:37	DFR Installation
104			09.Dec.2017	8:03	09.Dec.2017	15:36	7:33	DFR Installation – Saturday only
105			23.Apr.2018	10:54	23.Apr.2018	11:06	0:11	Doble Testing
106			25.Apr.2018	15:41	25.Apr.2018	15:53	0:12	Doble Testing
107			13.Jun.2018	4:52	13.Jun.2018	12:07	7:14	Relay Failure – 72RG7 Trip
108	Garneau (72kV Bus)	G724	12.MAR.2014	10:43	12.MAR.2014	13:12	2:29	Relay Maintenance
109			26.MAY.2014	9:30	29.MAY.2014	11:35	74:05	RTU Upgrades
110			18.APR.2015	8:48	18.APR.2015	18:13	9:25	Switchgear Maintenance
111			17.OCT.2015	8:25	18.OCT.2015	11:07	26:42	Protection cut overs
112			20.NOV.2015	13:41	20.NOV.2015	14:26	0:45	Breaker Replacement (Rossdale)
113			02.FEB.2016	8:22	02.FEB.2016	15:53	7:31	Relay Repairs/Maintenance
114			27.FEB.2016	7:39	27.FEB.2016	14:26	6:47	Relay Maintenance
115			29.MAY.2016	8:03	29.MAY.2016	11:21	3:18	Gas Relay Repair
116			14.Oct.2017	6:31	14.Oct.2017	15:08	8:36	DFR Installation
117			07.Dec.2017	8:14	07.Dec.2017	15:30	7:15	72RG1 isolation
118			15.Jan.2018	16:23	15.Jan.2018	23:17	6:53	72RG1 isolated for portion of Jasper T1 manhole repair (see lines 177 and 198)
119			16.Jan.2018	18:17	16.Jan.2018	23:04	4:46	72RG1 isolated for portion of Jasper T1 manhole repair (see lines 177 and 198)
120			23.Apr.2018	10:55	23.Apr.2018	11:06	0:11	Doble Testing
121			25.Apr.2018	15:40	25.Apr.2018	15:53	0:12	Doble Testing
122			15.Jul.2018	8:30	15.Jul.2018	8:56	0:25	Doble Testing – Weekend Only
123			15.Jul.2018	14:01	15.Jul.2018	14:18	0:16	Doble Testing – Weekend Only
124	Garneau (72kV Bus)	G725	11.MAR.2014	8:17	11.MAR.2014	13:11	4:54	Relay OP Checks
125			11.APR.2015	8:44	11.APR.2015	22:52	14:08	Switchgear Maintenance
126			24.SEP.2015	8:10	25.SEP.2015	19:18	35:08	Protection cut overs
127			20.NOV.2015	13:41	20.NOV.2015	14:26	0:45	Breaker Replacement (Rossdale)
128			02.FEB.2016	8:22	02.FEB.2016	15:53	7:31	Relay Repairs/Maintenance

	Station	A Asset	B Start Date	C Start Time	D End Date	E End Time	F Duration (HRS:MIN)	G Reason
129			28.MAY.2016	12:49	28.MAY.2016	15:26	2:37	Relay OP Checks
130			01.JUN.2016	5:06	01.JUN.2016	7:26	2:20	Gas Relay Repair
131			12.Oct.2017	23:00	13.Oct.2017	7:05	8:05	DFR Installation
132			07.Dec.2017	8:14	07.Dec.2017	15:30	7:16	72RG1 isolation
133			15.Jan.2018	16:24	15.Jan.2018	23:16	6:52	72RG1 isolated for portion of Jasper T1 manhole repair (see lines 177 and 198)
134			16.Jan.2018	18:17	16.Jan.2018	23:04	4:46	72RG1 isolated for portion of Jasper T1 manhole repair (see lines 177 and 198)
135			30.Apr.2018	7:21	30.Apr.2018	7:43	0:22	Doble Testing
136			03.May.2018	14:58	03.May.2018	15:05	0:07	Doble Testing
137			15.Jul.2018	8:30	15.Jul.2018	8:56	0:26	Doble Testing – Weekend Only
138			15.Jul.2018	14:01	15.Jul.2018	14:18	0:17	Doble Testing – Weekend Only
139	Garneau (72kV Bus)	G726	11.MAR.2014	8:17	11.MAR.2014	13:11	4:54	Relay OP Checks
140			11.APR.2015	8:44	11.APR.2015	22:52	14:08	Switchgear Maintenance
141			24.SEP.2015	8:09	25.SEP.2015	19:44	35:35	Protection cut overs
142			11.MAY.2016	9:47	11.MAY.2016	10:08	0:21	Doble Testing
143			11.MAY.2016	15:11	11.MAY.2016	15:29	0:18	Doble Testing
144			28.MAY.2016	12:49	28.MAY.2016	15:26	2:37	Relay OP Checks
145			01.JUN.2016	5:06	01.JUN.2016	7:26	2:20	Gas Relay Repair
146			12.Oct.2017	23:00	13.Oct.2017	6:57	7:57	DFR Installation
147			13.Oct.2017	7:03	19.Oct.2017	8:25	145:22	DFR Installation
148			20.Oct.2017	14:17	20.Oct.2017	15:37	1:19	DFR Installation
149			20.Dec.2017	7:31	20.Dec.2017	7:48	0:17	Replace CVT fuses at Meadowlark
150			21.Dec.2017	11:22	21.Dec.2017	11:26	0:04	Replace CVT fuses at Meadowlark
151			07.Feb.2018	9:36	07.Feb.2018	9:44	0:08	Measure MDS9 Disconnect
152			07.Feb.2018	10:52	07.Feb.2018	11:01	0:08	Measure MDS9 Disconnect
153			12.Feb.2018	9:38	15.Feb.2018	13:09	75:31	Relay OP Checks
154			15.Feb.2018	13:10	15.Feb.2018	13:14	0:04	Relay OP Checks
155			15.Feb.2018	13:16	15.Feb.2018	13:39	0:22	Relay OP Checks
156			15.Feb.2018	13:40	16.Feb.2018	12:55	23:15	Relay OP Checks
157			30.Apr.2018	7:21	30.Apr.2018	7:44	0:22	Doble Testing
158			03.May.2018	14:58	03.May.2018	15:05	0:07	Doble Testing
159			05.Nov.2018	7:03	05.Nov.2018	7:24	0:21	Replace MDS9 Disconnect
160			10.Nov.2018	13:33	10.Nov.2018	13:38	0:05	Replace MDS9 Disconnect
161			06.Mar.2019	9:04	06.Mar.2019	10:16	1:11	Repair MDS8
162			06.Mar.2019	13:25	06.Mar.2019	13:43	0:17	Repair MDS8
163	Jasper (72kV Bus)	J722	10.MAR.2014	7:49	17.MAR.2014	17:20	177:31	Relay Upgrade
164			20.MAR.2014	10:15	20.MAR.2014	10:30	0:15	Replace JDS19, JDS20
165			27.MAR.2014	15:54	27.MAR.2014	16:24	0:30	Replace JDS19, JDS20
166			31.MAR.2014	8:15	05.APR.2014	15:01	150:46	Replace JDS15, JDS16, JDS21
167			20.MAY.2014	10:34	23.JUN.2014	18:36	824:02	De-Gasification
168			05.OCT.2014	7:50	05.OCT.2014	8:08	0:18	Doble Testing
169			05.OCT.2014	15:28	05.OCT.2014	15:38	0:10	Doble Testing
170			10.OCT.2014	9:37	10.OCT.2014	15:08	5:31	Doble Testing
171			16.DEC.2014	9:31	18.DEC.2014	15:55	54:24	Temperature Monitor Install
172			26.JAN.2015	9:12	27.JAN.2015	15:29	30:17	Relay Maintenance
173			19.OCT.2015	7:57	23.OCT.2015	15:26	103:29	Replace JAB5
174			06.SEP.2016	9:40	10.OCT.2016	18:56	825:16	Bushing Replacement
175			03.APR.2017	7:37	07.APR.2017	14:27	102:50	Relay OP Checks
176			23.Oct.2017	7:37	27.Oct.2017	16:20	104:42	Replace MDS1
177			15.Jan.2018	10:52	17.Jan.2018	6:32	44:20	Manhole repair under 72kV Bus T1
178			19.Mar.2018	8:01	19.Mar.2018	10:36	2:35	72JM18 Relay Op Checks
179			19.Mar.2018	10:37	19.Mar.2018	10:42	0:05	72JM18 Relay Op Checks
180			19.Mar.2018	14:14	19.Mar.2018	15:00	0:45	72JM18 Relay Op Checks
181			19.Mar.2018	15:10	20.Mar.2018	8:34	18:36	72JM18 Relay Op Checks
182			20.Mar.2018	8:49	21.Mar.2018	10:48	25:58	72JM18 Relay Op Checks
183			04.Apr.2018	6:33	20.Apr.2018	14:18	391:45	Manhole repair under 72kV Bus T1
184			07.Jan.2019	1:51	08.Jan.2019	3:50	25:58	Transducer Replacement
185			08.Jan.2019	3:57	12.Jan.2019	0:55	21:02	Transducer Replacement
186	Jasper (72kV Bus)	J724	20.MAR.2014	9:39	27.MAR.2014	16:23	174:44	Replace JDS19, JDS20
187			31.MAR.2014	9:32	05.APR.2014	15:03	125:31	Replace JDS15, JDS16, JDS21
188			05.OCT.2014	7:51	05.OCT.2014	8:07	0:16	Doble Testing
189			05.OCT.2014	15:29	05.OCT.2014	15:37	0:08	Doble Testing
190			16.DEC.2014	9:30	18.DEC.2014	15:57	54:27	Temperature Monitor Install
191			24.AUG.2015	9:30	18.SEP.2015	13:29	603:59	De-Gasification
192			19.OCT.2015	8:06	23.OCT.2015	15:19	103:13	Replace JAB5
193			09.MAY.2016	8:43	12.MAY.2016	10:23	73:40	J724 Maintenance

	A	B	C	D	E	F	G
Station	**Asset**	**Start Date**	**Start Time**	**End Date**	**End Time**	**Duration (HRS:MIN)**	**Reason**
194		06.SEP.2016	9:38	10.OCT.2016	19:04	825:26	Bushing Replacement
195		16.JAN.2017	9:56	18.JAN.2017	11:16	49:20	Relay OP Checks
196		03.APR.2017	7:36	07.APR.2017	14:30	102:54	Relay OP Checks
197		10.JUL.2017	8:58	11.JUL.2017	12:55	27:57	Doble Testing
198		15.Jan.2018	11:03	17.Jan.2018	6:28	44:35	Manhole repair under 72kV Bus T1
199		30.Jan.2018	8:50	30.Jan.2018	13:29	4:38	Measure WDS1
200		04.Apr.2018	6:37	20.Apr.2018	14:16	391:38	Manhole repair under 72kV Bus T1
201		27.Jun.2018	12:19	27.Jun.2018	13:15	0:56	Breaker Replacement (Woodcroft)
202		07.Jan.2019	1:50	08.Jan.2019	3:50	26:00	Transducer Replacement
203		08.Jan.2019	3:57	12.Jan.2019	0:56	93:00	Transducer Replacement
204		21.Jan.2019	7:29	25.Jan.2019	14:56	103:27	Replace WDS1
205		22.Feb.2019	17:14	24.Feb.2019	16:31	47:43	Replace WDS11

In addition to the actual outages listed above, the following table describes the planned outages that were cancelled or delayed from October of 2017 to the present because of restrictions on the system. EDTI's Transmission function started tracking cancelled planned outages in October of 2017 and, as such, information prior to that month is not available.

Table EDTI-AESO-2019APR09-001-2
Cancelled/Delayed Outages Oct 2017-present

	A	B	C	D
System Element	**Station**	**Originally Scheduled Date**	**Completed Date**	**Reason**
1 72RG7	Garneau	October 2017	N/A	Doble testing cancelled due to high loading. Attempted to reschedule to occur during periods of lower loading (e.g., weekends). Weather prevented this work from being completed in 2017.
2 72RG7	Garneau	October 2018	N/A	Doble testing cancelled due to high loading Attempted to reschedule to occur during periods of lower loading (e.g., weekends). Weather prevented this work from being completed in 2018. This work is forecast to be complete in Q2 of 2019
3 T1, T2, T3	Garneau	Fall 2017	Spring 2018	Doble testing took 6 months to arrange between EDTI and the U of A due to required generator outages
4 72JM18	Meadowlark	Spring 2019	Forecast June 2019	Breaker failure relaying replacement outage has been restricted to occur during periods of lower loading (e.g., weekends), and is forecast to be complete in June of 2019 (a month with historically lower loading)

Equipment ages are shown in Table EDTI-AESO-2019APR09-001-3 below.

Table EDTI-AESO-2019APR09-001-3
Equipment Age

	Equipment	A **Year of Manufacture**	B **Age (years)**
1	Garneau T1	1981	38
2	Garneau T2	1981	38
3	Garneau T3	1981	38
4	Jasper T1	1975	44
5	72RG1	1969	50
6	72RG7	1981	38
7	72MG16	1969	50
8	72JM18	1975	44
9	Garneau 72kV Bus	1980	39
10	Jasper 72kV Bus	1975	44[1]

[1] Some equipment such as disconnect switches and CTs have been replaced at Jasper and are of newer vintage. Buswork and breakers were installed in 1975.

EDTI-AESO-2019APR09-002
Reference: EDTI TFO

Request:

Are there any common elements (ie. sharing the same trench/duct or being exposed to common mode failures) between 72RG1 and 72RG7?

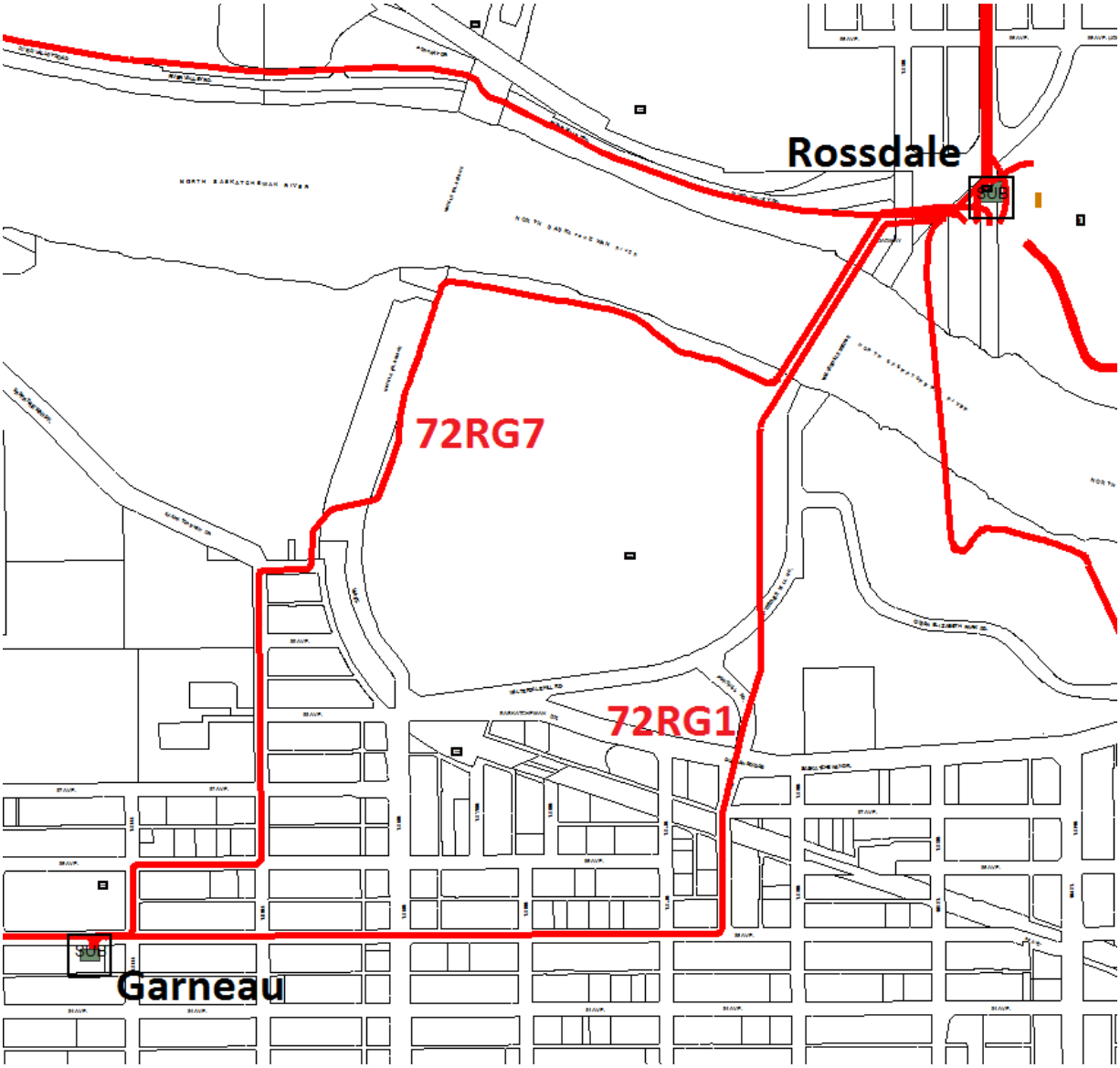
Response:

72RG1 and 72RG7 share failure modes primarily in relation to physical proximity, and common equipment such as oil pressurization equipment and a DC system to support the protective relaying, each of which is explained more fully below.

Physical Proximity

As shown in Figure EDTI-AESO-2019APR09-002-1 below the routes of 72RG1 and 72RG7 are generally physically distinct, however the circuits are in proximity to each other near the Garneau substation, for the crossing of the North Saskatchewan River, and near the Rossdale substation.

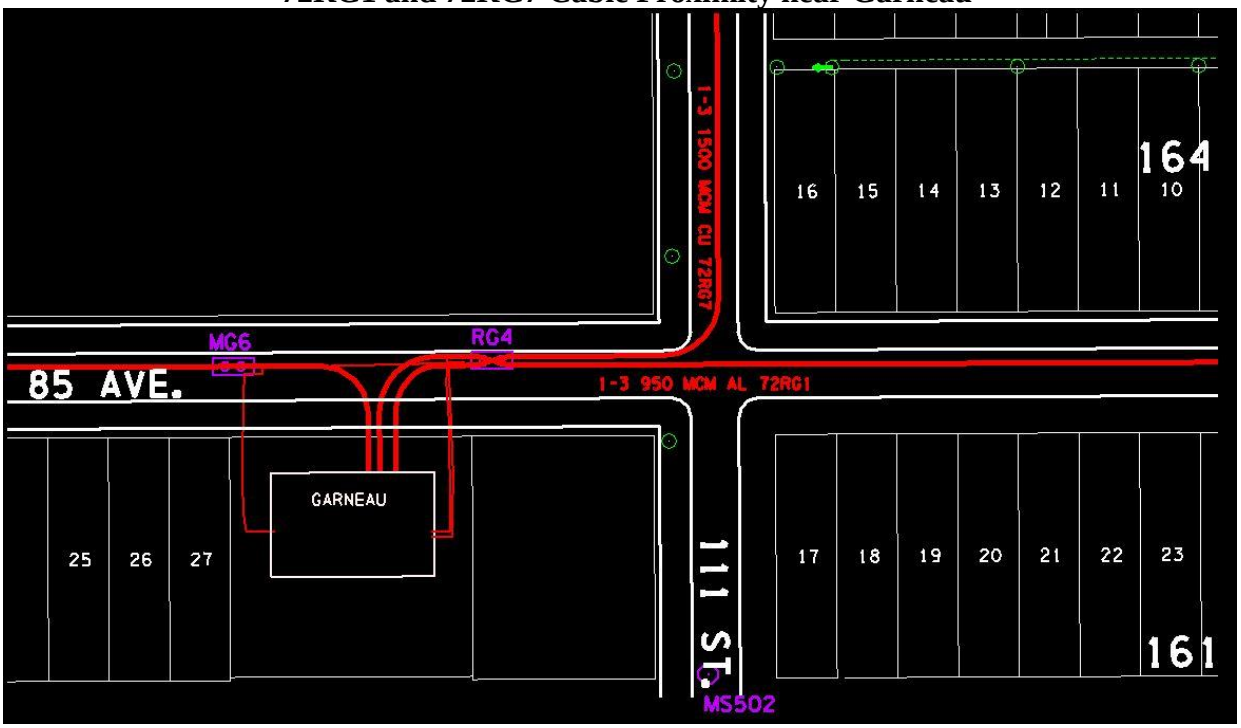
Figure EDTI-AESO-2019APR09-002-1
72RG1 and 72RG7 Routes



The two circuits connect to gas insulated switchgear ("GIS") within the Garneau substation. From the switchgear lineup, each phase exits the north side of Garneau substation building through a 3" riser pipe. There is approximately 1 metre separating these pipes. The riser pipes come together (3 phases per circuit) in trifurcators (1 trifucator per circuit) outside the building, and each circuit is then enclosed in its own 5" pipe. As shown in Figure EDTI-AESO-

2019APR09-002-2 below, the two circuits are separated by approximately 2 metres over a distance of 70 metres outside of Garneau, and transit through the same manhole (RG4), within which each cable is spliced.

Figure EDTI-AESO-2019APR09-002-2
72RG1 and 72RG7 Cable Proximity near Garneau



As shown in Figure EDTI-AESO2019APR09-002-2, the circuits deviate from each other, about 55 metres northeast of the substation, with 72RG7 travelling north and 72RG1 travelling east. From this point, the separation between the two circuits remains greater than 100m until the North Saskatchewan River crossing, where they converge. The separation between the two circuits for the river crossing is approximately 13 metres. From the river crossing to the entry point at Rossdale substation yard there is approximately 16 metres of separation between the cables, and the terminations within the substation yard are about 48 metres apart.

Cable proximity increases the risk of an incident impacting both cables as a catastrophic failure event (e.g., cable fault causing pipe rupture, termination failure, splice failure in manhole, third

party damage from excavation, riverbank failure, etc.) could potentially result in damage to both circuits.

Oil Pressurization Equipment

Both circuits are oil filled pipe type ("OFPT"). The oil is supplied under pressure to both circuits from EDTI's oil pressurization plant #2 within the Rossdale substation (note that other OFPT circuits in addition to 72RG1 and 72RG7 are supplied by the Rossdale oil pump plant). The circuits are pressurized by different oil pumps, however the pumps share the same control system, power supply, and oil supply tank. The circuits also share a common nitrogen backup pump, with nitrogen bottles.

In the event of oil pressure loss caused by failure of the oil pressurization equipment there is a high probability of failure of the cable or its accessories (e.g., terminations and splices) due to cable overheating. This would result in a lengthy and costly repair and restoration.

Additionally, in its review of EDTI's underground transmission cable system, Quanta Technology LLC (a highly qualified electrical engineering consulting firm specializing in electric utility equipment and infrastructure) determined that a fault causing a pipe rupture in one of the 72RG7 or 72RS5 OFPT cable circuits could adversely affect all other transmission circuits that are hydraulically connected to the Rossdale oil pressurization plant #2, due to a loss of oil pressure to the connected system.[1]

DC System

The two circuits have their own distance and pilot wire protection devices used to detect faults or abnormal conditions on the circuits. These four protective relays are located in the same protection panel and are fed from the same DC power supply equipment (battery banks, chargers, DC panel). The distance protections for both lines share a fuse within the DC panel. The pilot wire protections for both lines share a fuse within the same DC panel.

1 Exhibit 23165-X0028 Appendix E-1 T-CBC-13, PDF 261.

Should a fault occur at the same time as a DC system failure, the protective relaying would not operate resulting in a longer duration or sustained fault, which would lead to more severe equipment damage as the lack of protective relaying would allow fault current to continue to flow until back-up protection at other stations operates or the electrical path was effectively "burned out". This would not only result in greater damage to the faulted equipment, but would increase the likelihood of thermal, fire or explosion damage to adjacent equipment.

EDTI-AESO-2019APR09-003
Reference: EDTI TFO

Request:

Is the historic availability of 72RG1, 72RG7, 72MG16 and 72JM18 typical for cables of similar design?

Response:

EDTI is not aware of any facts that would suggest that the historic availability of the 72RG1, 72RG7, 72MG16 and 72JM18 cables is atypical vis-à-vis cables of similar design. EDTI notes that the unavailability of these cables has historically been related to outages required for minor repairs and preventative maintenance along with some capital life cycle replacement of auxiliary equipment, terminal equipment and cable splices. EDTI also notes, however, that due to the loading restrictions on these cables, it is becoming more difficult to obtain outages to perform preventative and corrective maintenance on these cables (see also EDTI-AESO-2019APR09-001). Reduced maintenance will lead to an increased likelihood of failures.

Circuits 72RG1, 72RG7, 72MG16 and 72JM18 are oil filled pipe type ("OFPT") cables. EDTI operates approximately 91 km of OFPT, which is 47% of EDTI's total transmission circuit length. Although still present within EDTI's system, OFPT is no longer commonly used in North America, and is found in Canada only in EDTI's system and in certain other utilities' systems in the North Eastern United States. As a result, potentially comparative availability data would be extremely limited. This, coupled with the significant impact that historical loading and operation of this type of equipment and utility specific maintenance practices can have on availability, would make it difficult to draw reliable comparisons among the utilities still operating these types of cables.

Although historically infrequent, major equipment failures such as a cable fault, a cable splice failure or a termination failure would result in extended unavailability of the equipment, as does the completion of planned maintenance. For example, EDTI recently required a termination

repair to a similar OFPT cable, the need for which was discovered during a planned cable splice replacement. The termination repair was unexpected and resulted in an outage of 3 months to complete and return the cable to service. Planned equipment upgrades such as a splice or termination replacement require a 4-5 week outage to complete. Repair of cable sections under the North Saskatchewan River is estimated to take a minimum of 9-12 months.

EDTI-AESO-2019APR09-004
Reference: EDTI TFO

Request:

Is the historic availability of Garneau transformers T1, T2 and T3 and Jasper substation T1 typical for transformers of similar design?

Response:

EDTI is not aware of any facts that would suggest that the historic availability of the Garneau transformers T1, T2 and T3 and Jasper substation T1 is atypical vis-à-vis transformers of similar design. EDTI notes that the unavailability of these transformers has historically been related to oil leaks, tap changer failures (e.g., motor, contacts), repairs (e.g., fans, filtration units, monitors) and preventative maintenance along with some capital life cycle replacement of auxiliary equipment (e.g., monitors, bushings or tapchanger components). EDTI also notes, however, that due to the loading restrictions on these transformers, it is becoming more difficult to obtain outages to perform preventative and corrective maintenance on these transformers. Reduced maintenance will lead to an increasing likelihood of failures.

It would be very difficult to reliably compare the availability of the referenced transformers to industry data/statistics. An individual transformer's availability can vary significantly from year to year based on maintenance requirements alone, making comparisons to "average" availability challenging to say the least. Further, transformer availability over time is a product of factors like historical operation and loading of the equipment, and the specific maintenance practices employed by the operator, which are typically unknown by all but the specific utility operator. Unless these important "drivers" of availability are carefully examined and accounted for in analyzing the data, it is not possible to arrive at "apples-to-apples" comparisons of availability.

Finally, EDTI notes that major equipment failures such as a bushing failure, tapchanger failure, winding fault or a main tank rupture would result in extended unavailability to the equipment. While EDTI stocks spare components such as transformer high and low voltage bushings, an in-

service failure of this type of component often results in collateral damage. As EDTI does not have a spare transformer that can be used at Garneau or Jasper in the event of total failure, replacement of one of these transformers would likely take 12-16 months.

EDTI-AESO-2019APR09-005
Reference: EDTI TFO

Request:

Is the historic availability of the 72 kV buses at Garneau and Jasper substations typical for similar designs?

Response:

EDTI is not aware of any facts that would suggest that the historic availability of the 72 kV buses at Garneau and Jasper substations is atypical vis-à-vis buses of similar design.

EDTI has not experienced any recent significant failures on the Jasper 72kV bus and associated HV equipment (instrument transformer, disconnect switches, ground switches and circuit breakers). The unavailability of the bus and HV equipment is historically related to oil leaks, disconnect alignment adjustments, minor repairs and preventative maintenance along with some capital life cycle replacements. With loading restrictions on the 72kV system (72kV cables and transformers), it is becoming more difficult to obtain outages to perform preventative and corrective maintenance. Reduced maintenance will lead to an increasing likelihood of failures.

At Garneau, the 72kV bus and associated HV equipment (instrument transformer, disconnect switches, ground switches and circuit breakers) is unique to EDTI's system. It is SF6 insulated, phase segregated, indoor bus work that was installed in 1982. The original equipment manufacturer (Sprecher and Schuh) was bought out by Siemens. Due to the uniqueness of the equipment, obtaining replacement parts is often more difficult and time-consuming compared to traditional air insulated equipment. Replacement parts are custom built by Siemens when needed. As an example, EDTI experienced minor equipment failures on disconnects and ground switches in 2012 and 2017. The length of time to obtain parts in addition to the fact that very few contractors have the specific skills and specialized equipment required to repair or install SF6 indoor switchgear, led to longer repair and outage timelines that resulted in what EDTI believes

was higher unavailability of the equipment compared to traditional air insulated bus work and switchgear.

It would be very difficult to reliably compare the availability of either of these two buses and their associated equipment to industry data/statistics. An individual bus's availability can vary significantly from year to year based on maintenance requirements alone, making comparisons to "average" availability challenging to say the least. Further, equipment availability over time is a product of factors like historical operation and loading of the equipment, and the specific maintenance practices employed by the operator, which are typically unknown by all but the specific utility operator. Unless these important "drivers" of availability are carefully examined and accounted for in analyzing the data, it is not possible to arrive at "apples-to-apples" comparisons of availability. Finally, in relation to the equipment at Garneau, given the uniqueness of those facilities, potential comparators would be difficult if not impossible to find.

EDTI-AESO-2019APR09-006
Reference: EDTI TFO

Request:

Provide an overview of the procedures that the TFO would take to respond to independent outages of:

- 72RG1
- 72RG7
- 72MG16
- 72JM18
- Garneau transformer T1
- Garneau transformer T2
- Garneau transformer T3
- Jasper substation T1

Response:

EDTI's response to an outage of any one element will depend on the state of the transmission system at the time of the outage, and will be determined through the application of a general procedure to respond to outage events rather than by the application of pre-established, asset-specific procedures. The transmission system is dynamic and pre-established, asset-specific procedures are often not applicable in the specific circumstances of an outage.

The following steps describe how EDTI's system control operators ("SCO") respond to the loss of a system element.

1. Review available alarms in EDTI's Outage Management System ("OMS")
2. Assess new current system state (confirm which elements are in/out of service)
3. Verify loading of elements adjacent to the outage element

4. Review historical loading
5. Complete any initial emergency switching, load transfers and/or load shedding:
   - 5.1. Create switching orders
     - 5.1.1. Substation equipment switched through control room
     - 5.1.2. Manual switching through trouble truck
6. SCO will notify as required:
   - 6.1. AESO
   - 6.2. ALTALINK
   - 6.3. Foreman
   - 6.4. Mangers
   - 6.5. ATCO
   - 6.6. Power Trouble Dispatch
   - 6.7. Trouble truck crews
7. Field Crews will proceed to damage area and report the following information to SCO:
   - 7.1. Location of trouble and apparent cause
   - 7.2. Assessment of damage
   - 7.3. Action necessary for repair and restoration of service
   - 7.4. Estimated time until service will be restored
8. SCO will log all applicable information and complete incident in OMS
9. SCO will create plan within 30 minutes to re-prepare system in the event of next contingency.

EDTI-AESO-2019APR09-006 Attachment 1 is the contingency report for the Meadowlark and Garneau substations. It provides information on potential additional contingencies (i.e., an additional outage putting the system in an N-1-1 state) as contemplated in Step 9 above.

In addition to the application of the general procedure described above, certain operating restrictions must be put in place in response to particular asset outages. Table EDTI-AESO-2019APR09-006-1 shows transmission operating restrictions related to independent outages of the equipment listed in the question. (Outages on certain adjacent assets will also place operating restrictions on the equipment listed in the question, but these are not listed in the table below.)

Table EDTI-AESO-2019APR09-006-1
System Restrictions

	Asset Outage	A Resultant Action
1	Normal State: Garneau	T1 & T2 Transformers must be kept paralleled to avoid overload condition on T1 at Garneau
2	T1 @ GARNEAU	UofA – Disconnect one generator (seasonal/weekend)
3	T2 @ GARNEAU	UofA – Close both reactors at Garneau
4	T3 @ GARNEAU	UofA – Disconnect one generator (seasonal/weekend)
5	T1 @ JASPER	Reduce loading at Meadowlark to avoid overload on 72RG1/72RG7
6	72RG1	72MG16 Offloaded - Switching at Meadowlark to reduce loading on 72JM18
7	72RG7	72MG16 Offloaded - Switching at Meadowlark to reduce loading on 72JM18 (seasonal/weekend)
8	72JM18	72RG1 Offloaded – to avoid overload if 72RG7 tripped
9	72JM18	Reduce loading at Meadowlark to avoid overload on 72RG1/72RG7

Contingency Report

Contingency

Loss of 72MG16

Impact Area: **Station Area**
Potential Consequence of next Failure: **Very High**

Start:	Any	Worst Next Failure:	72JM18
End:	Any	Effect:	**Extended Loss of Load**

Mitigations if next failure occurs	1. Restore 72JM18 2. Restore 72MG16
Priority Customers?	Yes Hospital, Edmonton Public Schools
N-1 considered:	If 72MG16 is lost, further loss of 72JM18 will result in loss of all firm load at Meadowlark POD.

Loss of 72RG1

Impact Area: **Station Area**
Potential Consequence of next Failure: **Very High**

Start:	Any	Worst Next Failure:	72RG7
End:	Any	Effect:	**Extended Loss of Load**

Mitigations if next failure occurs	1. If 72RG1 is lost, Meadowlark TX3 must be switched to 72JM18 to reduce overload on 72RG7 2. Restore 72RG7 or 72RG1
Priority Customers?	Yes University of Alberta, Edmonton Public Schools, AHS, LRT
N-1 considered:	If 72RG1 is lost, further loss of 72RG7 will result in loss of all firm load at Garneau POD.

Loss of 72RG7

Impact Area: **Station Area**
Potential Consequence of next Failure: **Very High**

Start:	Any	Worst Next Failure:	72RG1
End:	Any	Effect:	**Extended Loss of Load**

Mitigations if next failure occurs	1. If 72RG7 is lost, Meadowlark TX3 must be switched to 72JM18 to reduce overload on 72RG1 2. Restore 72RG1 or 72RG7
Priority Customers?	Yes University of Alberta, Edmonton Public Schools, AHS, LRT
N-1 considered:	If 72RG7 is lost, 72RG1 may run into overload conditions. Further loss of 72RG1 will result in loss of all firm load at Garneau POD.

Loss of 72JM18

Impact Area: **Station Area**
Potential Consequence of next Failure: **Very High**

Start:	Any	Worst Next Failure:	72MG16
End:	Any	Effect:	**Extended Loss of Load**

Mitigations if next failure occurs	1. If 72JM18 is lost, all meadowlark load must be transferred to 72MG16 2. Restore 72JM18
Priority Customers?	Yes Hospital, Edmonton Public Schools
N-1 considered:	1. If 72JM18 is lost, loss of 72MG16 will result in loss of all load at Meadowlark. Further loss of any of 72RG1 or 72RG7 may result in overload condition and require load shed.

Loss of Garneau TX1,TX2 or TX3

Impact Area: **Station Area**
Potential Consequence of next Failure: **High**

Start:	Any	Worst Next Failure:	Garneau TX1, TX2 or TX3
End:	Any	Effect:	**Overloaded Elements**

Mitigations if next failure occurs	1. Immediate load shed is required if transformer is in overload 2. Restore lost transformer (TX1, TX2 or TX3)
Priority Customers?	Yes University of Alberta, Edmonton Public Schools, AHS, LRT
N-1 considered:	Loss of TX1, TX2 or TX3 at Garneau could result in overload of the remaining transformers. Immediate offload will be required to reduce overload on the transformers.

Loss of Jasper TX1

Impact Area: **Station Area**
Potential Consequence of next Failure: **Very High**

Start:	Any	Worst Next Failure:	72RW3 or 72MG16
End:	Any	Effect:	**Extended Loss of Load**

Mitigations if next failure occurs	1. Immediate switching is required to reduce overload conditions on 72RW3, 72MG16, 72RG1 or 72RG7 2. Restore Jasper TX1
Priority Customers?	Yes Hospital, Edmonton Public Schools
N-1 considered:	If Jasper TX1 is lost, there will be lose of 72JW19 and 72JM18. All Meadowlark load will be transferred to 72MG16. Any loss to 72RG7 or 72RG1 when 72JM18 is lost will result in an overload of the available cable. All Woodcroft load will be on 72RW3 which may run into overload conditions and require immediate switching.

Definitions

Summary:

Assessing Risk is not a fully empirical exercise. In developing the method utilized in this report, the goal was to capture the primary dimensions which contribute to Risk to the EDTI system, as they are captured and assessed by Operations Engineering or System Control, and producing an overall Risk assessment that is in step with our current practices. Based on the experience of EDTI's operations engineers and system control staff, when considering the Risk to EDTI's system when in an abnormal condition, 4 primary dimensions are identified:

1 What is the worst possible next failure, and it's resulting impact **(Effect)**
2 What is the area (or how much of our system) would experience this effect? **(Area)**
3 What is the likelihood of failure of the element(s) that would be the next worst possible failure?

4 What is the duration of the abnormal configuration?

Risk is then assessed by evaluating a product (or referring to a matrix) of consequence and probability.

**Note:

Currently, Operations Engineering and System Control can definitively determine **Effect** and **Area**, and can therefore define **Consequence** in a consistent way. **Duration** is also a straightforward measure (or estimate, if un-planned), but **likelihood of failure** is not well defined or assessable yet. Therefore in the current format **Probability** is placed as a placeholder, for better future definition.

Consequence:

Consequence of the next worst failure is based on the matrix below:

Effect of next failure	Large Area	Station Area	Circuit Area
Extended Loss of Load or System Damage	Significant	Very High	High
Overloaded Elements	Very High	High	Medium
Degraded Reliability	High	Medium	Low
Abnormal Loading	Medium	Low	Low

Definitions:

Extended Loss of load	Loss of load requiring mobilization of crews for restoration.
Overloaded Elements	Elements operating above continuous rating (loss of life and higher chance of failure).
Degraded Reliability	N-1 capability is lost due to loading or other restriction (e.g. high load or protection failure).
Abnormal Loading	Load transfers have occurred, but N-1 capability has not been compromised.
Large Area	Impact affects multiple transmission lines or multiple substations
Station Area	Impact is to power transformer(s) up to whole substation.
Circuit Area	Impact area is at the full circuit level; 1-4 whole distribution circuits.
Small distribution	Impact area is sub-circuit, a portion of a distribution circuit.

Assigned **Consequence** values for **Risk** Calculation:

Consequence	Value
Significant	1.5
Very High	1
High	0.75
Medium	0.5
Low	0.25

Probability:

Assigned **Probability** values for **Risk** Calculation:

Probability	Value	Suggested Interpretation
1 in 100	1	Very Likely (for whatever reason).
1 in 1000	0.75	Equipment with known degradation / Problems and failures are common.
1 in 10,000	0.5	Older equipment with no known issues / many possible failure modes.
1 in 100,000	0.25	Good, new equipment with no known issues.
Extremely Remote	0.05	Should never occur (but nothing is impossible).

Risk Calculation:

Risk is assessed by multiplying the numerical values assigned to **Consequence** and **Probability above,** and then taking the resultant product such that:

Calculation Between		Resulant Risk Rating	Suggested Interpretation
0	0.5	Normal	Acceptable for normal course of business; some risk is present, but reasonable.
0.5	0.9	Elevated	Business should limit total of concurrent elevated risks if possible; elevated resources should respond if un-planned.
0.9	1.5	Major	Should never occur from planned work. if unplanned, could result in EOC activation.

EDTI-AESO-2019APR09-007
Reference: EDTI TFO

Request:

Provide an overview of the timelines that the EDTI TFO would take to respond to independent outages of:

- 72RG1
- 72RG7
- 72MG16
- 72JM18
- Garneau transformer T1
- Garneau transformer T2
- Garneau transformer T3
- Jasper substation T1

Response:

Independent outages to any of these elements would involve an immediate response by EDTI's system control operators using the procedures described in EDTI's response to EDTI-AESO-2019APR09-006.

Under normal system operating conditions (i.e., N-0 but for the independent outage contemplated in the question), the time required to restore all load would vary with the specific listed item of equipment involved in the outage. Although EDTI's personnel would respond immediately, it could take up to 4 hours to restore all load to within operating limits, assuming that sufficient capacity is available via distribution and/or transmission switching opportunities. Under peak and near-peak conditions, sustained customer outages may be required as there is currently insufficient N-1 capacity under certain contingencies (see also EDTI-AESO-2019APR09-008 and 011). By sustained customer outages, EDTI means that at least some

customer load would be left unsupplied even after making use of all available distribution and/or transmission switching capabilities to restore load.

Restoration times for the faulted system element would also vary significantly depending on the severity of the equipment fault. For example, it is possible that transitory faults such as those caused by lightning or foreign interference (vegetation or wildlife) could be restored by system control without on-site attendance from Trouble Crews or Transmission field personnel, resulting in prompt restoration of load (approximately 5-10 minutes). Conversely, restoration times for a permanent fault on a system element could range from a few days (e.g., instrument transformer failure that requires replacement using an available system spare) to months or years (e.g., the catastrophic failure of a transformer or a cable with collateral damage to adjacent equipment; could result in the equipment being unavailable for 6 to 16 months).

EDTI-AESO-2019APR09-008
Reference: EDTI DFO

Request:

In the event of an outage given the assumptions presented in EDTI's DDR to any of the below, does EDTI anticipate the "load at risk" (referenced in the DDR) to result in loss of customer load?

a. 72RG1
b. 72RG7
c. 72MG16
d. 72JM18
e. Garneau transformer T1
f. Garneau transformer T2
g. Garneau transformer T3
h. Jasper substation T1

(i) If yes, provide an overview of the procedures that EDTI DFO would take to restore service to these customers.

(ii) If yes, provide an overview of the timelines that EDTI DFO would take to restore service to these customers.

(iii) If no, please provide the rational for why the "load is at risk".

Response:

Load at risk, as referenced in the DDR, is load EDTI would be forced to interrupt to reduce transmission equipment loading below its maximum safe thermal limit following a single transmission contingency.

The 2014-2018 average peak loads for Garneau and Meadowlark PODs are shown in Table EDTI-AESO-2019APR09-008-1. The relevant transmission equipment ratings are shown in Table EDTI-AESO-2019APR09-008-2 below.

Table EDTI-AESO-2019APR09-008-1
Garneau and Meadowlark Peak Load (2014-2018 Average)

		A **72 kV Load [MVA]**	B **14.4 kV Load [MVA]**
1	**Garneau**	90.8*	82.8*
2	**Meadowlark**	54.7	52.9

* Does not include U of A generation.

Table EDTI-AESO-2019APR09-008-2
Load At Risk Under Contingencies at Summer Peak (2014-2018 Average)

	Contingency	A **72RG1**	B **72RG7**	C **72MG16**	D **72JM18 or Jasper T1**	E **Garneau T1, T2, or T3**
1	Limiting Transmission Equipment:	72RG7	72RG1	72JM18	72RG1 and 72RG7 operating in parallel (See Note 2)	Any Two Garneau Transformers
2	Load on Limiting Transmission Equipment [MVA]	90.8 (Garneau 72 kV Load)	90.8 (Garneau 72 kV Load)	54.7 (Meadowlark 72 kV Load)	145.5 (See Note 3)	81.2 (Garneau 14.4 kV Load)
3	Limiting Thermal Rating [MVA]	80	60	60	130.4 (See Note 2)	80
4	Load at Risk / Interrupted Customer Load [MVA]	10.8	30.8	0	15.1 (See Note 3)	1.2

Note 1: Garneau 72 kV load includes POD transformer losses. Meadowlark 72 kV load includes POD transformer losses.
Note 2: Limiting transmission equipment is the lesser of: i) 60 MVA capacity of 72MG16; or ii) 130.4 MVA parallel capacity of 72RG1 and 72RG7 less Garneau 72kV load. 72RG1 rating is 60 MVA and 72RG7 rating is 80 MVA. However, 72RG1 and 72RG7 are operated in parallel, and due to unequal cable impedances 72RG1 carries ~46% of total load (rather than 50%). Consequently, the total load that can be supplied by 72RG1 and 72RG7 in parallel without 72RG1 exceeding its ratings is 130.4 MVA.
Note 3: Equal to the sum of peak 72kV Garneau and Meadowlark loads, which assumes that the Garneau and Meadowlark summer POD peaks occur at approximately the same time.

Based on the data shown in these tables, EDTI expects that certain contingencies will result in forced interruption of customer load at Garneau or Meadowlark PODs equal to the load at risk identified in Table 2 above. Note that for the 72RG7 contingency shown in Table 2, the Load at Risk / Interrupted Customer Load would include some University of Alberta load.

Overview of Procedures and Timelines to Restore Load

The following procedures are available to EDTI to restore interrupted load (or prevent load interruption) at Garneau or Meadowlark PODs following one of the transmission circuit outages

noted above, and the associated timelines. Note that the restoration of load (or prevention of load interruption) may only be temporary as these procedures rely on either: i) emergency capacity of EDTI distribution circuits (which is available only for a maximum of 36 hours), or ii) the availability of U of A steam turbine generation. After 36 hours, or if U of A generation is unavailable, interrupted load may not be permanently restored until adequate transmission capacity is available. EDTI notes that the Garneau POD feeders that supply the U of A do not have ties to non-Garneau distribution feeders, and therefore it would not be possible to restore interrupted U of A load with emergency capacity on non-Garneau distribution circuits.

Table EDTI-AESO-2019APR09-008-3
EDTI DFO Procedures to Restore Load Or Prevent Load Interruption

	Procedure to Restore Load	A **Time to Implement**	B **Load Restored By Procedure (MVA)**	C **Duration of Restoration**
1	Use of emergency capacity on non-Garneau distribution circuits adjacent to Garneau service territory.	4 hours	≤ 12.8	36 hours (See Note 1)
2	In the event of a 72RG7 contingency and resulting severe overload on 72RG1, EDTI will inform the U of A that unless loading on transmission circuit 72RG1 can be reduced below its 60 MVA rating within 10 minutes (the emergency rating duration for 72RG1), EDTI must interrupt a portion of U of A load supplied from Garneau POD. EDTI's intent is to provide the U of A an opportunity dispatch its generation and/or voluntarily reduce load to avoid the interruption of U of A load necessary to eliminate 72RG1 overloading. Based on Table 2 load at risk of 30.8 MVA following a 72RG7 outage, and assuming 12.8 MVA of non-U of A load restored using emergency distribution circuit capacity noted above, 18 MVA of U of A load must be supplied by U of A generation to reduce 72RG1 loading below 60 MVA. If no U of A generation is available, then the 18 MVA of U of A load must be interrupted until 72RG7 is restored.	See Note 2	≤ 31 MVA (See Note 3)	While U of A generation is available
3	Use of emergency capacity on non-Meadowlark distribution circuits adjacent to Meadowlark service territory.	4 hours	≤ 5.0	36 hours (See Note 1)

Note 1: 36 hours is the duration of the emergency rating for an EDTI distribution circuit. After 36 hours of emergency loading on a distribution circuit, the load must be reduced to its normal continuous rating resulting in any load supplied by emergency capacity of a distribution circuit again being interrupted. This interruption of load would last until adequate transmission capacity is restored.
Note 2: Dependent on ability of U of A operators to respond.
Note 3: The U of A's 31 MVA condensing steam turbine generator operates independently of U of A heating load. U of A's other generator is a 15.5 MVA cogeneration unit and power production from this turbine is directly related to the campus heating load; most power production from the 15.5 MVA unit is unavailable during summer months.

The specific application of the procedures outlined above is shown in Table EDTI-AESO-2019APR09-008-4 and Table EDTI-AESO-2019APR09-008-5 below.

Table EDTI-AESO-2019APR09-008-4
Restorable Load for Transmission Outages shorter than 36 Hours

Contingency	A 72RG1	B 72RG7	C Garneau T1, T2, or T3	D 72JM18 or Jasper T1
1 Load at Risk / Interrupted Customer Load [MVA]*	10.8	30.8	1.2	15.1
2 Restoration Procedure**	1	1, 2	1	1, 3
3 Maximum Restorable Load [MVA]	12.8	43.8	12.8	17.8
4 Limitations***	a	a, b	a	a

* Based on Garneau and Meadowlark summer peak load (2014-2018 average)
** Restoration Procedures:
1) Use 36 hour emergency capacity on non-Garneau distribution circuits adjacent to Garneau service territory.
2) Dispatch U of A generation.
3) Use 36 hour emergency capacity on non-Meadowlark distribution circuits adjacent to Meadowlark service territory.
*** Limitations
a) 36 hours is the duration of the emergency rating for an EDTI distribution circuit. After 36 hours of emergency loading on a distribution circuit, any load supplied by emergency capacity of a distribution circuit would again be interrupted.
b) Generation dispatch is under U of A control.

Table EDTI-AESO-2019APR09-008-5
Restorable Load for Transmission Outages longer than 36 Hours

Contingency	A 72RG1	B 72RG7	C Garneau T1, T2, or T3	D 72JM18 or Jasper T1
1 Load at Risk / Interrupted Customer Load [MVA]*	10.8	30.8	1.2	15.1
2 Restoration Procedure**	none	2	none	none
3 Maximum Restorable Load [MVA]	0	31	0	0
4 Limitations***	N/A	b	N/A	N/A

* Based on Garneau and Meadowlark summer peak load (2014-2018 average)
** Restoration Procedures:
1) Use 36 hour emergency capacity on non-Garneau distribution circuits adjacent to Garneau service territory.
2) Dispatch U of A generation.
3) Use 36 hour emergency capacity on non-Meadowlark distribution circuits adjacent to Meadowlark service territory.
*** Limitations
a) 36 hours is the duration of the emergency rating for an EDTI distribution circuit. After 36 hours of emergency loading on a distribution circuit, any load supplied by emergency capacity of a distribution circuit would again be interrupted.
b) Generation dispatch is under U of A control.

EDTI-AESO-2019APR09-009
Reference: EDTI DFO

Request:

Provide a summary of the type of customers (eg. residential, industrial, commercial, and farming/agriculture) and number of customers within each type served by each of:

- Garneau Substation
- Meadowlark Substation

Response:

A detailed breakdown of the customers served by the Garneau and Meadowlark substations is presented below. EDTI notes that the customer load type tables use the EDTI rate class classifications reflected in EDTI's annual Rule 005 filings to the Alberta Utilities Commission.

Garneau Substation

Table EDTI-AESO-2019APR09-009-1
Customer Count per Load Type for Garneau Substation

	Customer Load Type	A Customer Count
1	**GARNEAU**	**7351**
2	Commercial/Industrial < 50 kVA	580
3	Commercial/Industrial 50 - 149 kVA	60
4	Commercial/Industrial 50 < 4999 kW	18
5	Customer Specific Totalization	1
6	Primary Commercial/Industrial 150 < 4999 kW	1
7	Residential	6618
8	Security Lighting	48
9	Unmetered	24
10	Vacant	1

Specific customers of note served by the Garneau substation include:

- University of Alberta North Campus[1]
- Old Strathcona Police Station
- Lendrum EMS Station
- Schools, including:
  - 1 Senior High School
  - 3 Junior High Schools
  - 5 Elementary Schools
- 2 LRT Stations (40th Ave and South Campus stations)

Meadowlark Substation

Table EDTI-AESO-2019APR09-009-2
Customer Count per Load Type for Meadowlark Substation

	Customer Load Type	A Customer Count
1	**MEADOWLARK**	**28894**
2	Commercial/Industrial < 50 kVA	1008
3	Commercial/Industrial 50 - 149 kVA	106
4	Commercial/Industrial 50 < 4999 kW	34
5	Commercial/Industrial 5000+ kW	1
6	Primary Commercial/Industrial 150 < 4999 kW	5
7	Residential	27515
8	Security Lighting	122
9	Unmetered	99
10	Vacant	4

Specific customers of note served by the Meadowlark substation include:

- Callingwood Fire/EMS Station #19
- Meadowlark Fire Station #12
- Capital Care Lynnwood

[1] EDTI notes that the University of Alberta is itself a DFO, with many individual customers that are not reflected in the EDTI customer count for the Garneau substation.

- Misericordia Hospital (Standby)
- Meadowlark Health and Shopping Centre
- Schools, including:
    - 10 Junior High Schools
    - 27 Elementary Schools
    - 4 Senior High Schools
- LRT Station – McKernan Belgravia
- Edmonton Valley Zoo
- West Edmonton Mall (as of 2021, as further described in EDTI-AESO-2019APR09-012)

EDTI-AESO-2019APR09-010
Reference: EDTI DFO

Request:

Describe the potential impacts including critical loads with public safety or environmental sensitives, on the unsupplied loads for each of the N-1 transmission contingency of the following:

a. 72RG1
b. 72RG7
c. 72MG16
d. 72JM18
e. Garneau transformer T1
f. Garneau transformer T2
g. Garneau transformer T3
h. Jasper substation T1

Response:

EDTI notes that response EDTI-AESO-2019APR09-009 lists specific customers of note, including public health and safety facilities, within the affected Garneau and Meadowlark service territories.

(a) 72RG1 supports load in the Garneau and Meadowlark areas of Edmonton. These areas consist primarily of residential customers, with some commercial and institutional customers. The public safety and environmental sensitivities due to an outage of 72RG1 would be relatively low. However, as explained in EDTI's response to EDTI-AESO-2019APR09-008, the distribution circuit switching used to respond to an outage of 72RG1 can be used for a maximum of 36 hours. A transmission outage of longer than 36 hours would result in extended periods of customer load interruption, with corresponding impacts to public safety.

(b) Although serving the same areas as 72RG1, the failure of 72RG7 presents a greater risk to public safety as 72RG7 is of higher capacity than 72RG1 (80MVA vs. 60MVA). As explained in EDTI's response to EDTI-AESO-2019APR09-008, distribution switching is insufficient to restore interrupted load in the event of a 72RG7 contingency at or near peak load. Regardless as to whether the University of Alberta's generation is active to reduce the loading (as shown in Figure EDTI-AESO-2019APR09-011-2), 72RG1 would exceed its operating limit and EDTI would be required to interrupt load served by the Garneau substation, including University of Alberta load. As this area includes a number of public health facilities (including the University of Alberta Hospital, the Stollery Children's Hospital, the Mazankowski Alberta Heart Institute, and the Kaye Edmonton Clinic), any interruption of load could potentially affect those facilities.

(c-h) The loss of any of these elements would present similar risks to public safety as described in EDTI's response to (a) above.

EDTI-AESO-2019APR09-011
Reference: EDTI DFO

Request:

Provide relevant data on the amount of unsupplied load in the event of the above noted contingencies that could occur at different times of the year beyond just peak periods.

Response:

In the event that a contingency results in the thermal overloading of transmission equipment (i.e., transmission equipment exceeding its thermal rating), EDTI would interrupt POD load to reduce transmission equipment loading to below its thermal rating. This interrupted POD load is referred to as unsupplied load.

The tables below show the total number of hours in which potential unsupplied load existed; the average MVA of potential unsupplied load; and the maximum MVA of potential unsupplied load for the years 2014 to 2018 and forecast year 2021 had the above noted[1] single contingencies occurred between May 1 and October 31[2].

[1]Listed in EDTI-AESO-2019APR09-010.
[2]Data from the period from May 1 to October 31 is relevant because, as noted in section 3.2 of the DDR, the aggregate peak of Garneau, Meadowlark and Rossdale PODs is substantially higher in summer than winter. Additionally, transmission equipment ratings are lower in summer than winter resulting in a higher potential for unsupplied load under contingency in the summer rather than in the winter.

Table EDTI-AESO-2019APR09-011-1
Unsupplied Load Under Contingency by Year
(Assumes No U of A Generation Available)

	Contingency	A Limiting Transmission Equipment	B Limiting Thermal Rating (MVA)	C	D 2014	E 2015	F 2016	G 2017	H 2018	I 2021 F
1				Hours	479	443	392	211	115	383
2	72RG1	72RG7	80	Ave. MVA	6.77	4.78	6.04	4.60	2.04	4.36
3				Max MVA	36.51	20.90	35.28	31.64	6.28	12.72
4				Hours	2748	2690	2644	2268	2129	2745
5	72RG7	72RG1	60	Ave. MVA	11.81	11.61	11.37	9.38	8.33	10.75
6				Max MVA	56.51	40.90	55.28	51.64	26.28	32.72
7				Hours	0	19	0	0	0	327
8	72MG16	72JM18	60	Ave. MVA	0	1.71	0.00	0.00	0.00	4.42
9				Max MVA	0	4.88	0.00	0.00	0.00	14.54
10		72RG1 //		Hours	101	281	76	91	7	584
11	72JM18	72RG7	130.4 (See Note 1)	Ave. MVA	6.08	6.23	5.86	4.86	0.99	8.73
12				Max MVA	22.34	29.46	22.71	25.46	2.11	27.65
13				Hours	0	19	0	0	0	327
14	72JM18	72MG16	60	Ave. MVA	0	1.71	0.00	0.00	0.00	4.42
15				Max MVA	0	4.88	0.00	0.00	0.00	14.54
16				Hours	112	64	72	23	0	17
17	Garneau T1	Garneau T2+T3	80	Ave. MVA	5.50	2.52	4.90	4.54	0.00	0.98
18				Max MVA	20.06	8.54	19.17	16.51	0.00	2.32
19				Hours	112	64	72	23	0	17
20	Garneau T2	Garneau T1+T3	80	Ave. MVA	5.50	2.52	4.90	4.54	0.00	0.98
21				Max MVA	20.06	8.54	19.17	16.51	0.00	2.32
22				Hours	112	64	72	23	0	17
23	Garneau T3	Garneau T1+T2	80	Ave. MVA	5.50	2.52	4.90	4.54	0.00	0.98
24				Max MVA	20.06	8.54	19.17	16.51	0.00	2.32
25		72RG1 //		Hours	101	281	76	91	7	584
26	Jasper T1	72RG7	130.4 (See Note 1)	Ave. MVA	6.08	6.23	5.86	4.86	0.99	8.73
27				Max MVA	22.34	29.46	22.71	25.46	2.11	27.65
28				Hours	0	19	0	0	0	327
29	Jasper T1	72MG16	60	Ave. MVA	0.00	1.71	0.00	0.00	0.00	4.42
30				Max MVA	0.00	4.88	0.00	0.00	0.00	14.54

Note 1: 130.4 MVA is the parallel capacity of 72RG1 and 72RG7. 72RG1 rating is 60 MVA and 72RG7 rating is 80 MVA. However, 72RG1 and 72RG7 are operated in parallel, and under this condition 72RG1 carries ~46% of total load (as dictated by paralleled cable impedances). Consequently, the total load that can be supplied by 72RG1 and 72RG7 in parallel without 72RG1 exceeding its ratings is 130.4 MVA.

Table EDTI-AESO-2019APR09-011-2
Unsupplied Load Under Contingency by Year
(with Actual Historically Metered U of A Generation Available)

	Contingency	A Limiting Transmission Equipment	B Limiting Thermal Rating (MVA)	C	D 2014	E 2015	F 2016	G 2017	H 2018	I 2021 F
1				Hours	11	21	34	0	46	231
2	72RG1	72RG7	80	Ave. MVA	1.53	1.59	2.54	0.00	1.30	3.50
3				Max MVA	3.69	3.18	4.92	0.00	3.48	9.69
4				Hours	1192	1213	1191	556	1493	1959
5	72RG7	72RG1	60	Ave. MVA	6.96	7.32	7.82	5.52	7.92	10.29
6				Max MVA	23.69	23.18	24.92	19.38	23.48	29.69
7				Hours	0	19	0	0	0	327
8	72MG16	72JM18	60	Ave. MVA	0.00	1.71	0.00	0.00	0.00	4.42
9				Max MVA	0.00	4.88	0.00	0.00	0.00	14.54
10				Hours	0	45	3	2	0	435
11	72JM18	72RG1 // 72RG7	130.4 (See Note 1)	Ave. MVA	0.00	3.78	0.66	0.98	0.00	8.24
12				Max MVA	0.00	10.70	1.32	1.64	0.00	24.76
13				Hours	0	19	0	0	0	327
14	72JM18	72MG16	60	Ave. MVA	0.00	1.71	0.00	0.00	0.00	4.42
15				Max MVA	0.00	4.88	0.00	0.00	0.00	14.54
16				Hours	0	0	0	0	0	0
17	Garneau T1	Garneau T2+T3	80	Ave. MVA	0.00	0.00	0.00	0.00	0.00	0.00
18				Max MVA	0.00	0.00	0.00	0.00	0.00	0.00
19				Hours	0	0	0	0	0	0
20	Garneau T2	Garneau T1+T3	80	Ave. MVA	0.00	0.00	0.00	0.00	0.00	0.00
21				Max MVA	0.00	0.00	0.00	0.00	0.00	0.00
22				Hours	0	0	0	0	0	0
23	Garneau T3	Garneau T1+T2	80	Ave. MVA	0.00	0.00	0.00	0.00	0.00	0.00
24				Max MVA	0.00	0.00	0.00	0.00	0.00	0.00
25				Hours	0	45	3	2	0	435
26	Jasper T1	72RG1 // 72RG7	130.4 (See Note 1)	Ave. MVA	0.00	3.78	0.66	0.98	0.00	8.24
27				Max MVA	0.00	10.70	1.32	1.64	0.00	24.76
28				Hours	0	19	0	0	0	327
29	Jasper T1	72MG16	60	Ave. MVA	0.00	1.71	0.00	0.00	0.00	4.42
30				Max MVA	0.00	4.88	0.00	0.00	0.00	14.54

Note 1: 130.4 MVA is the parallel capacity of 72RG1 and 72RG7. 72RG1 rating is 60 MVA and 72RG7 rating is 80 MVA. However, 72RG1 and 72RG7 are operated in parallel, and under this condition 72RG1 carries ~46% of total load (as dictated by paralleled cable impedances). Consequently, the total load that can be supplied by 72RG1 and 72RG7 in parallel without 72RG1 exceeding its ratings is 130.4 MVA.

The figures below show the potential unsupplied load by hour if a 72RG7 contingency occurred in 2018 between May 1 and October 31. Of the contingencies considered, a 72RG7 contingency is likely to result in the largest amount of unsupplied load.

Figure EDTI-AESO-2019APR09-011-1
2018 Summer Garneau 72 kV Load (Assumes No U of A Generation Available) and Limiting Transmission Rating Following 72RG7 Contingency

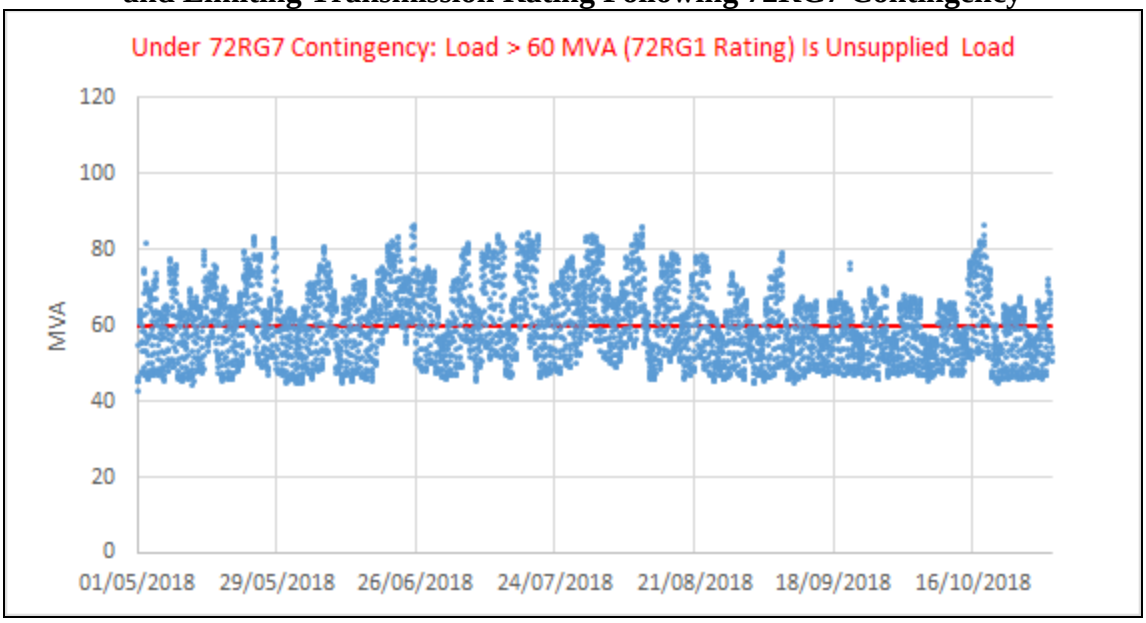
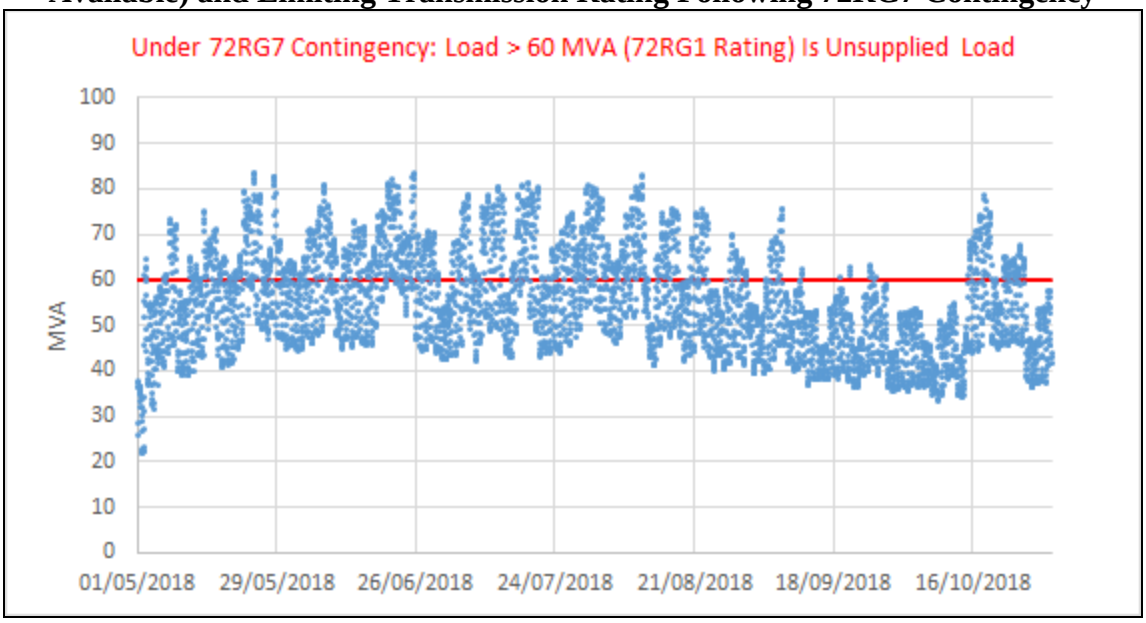


Figure EDTI-AESO-2019APR09-011-2
2018 Summer Garneau 72 kV Load (with Actual Historically Metered U of A Generation Available) and Limiting Transmission Rating Following 72RG7 Contingency



Additional figures illustrating substation loading relative to limiting transmission ratings are included in EDTI-AESO-2019APR09-011 Attachment 1.

Figure EDTI-AESO-2019APR09-011 Attachment 1-1
2014 Summer Garneau 72 kV Load (With No U of A Generation Available) and Limiting Transmission Rating Following 72RG1 Contingency

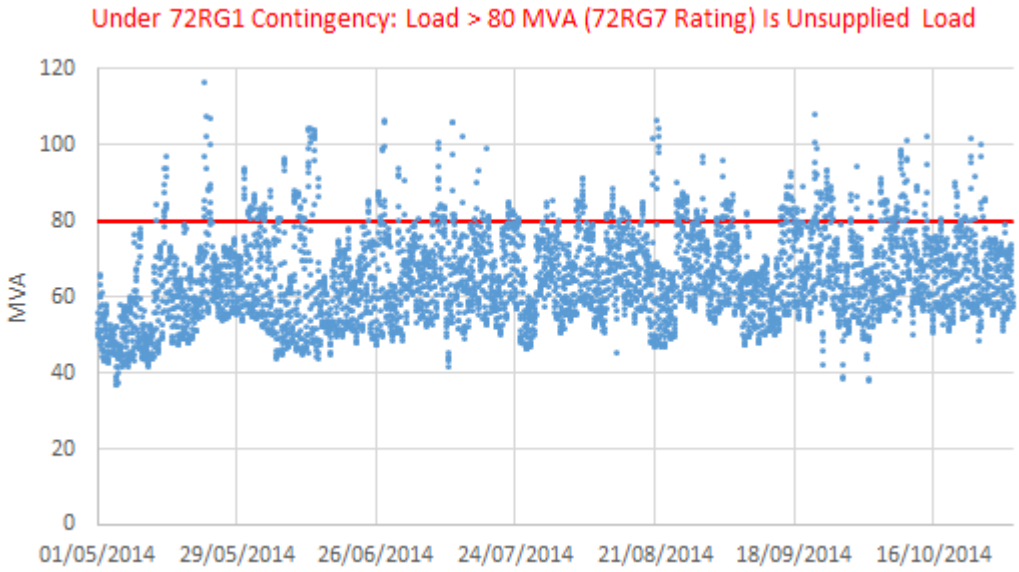


Figure EDTI-AESO-2019APR09-011 Attachment 1-2
2014 Summer Garneau 72 kV Load (With Actual U of A Generation) and Limiting Transmission Rating Following 72RG1 Contingency

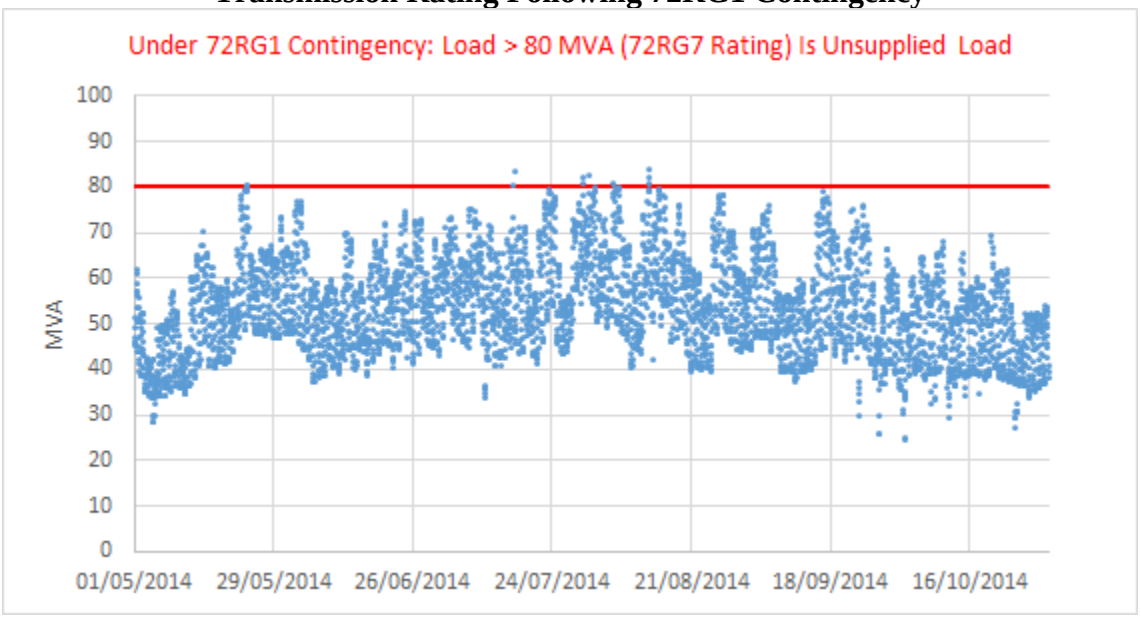


Figure EDTI-AESO-2019APR09-011 Attachment 1-3
2015 Summer Garneau 72 kV Load (With No U of A Generation Available) and Limiting Transmission Rating Following 72RG1 Contingency

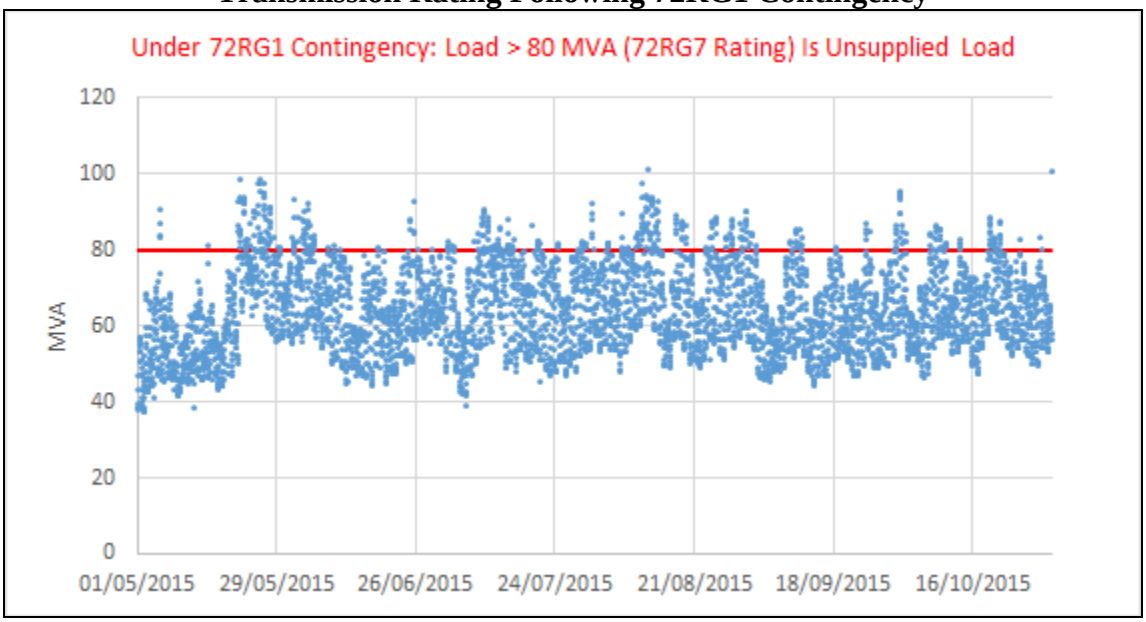


Figure EDTI-AESO-2019APR09-011 Attachment 1-4
2015 Summer Garneau 72 kV Load (With Actual U of A Generation) and Limiting Transmission Rating Following 72RG1 Contingency

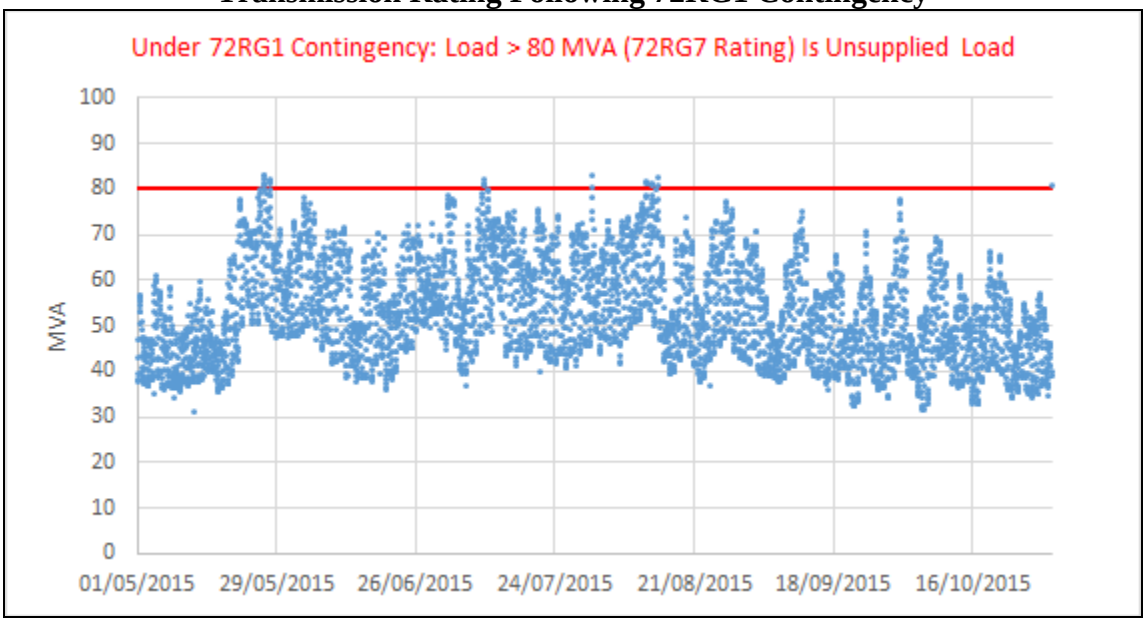


Figure EDTI-AESO-2019APR09-011 Attachment 1-5
2016 Summer Garneau 72 kV Load (With No U of A Generation Available) and Limiting Transmission Rating Following 72RG1 Contingency

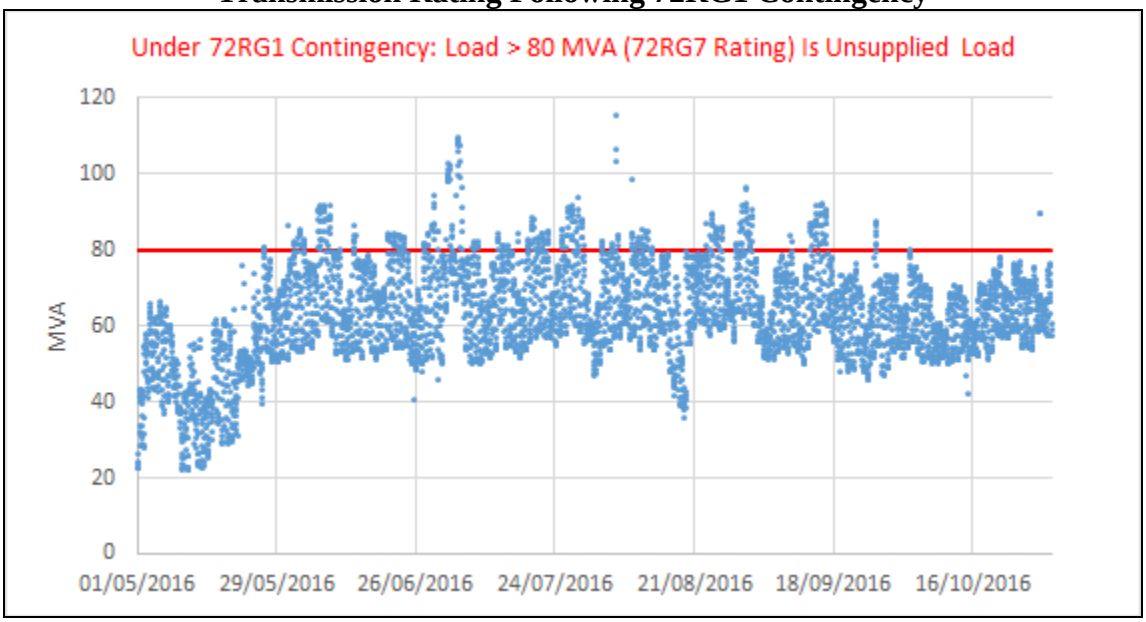


Figure EDTI-AESO-2019APR09-011 Attachment 1-6
2016 Summer Garneau 72 kV Load (With Actual U of A Generation) and Limiting Transmission Rating Following 72RG1 Contingency

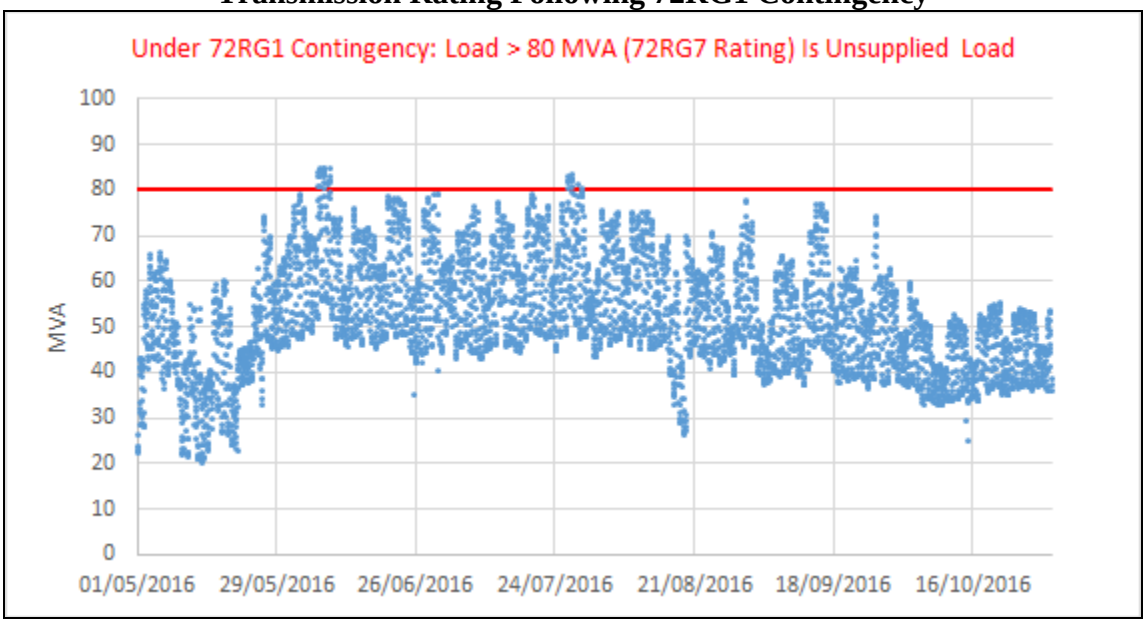


Figure EDTI-AESO-2019APR09-011 Attachment 1-7
2017 Summer Garneau 72 kV Load (With No U of A Generation Available) and Limiting Transmission Rating Following 72RG1 Contingency

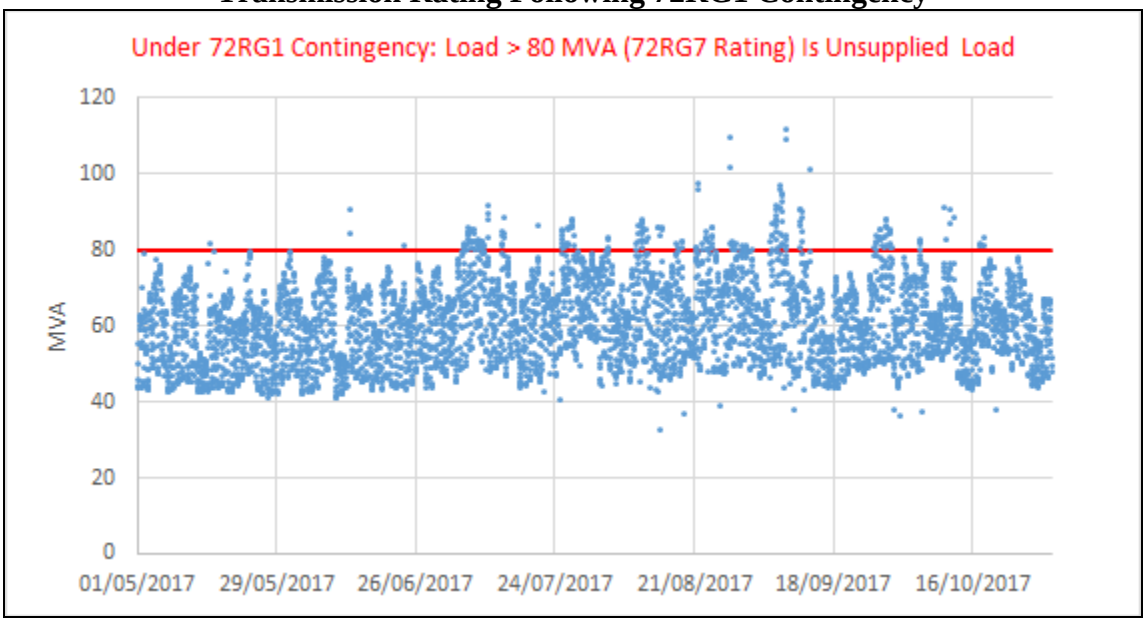


Figure EDTI-AESO-2019APR09-011 Attachment 1-8
2017 Summer Garneau 72 kV Load (With Actual U of A Generation) and Limiting Transmission Rating Following 72RG1 Contingency

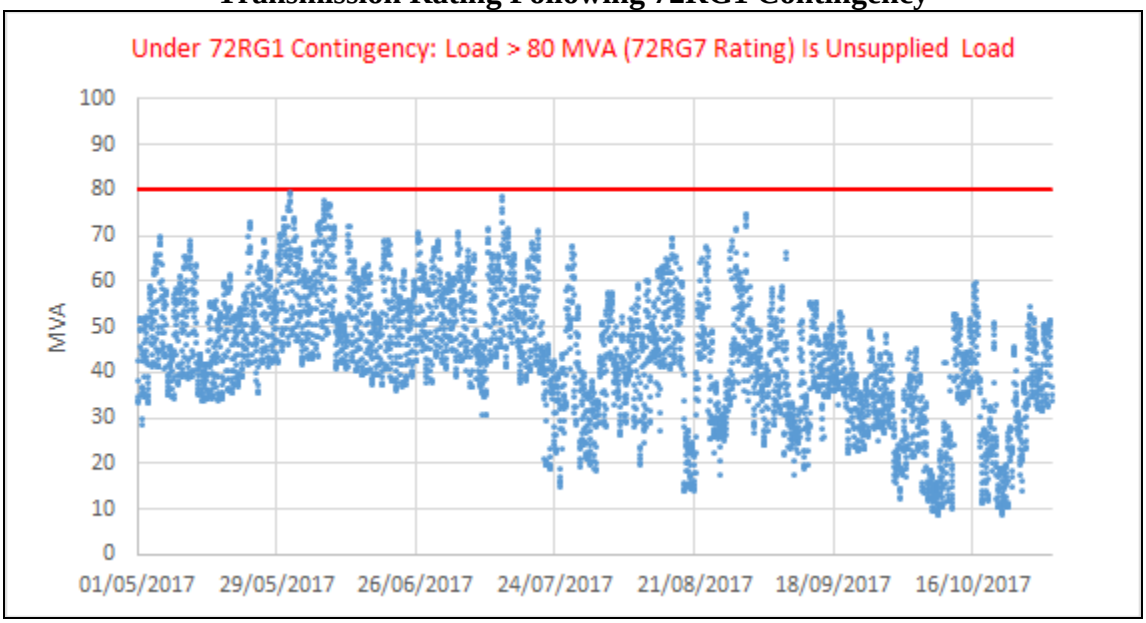


Figure EDTI-AESO-2019APR09-011 Attachment 1-9
2018 Summer Garneau 72 kV Load (With No U of A Generation Available) and Limiting Transmission Rating Following 72RG1 Contingency

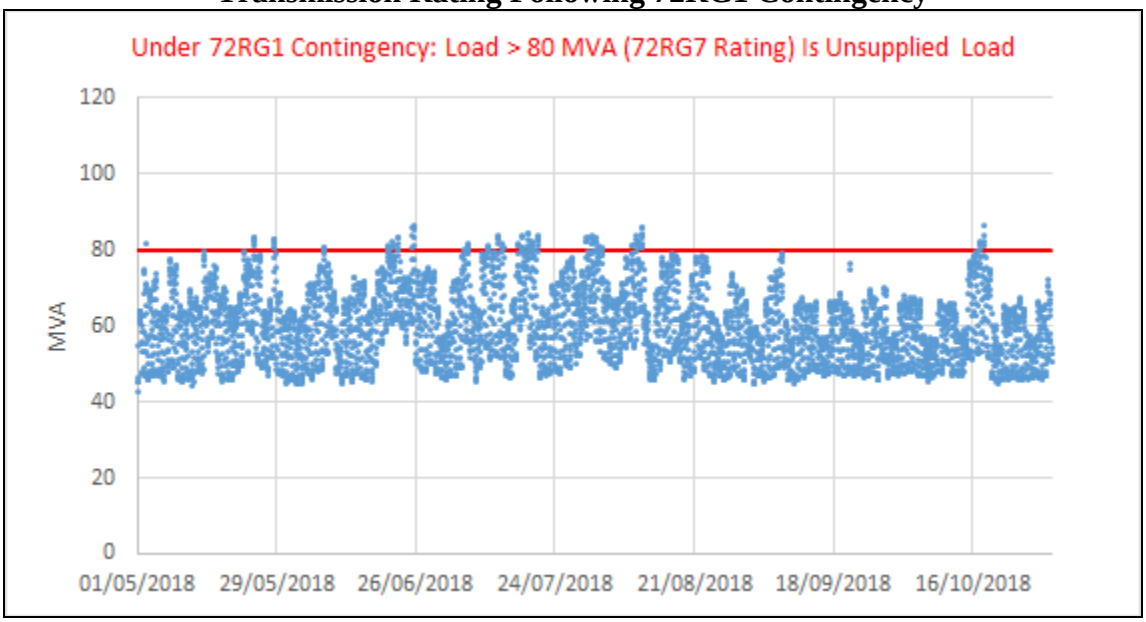


Figure EDTI-AESO-2019APR09-011 Attachment 1-10
2018 Summer Garneau 72 kV Load (With Actual U of A Generation) and Limiting Transmission Rating Following 72RG1 Contingency

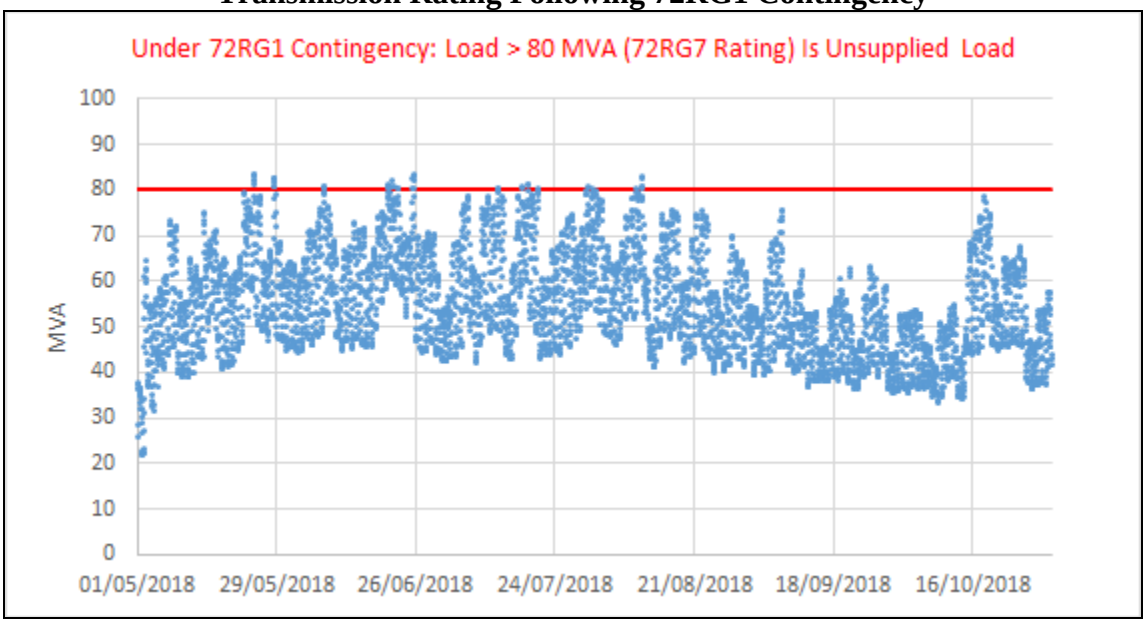


Figure EDTI-AESO-2019APR09-011 Attachment 1-11
2021 Summer Forecast Garneau 72 kV Load (With No U of A Generation Available) and Limiting Transmission Rating Following 72RG1 Contingency

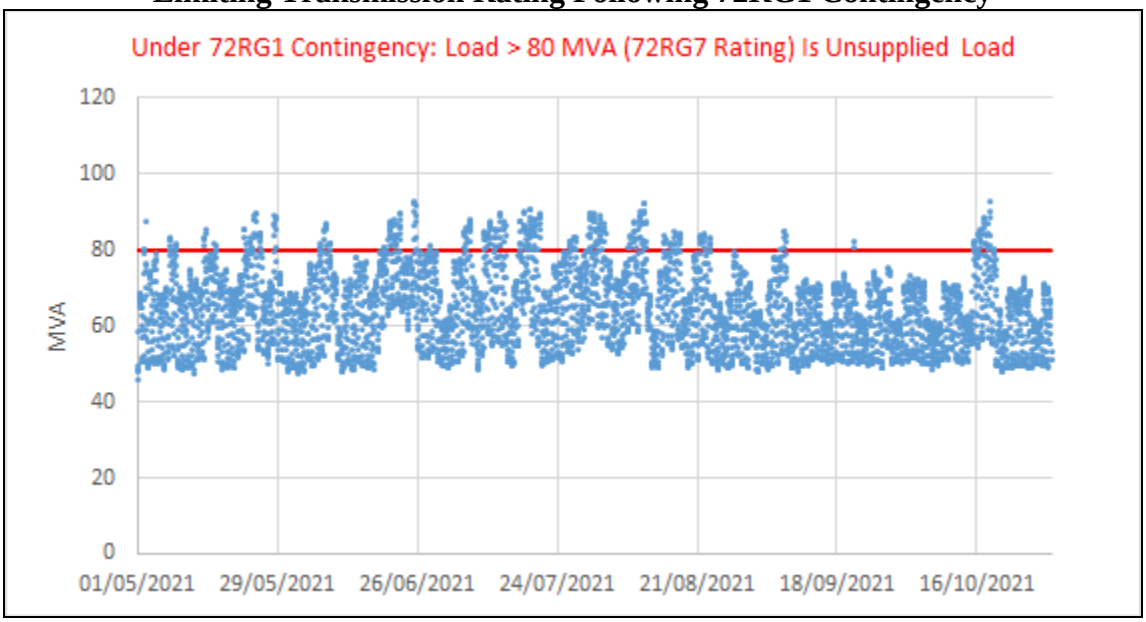


Figure EDTI-AESO-2019APR09-011 Attachment 1-12
2021 Summer Forecast Garneau 72 kV Load (With Actual U of A Generation) and Limiting Transmission Rating Following 72RG1 Contingency

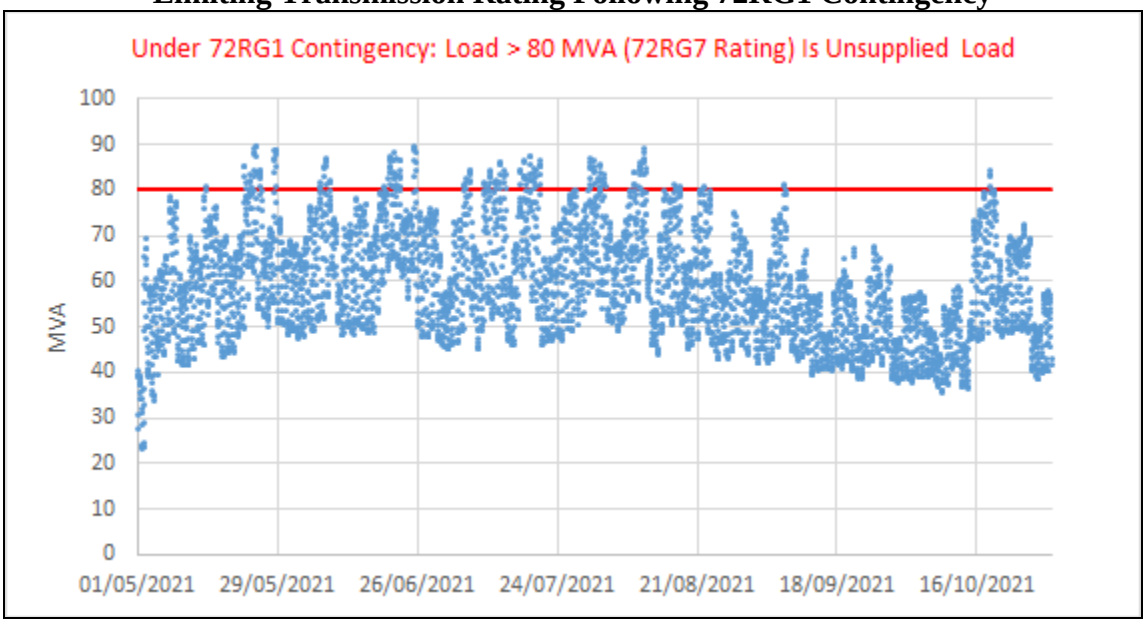


Figure EDTI-AESO-2019APR09-011 Attachment 1-13
2014 Summer Garneau 72 kV Load (With No U of A Generation Available) and Limiting Transmission Rating Following 72RG7 Contingency

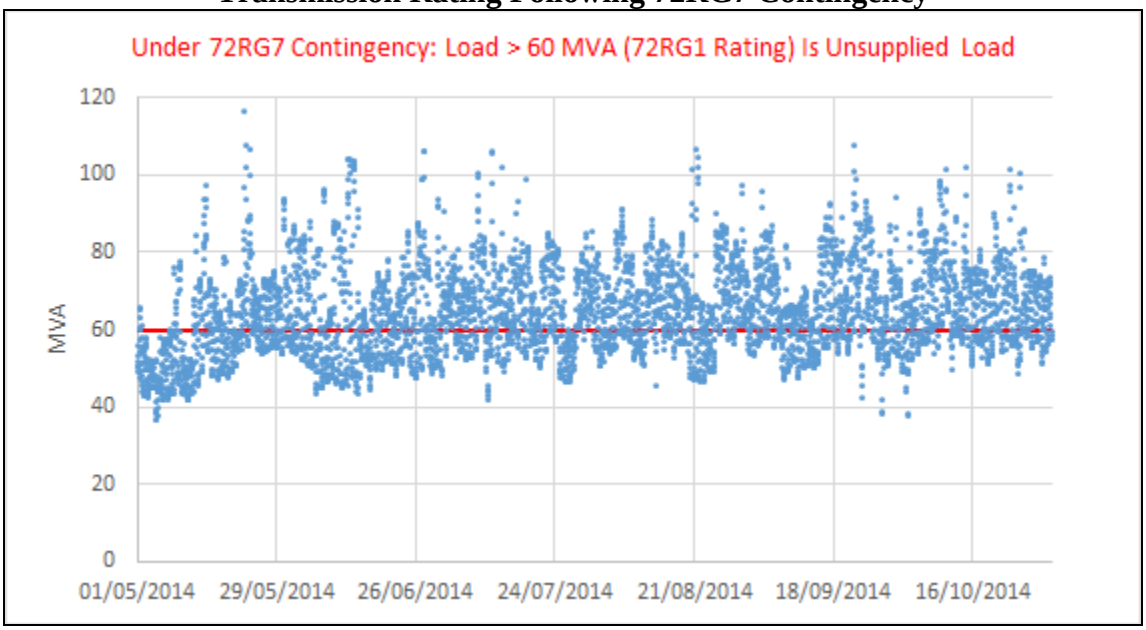


Figure EDTI-AESO-2019APR09-011 Attachment 1-14
2014 Summer Garneau 72 kV Load (With Actual U of A Generation) and Limiting Transmission Rating Following 72RG7 Contingency

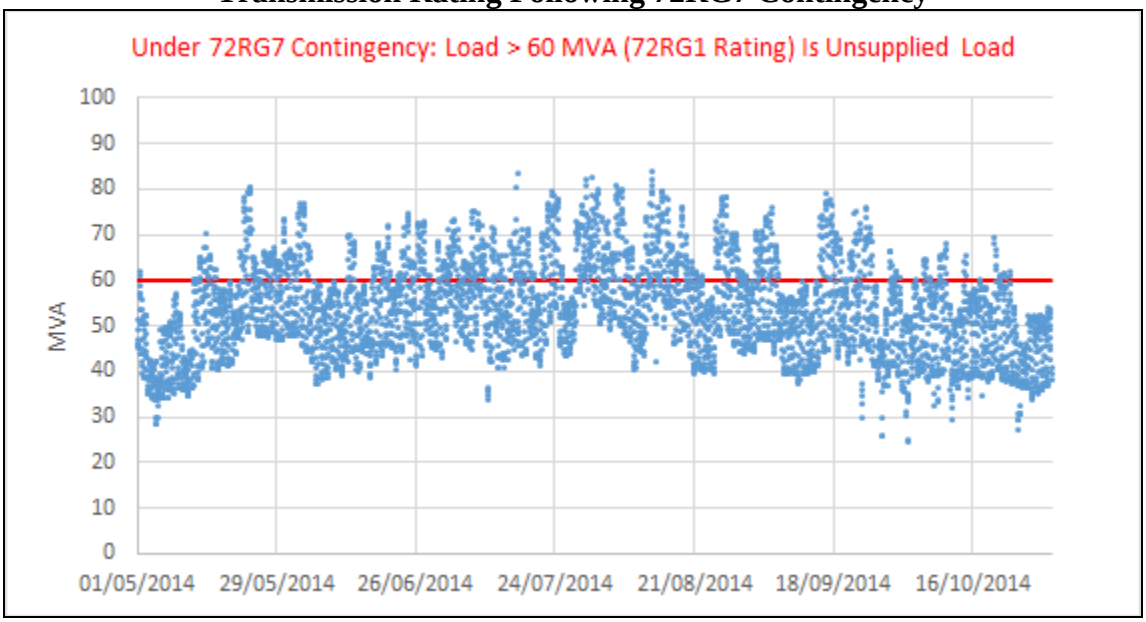


Figure EDTI-AESO-2019APR09-011 Attachment 1-15
2015 Summer Garneau 72 kV Load (With No U of A Generation Available) and Limiting Transmission Rating Following 72RG7 Contingency

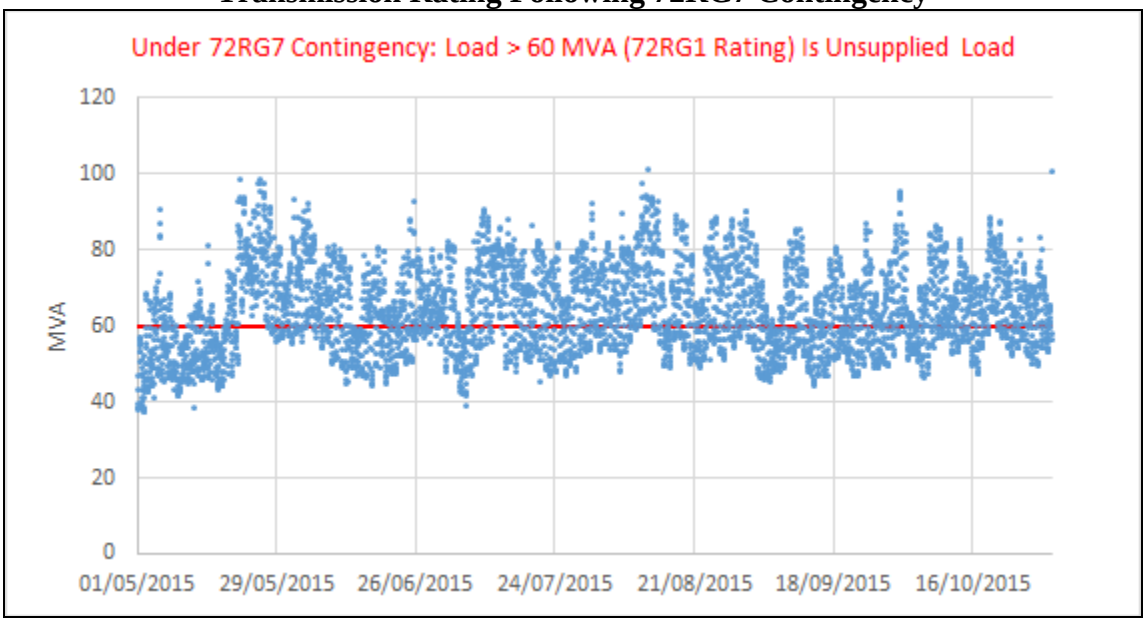


Figure EDTI-AESO-2019APR09-011 Attachment 1-16
2015 Summer Garneau 72 kV Load (With Actual U of A Generation) and Limiting Transmission Rating Following 72RG7 Contingency

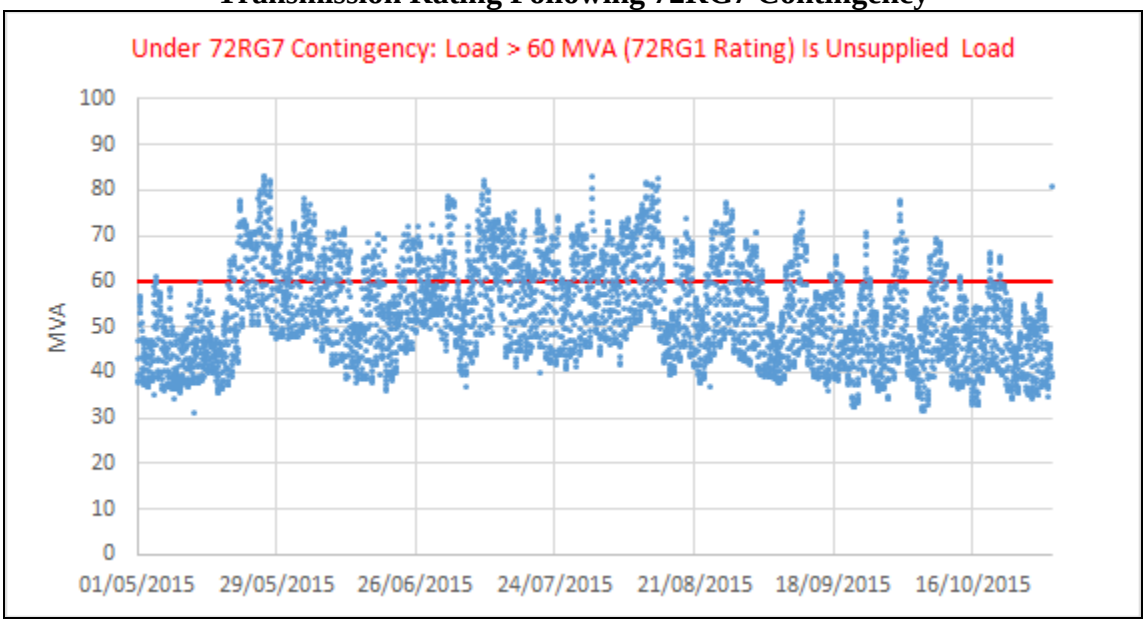


Figure EDTI-AESO-2019APR09-011 Attachment 1-17
2016 Summer Garneau 72 kV Load (With No U of A Generation Available) and Limiting Transmission Rating Following 72RG7 Contingency

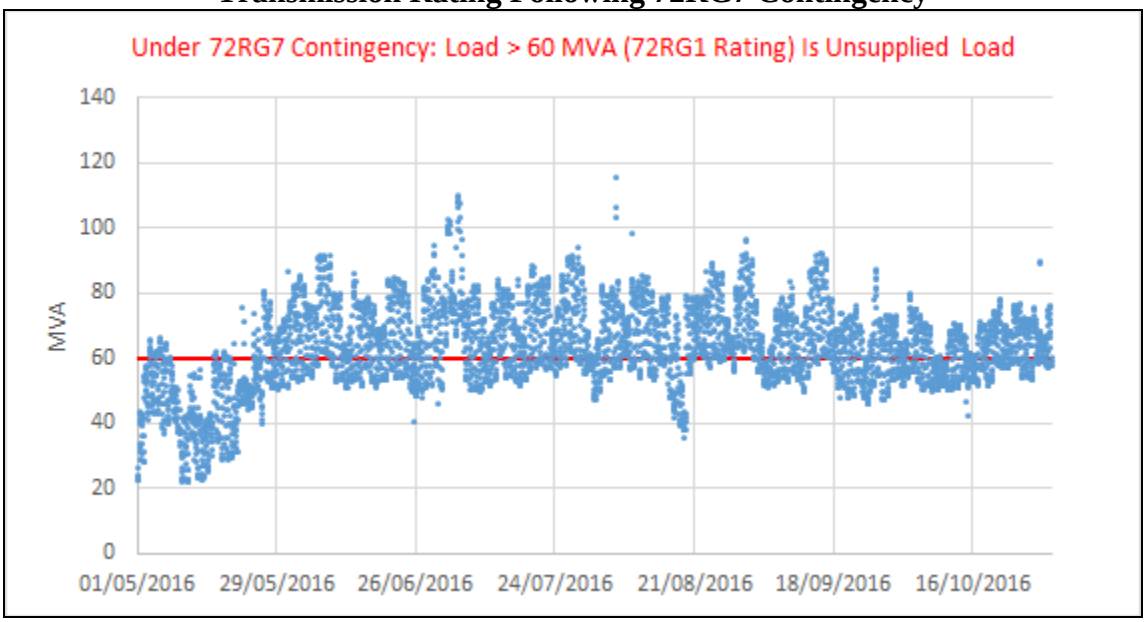


Figure EDTI-AESO-2019APR09-011 Attachment 1-18
2016 Summer Garneau 72 kV Load (With Actual U of A Generation) and Limiting Transmission Rating Following 72RG7 Contingency

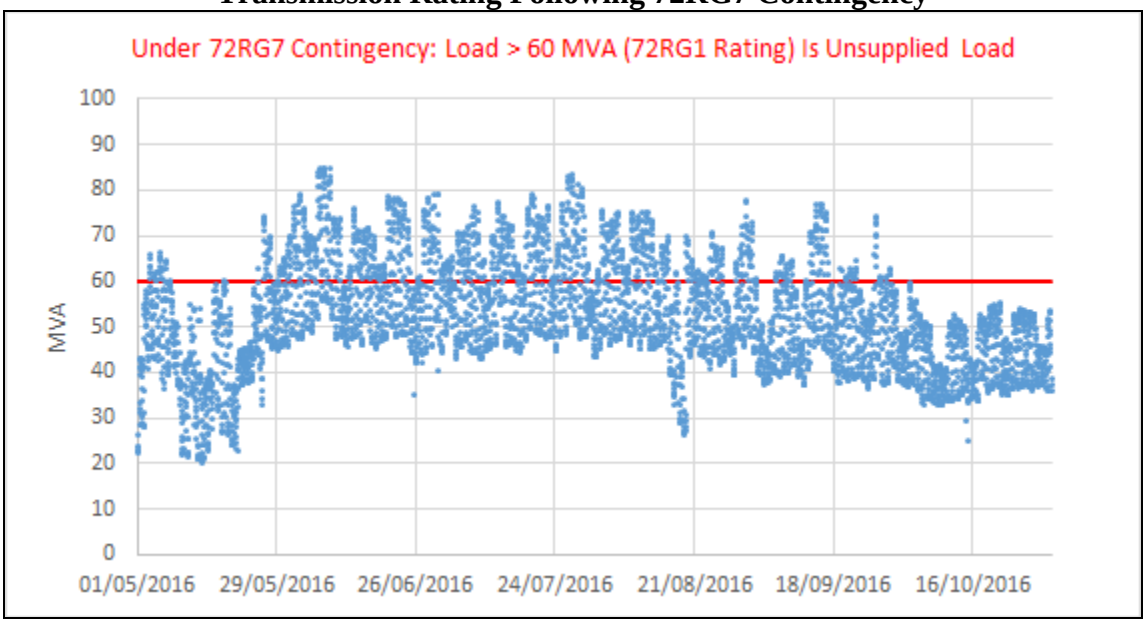


Figure EDTI-AESO-2019APR09-011 Attachment 1-19
2017 Summer Garneau 72 kV Load (With No U of A Generation Available) and Limiting Transmission Rating Following 72RG7 Contingency

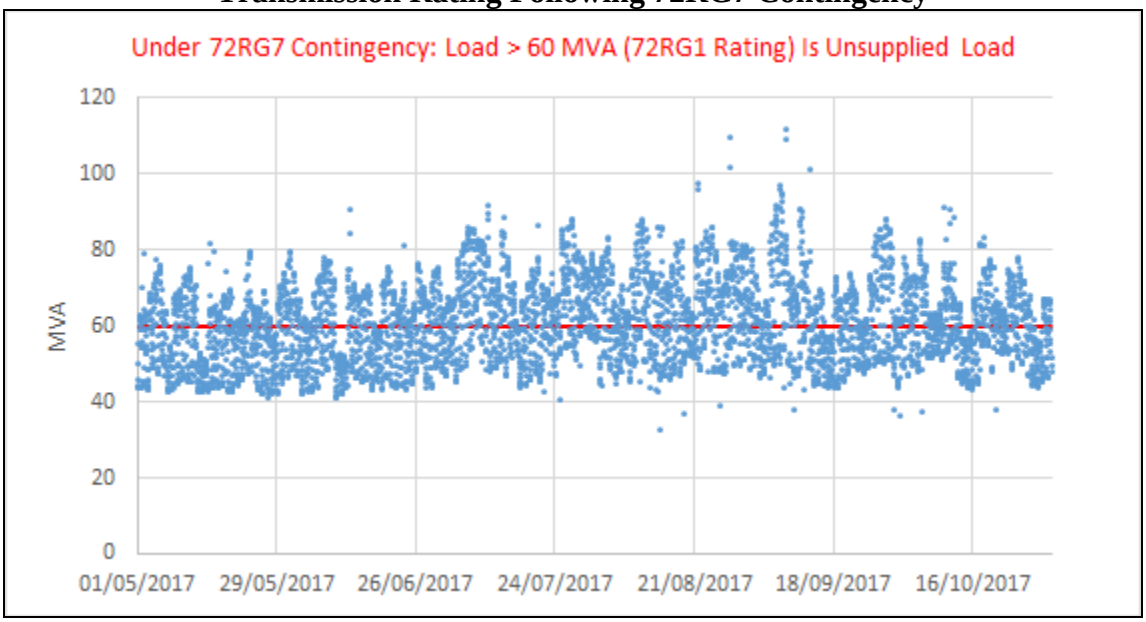


Figure EDTI-AESO-2019APR09-011 Attachment 1-20
2017 Summer Garneau 72 kV Load (With Actual U of A Generation) and Limiting Transmission Rating Following 72RG7 Contingency

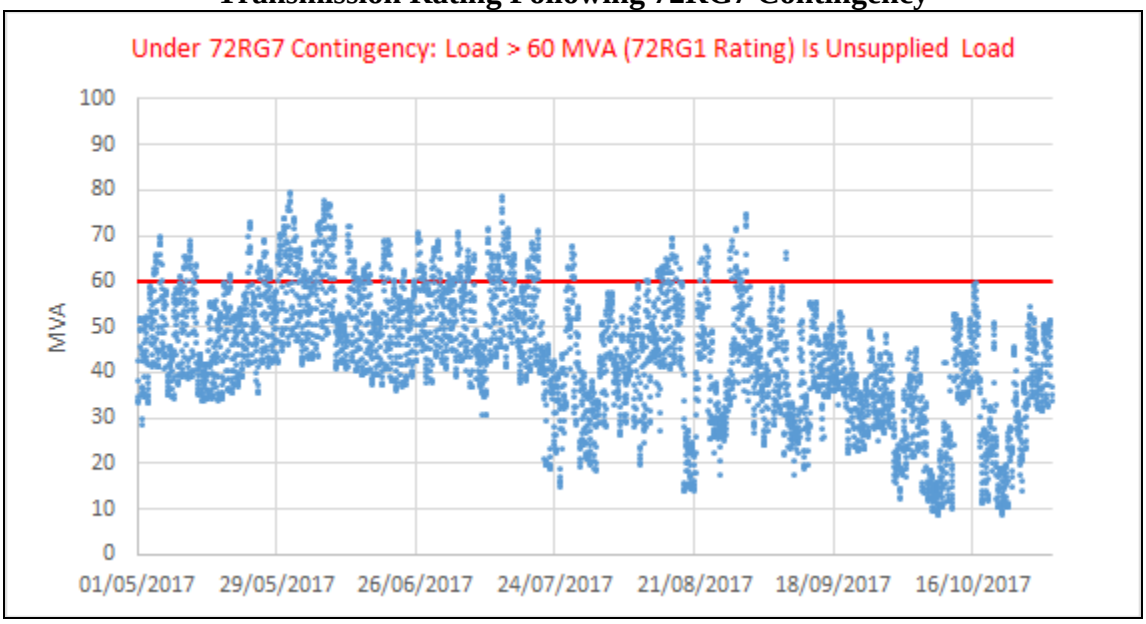


Figure EDTI-AESO-2019APR09-011 Attachment 1-21
2018 Summer Garneau 72 kV Load (With No U of A Generation Available) and Limiting Transmission Rating Following 72RG7 Contingency

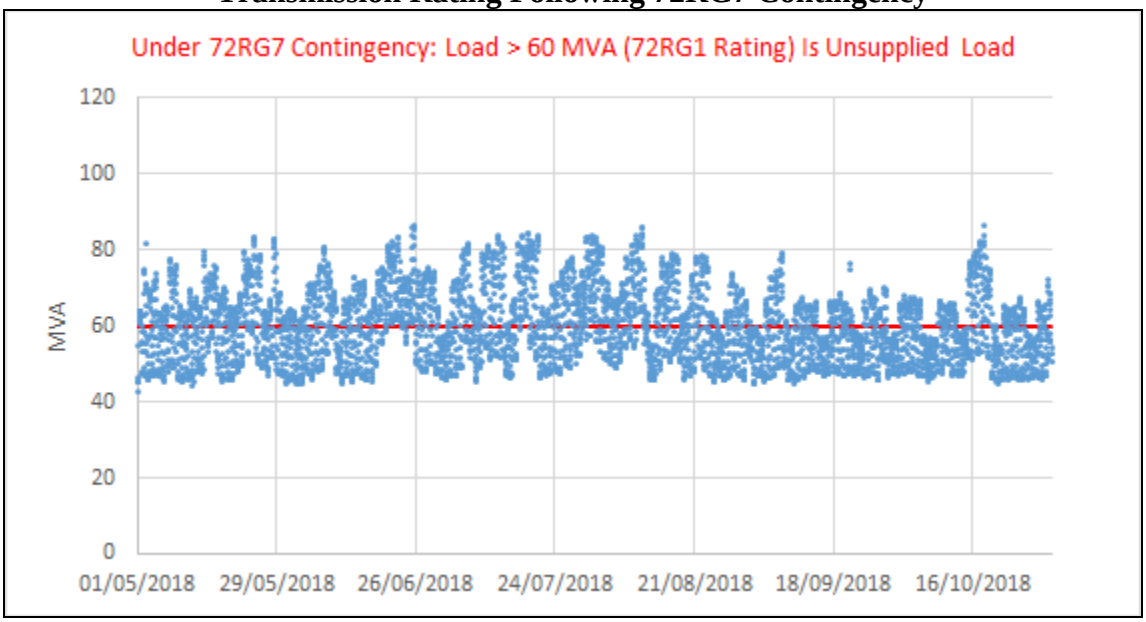


Figure EDTI-AESO-2019APR09-011 Attachment 1-22
2018 Summer Garneau 72 kV Load (With Actual U of A Generation) and Limiting Transmission Rating Following 72RG7 Contingency

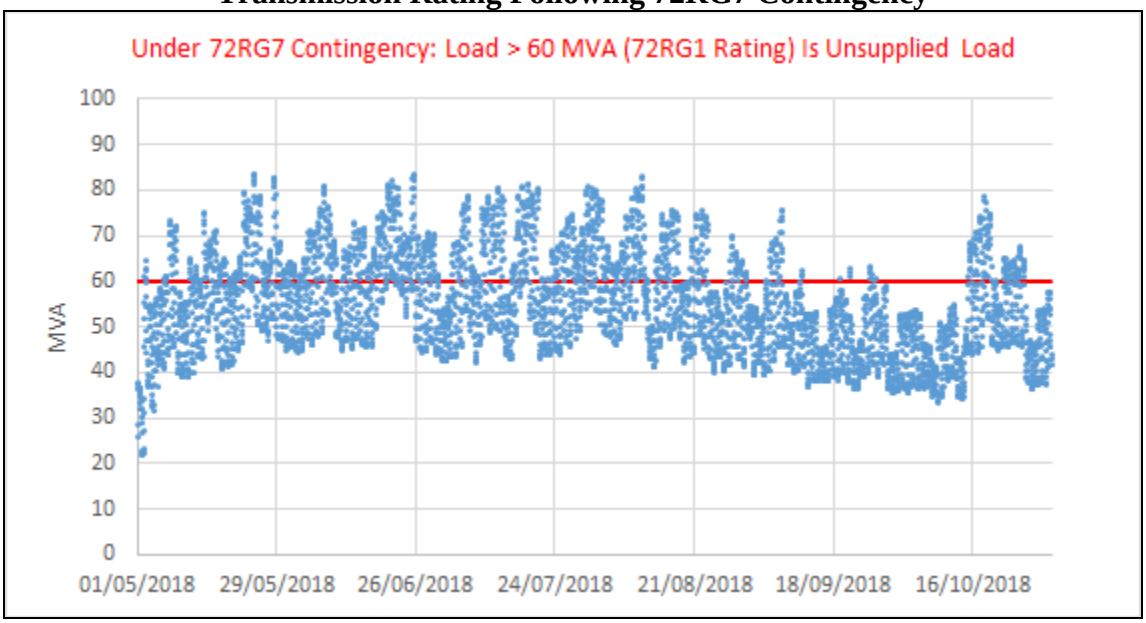


Figure EDTI-AESO-2019APR09-011 Attachment 1-23
2021 Forecast Summer Garneau 72 kV Load (With No U of A Generation Available) and Limiting Transmission Rating Following 72RG7 Contingency

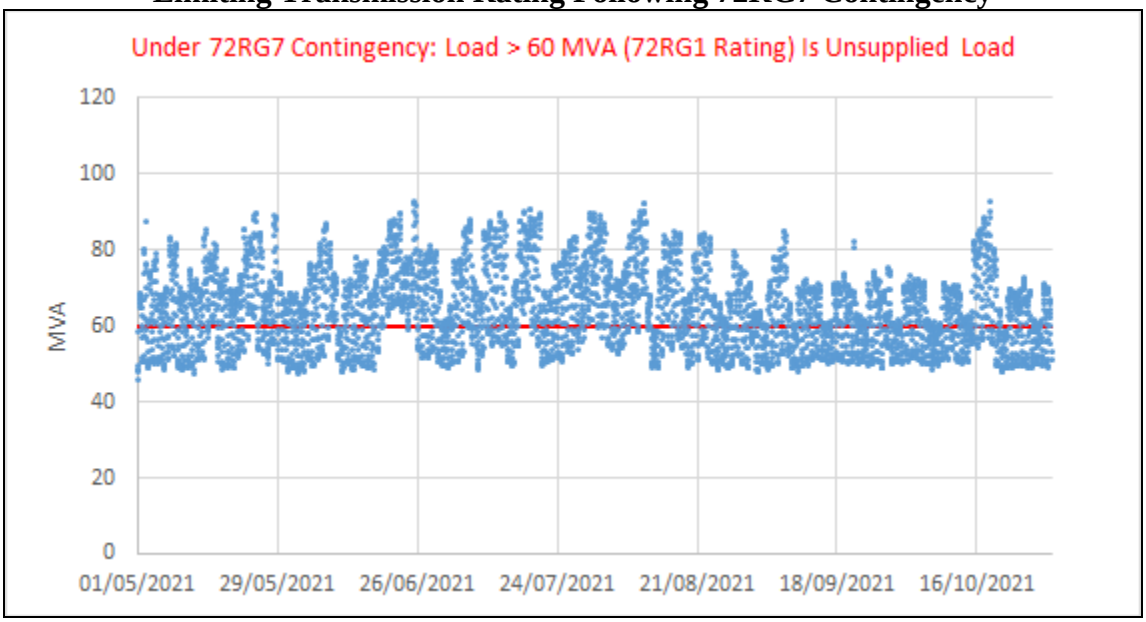


Figure EDTI-AESO-2019APR09-011 Attachment 1-24
2021 Forecast Summer Garneau 72 kV Load (With Actual U of A Generation) and Limiting Transmission Rating Following 72RG7 Contingency

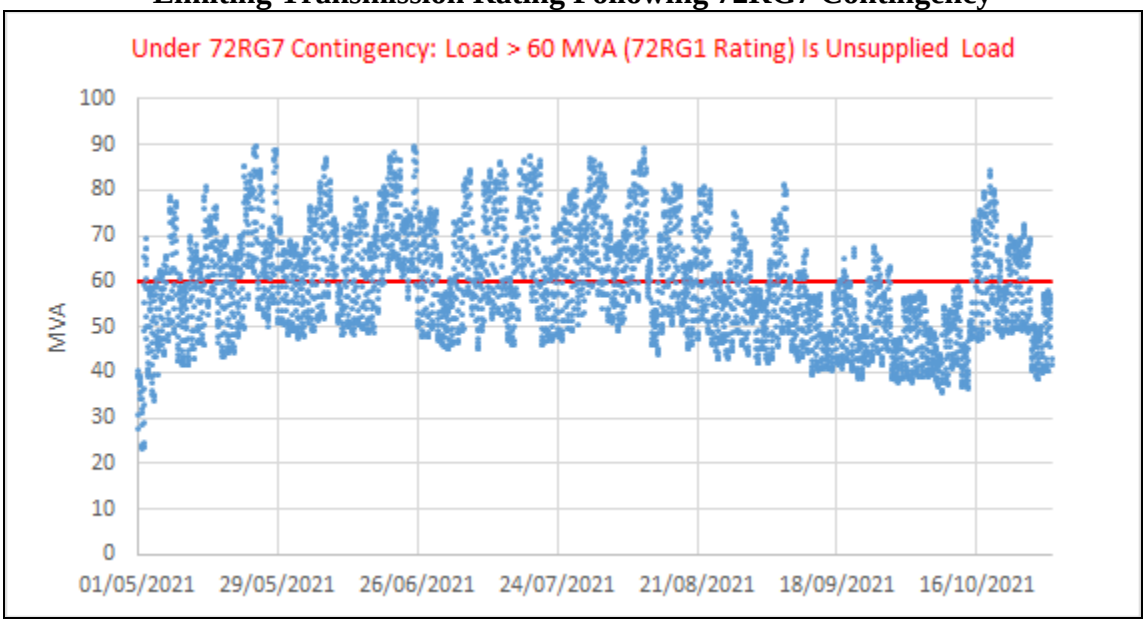


Figure EDTI-AESO-2019APR09-011 Attachment 1-25
2014 Summer Meadowlark 72 kV Load and Limiting Transmission Rating Following 72MG16 Contingency

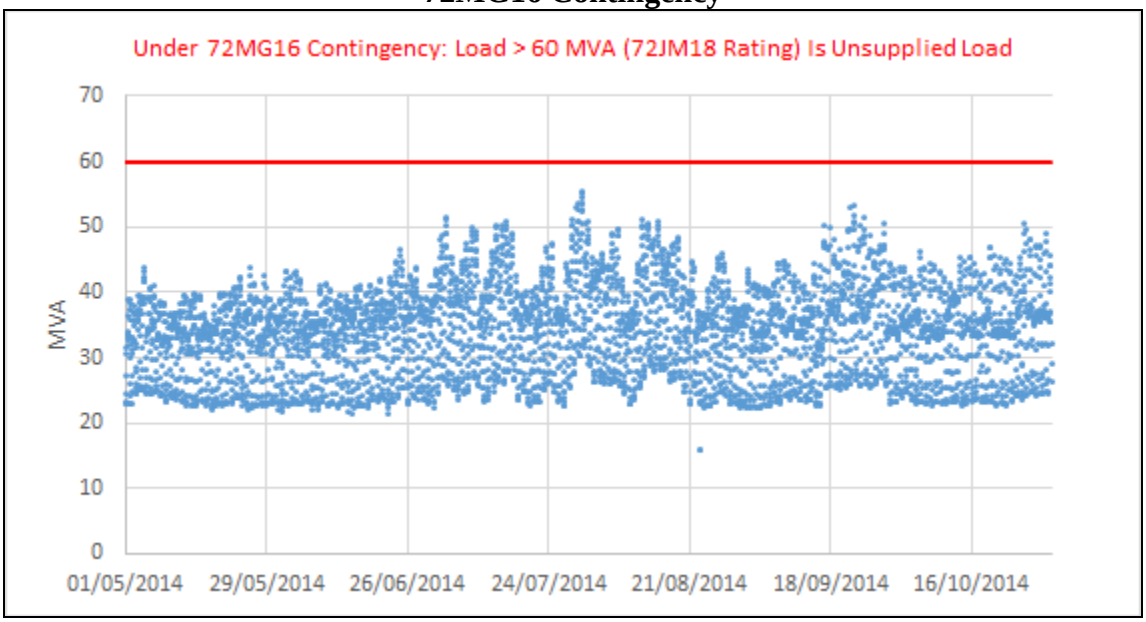


Figure EDTI-AESO-2019APR09-011 Attachment 1-26
2015 Summer Meadowlark 72 kV Load and Limiting Transmission Rating Following 72MG16 Contingency

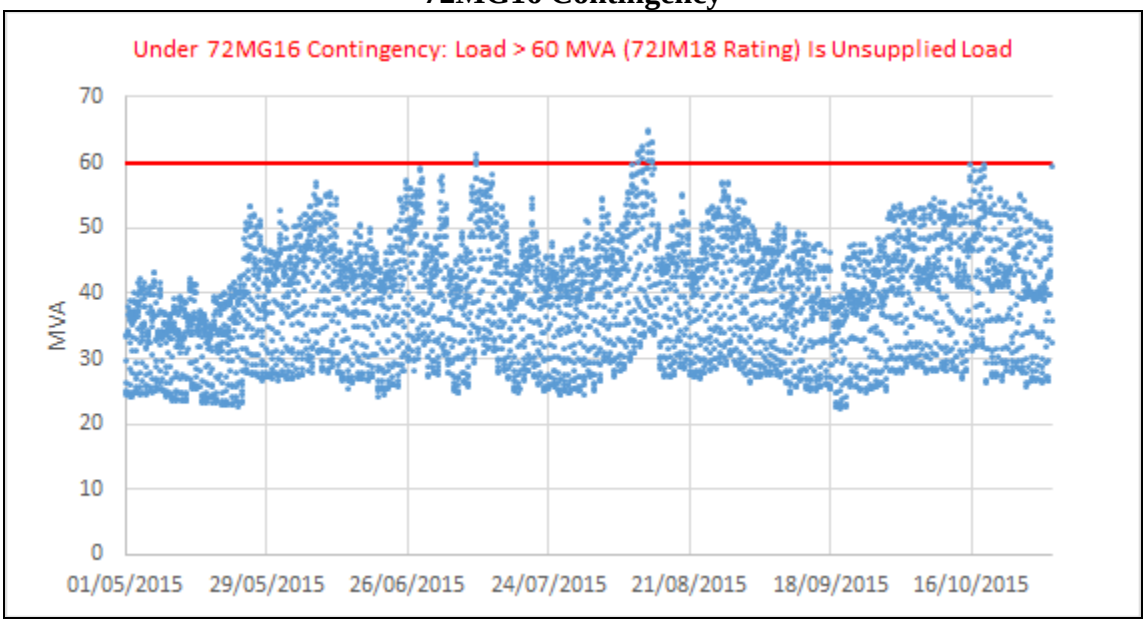


Figure EDTI-AESO-2019APR09-011 Attachment 1-27
2016 Summer Meadowlark 72 kV Load and Limiting Transmission Rating Following 72MG16 Contingency

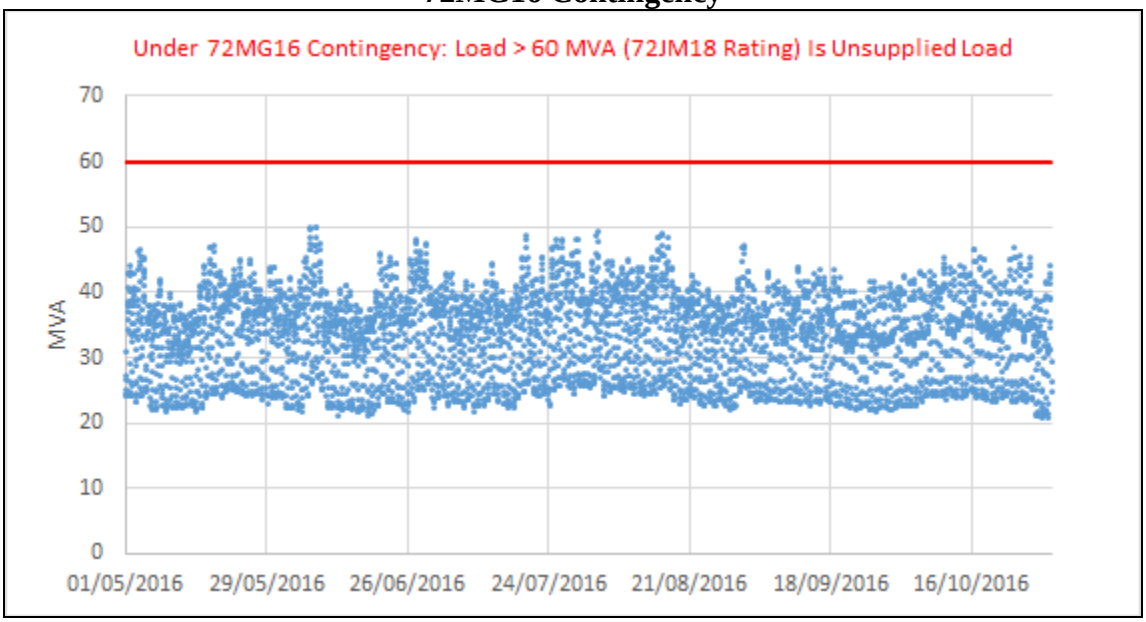


Figure EDTI-AESO-2019APR09-011 Attachment 1-28
2017 Summer Meadowlark 72 kV Load and Limiting Transmission Rating Following 72MG16 Contingency

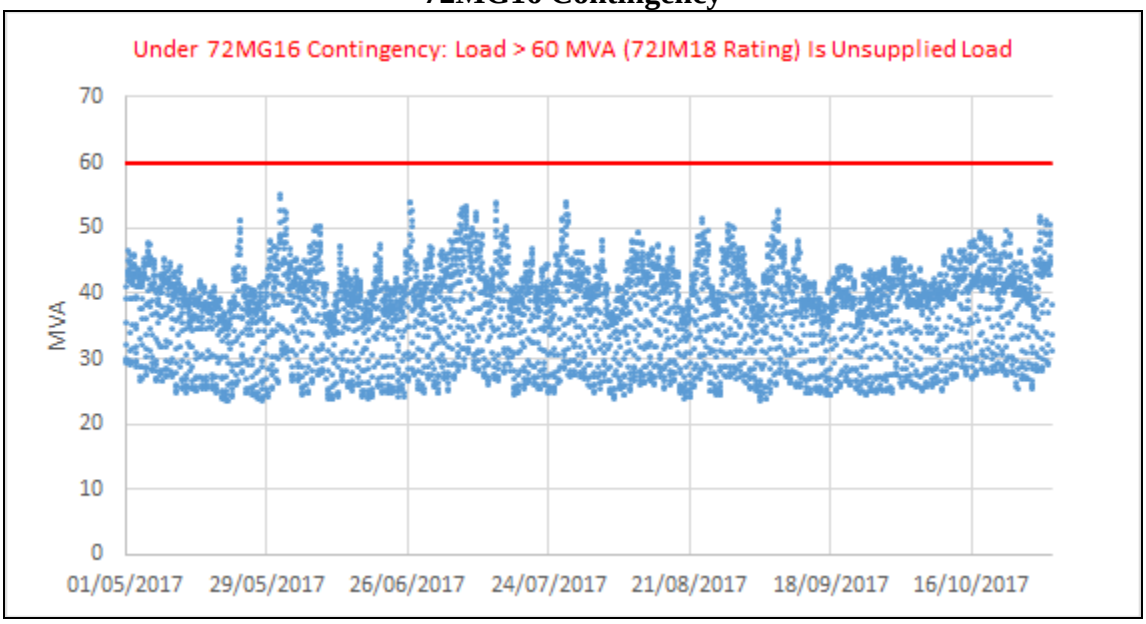


Figure EDTI-AESO-2019APR09-011 Attachment 1-29
2018 Summer Meadowlark 72 kV Load and Limiting Transmission Rating Following 72MG16 Contingency

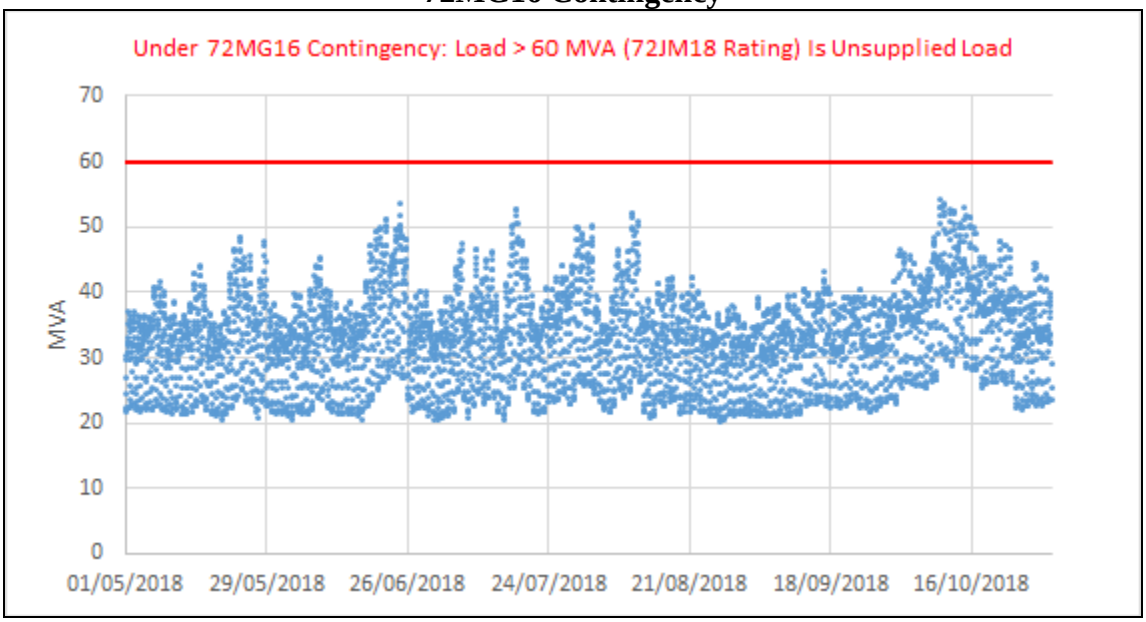


Figure EDTI-AESO-2019APR09-011 Attachment 1-30
2021 Forecast Summer Meadowlark 72 kV Load and Limiting Transmission Rating Following 72MG16 Contingency

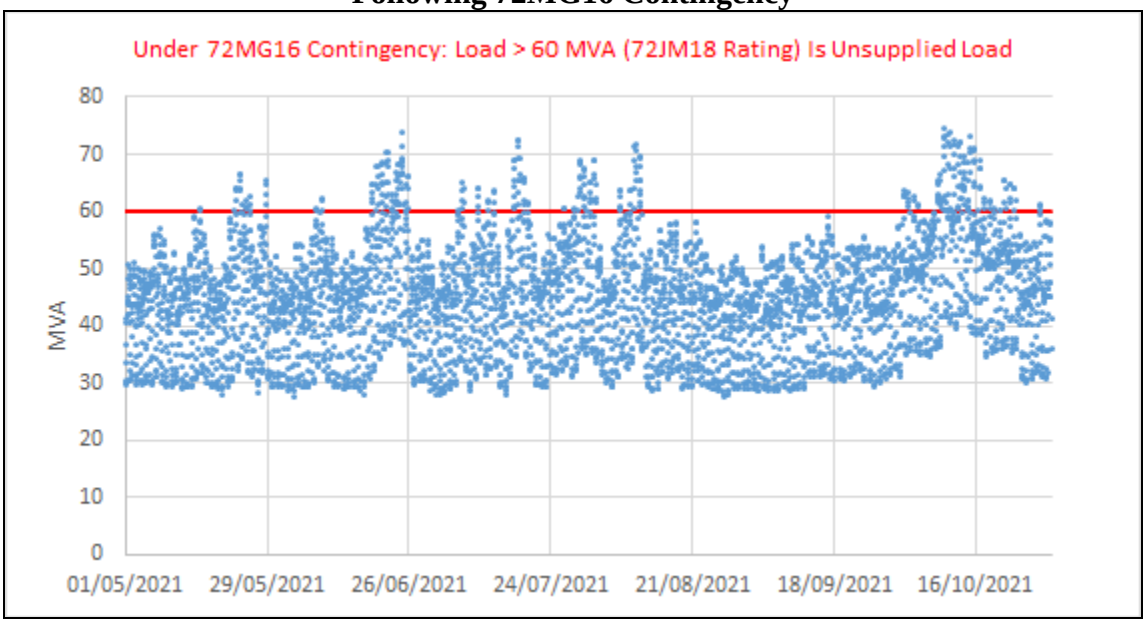


Figure EDTI-AESO-2019APR09-011 Attachment 1-31
2014 Summer Garneau+Meadowlark 72 kV Load and Limiting Transmission Rating (With No U of A Generation Available) Following 72JM18 or Jasper TX 1 Contingency

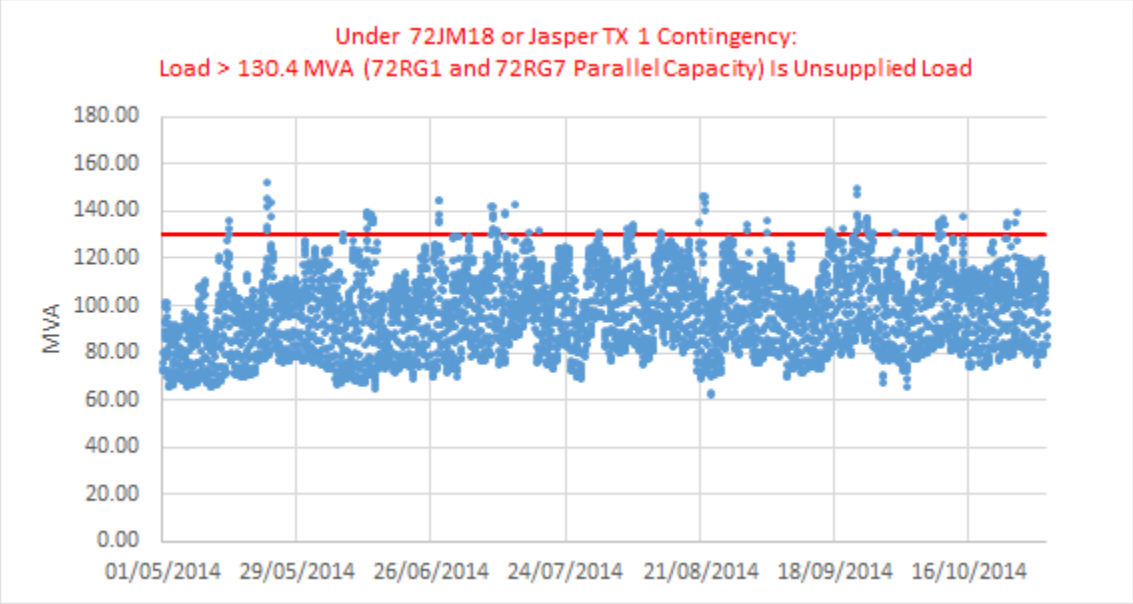


Figure EDTI-AESO-2019APR09-011 Attachment 1-32
2014 Summer Garneau+Meadowlark 72 kV Load and Limiting Transmission Rating (With Actual U of A Generation) Following 72JM18 or Jasper TX 1 Contingency

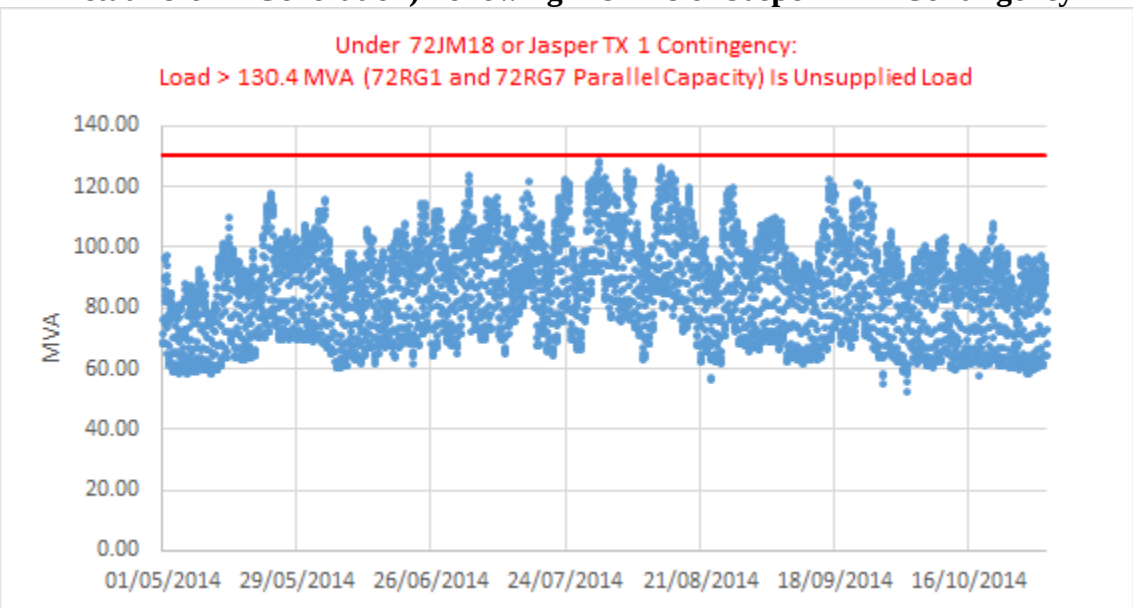


Figure EDTI-AESO-2019APR09-011 Attachment 1-33
2014 Summer Meadowlark 72 kV Load and Limiting Transmission Rating (With No U of A Generation Available) Following 72JM18 or Jasper TX 1 Contingency

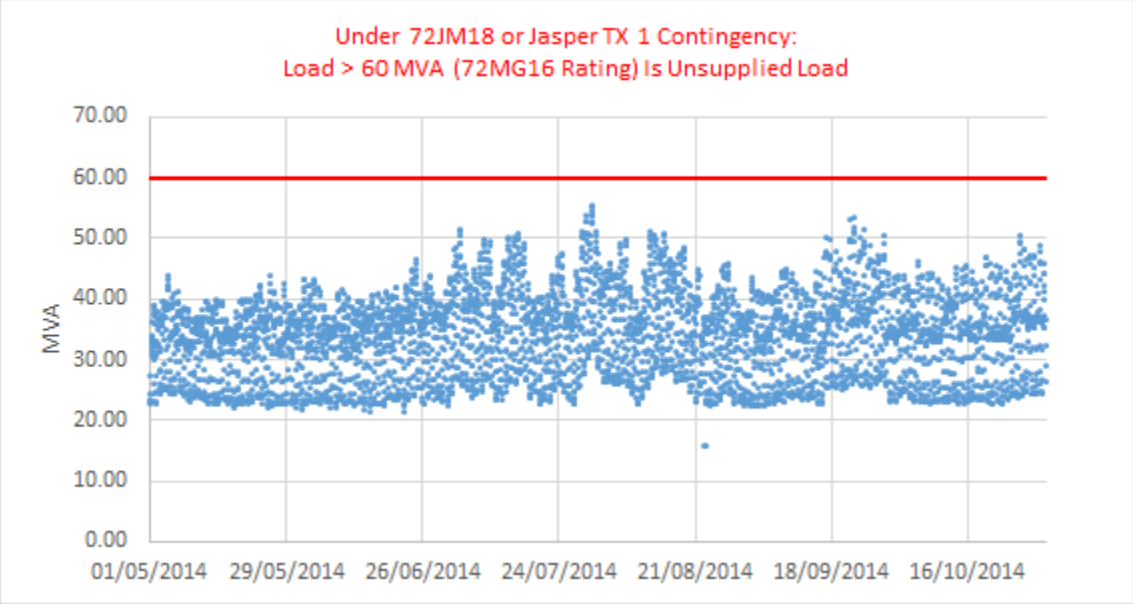


Figure EDTI-AESO-2019APR09-011 Attachment 1-34
2015 Summer Garneau+Meadowlark 72 kV Load and Limiting Transmission Rating (With No U of A Generation Available) Following 72JM18 or Jasper TX 1 Contingency

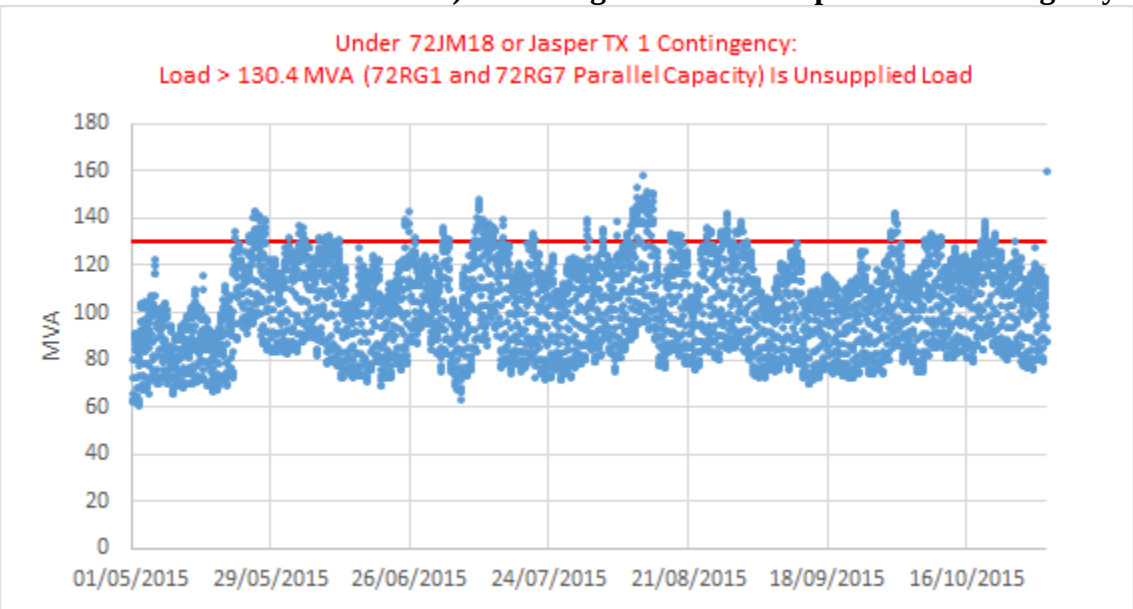


Figure EDTI-AESO-2019APR09-011 Attachment 1-35
2015 Summer Garneau+Meadowlark 72 kV Load and Limiting Transmission Rating (With Actual U of A Generation) Following 72JM18 or Jasper TX 1 Contingency

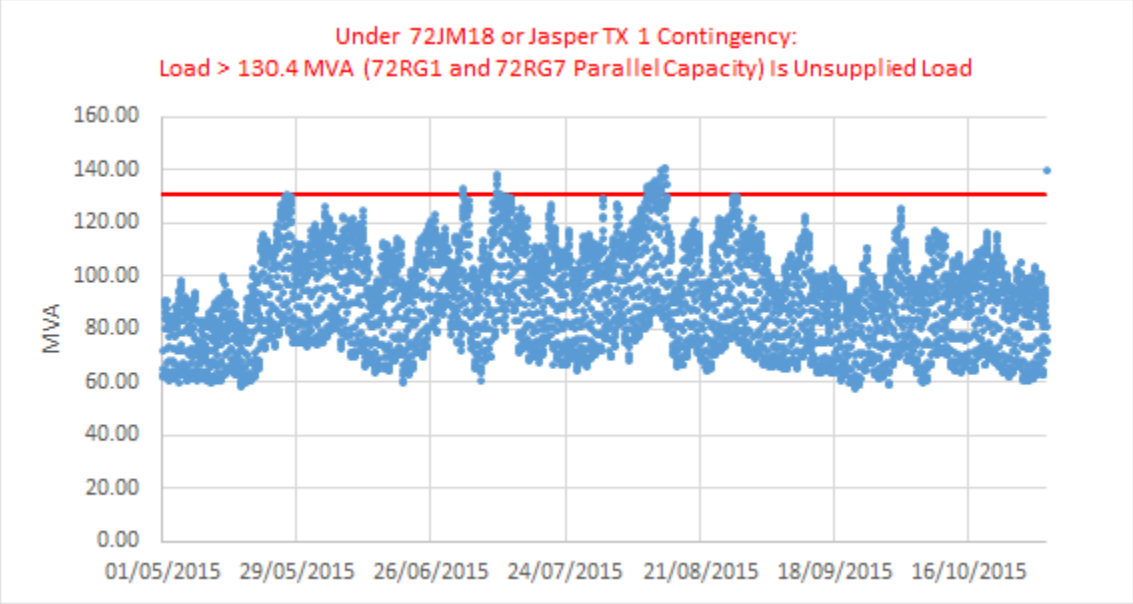


Figure EDTI-AESO-2019APR09-011 Attachment 1-36
2015 Summer Meadowlark 72 kV Load and Limiting Transmission Rating (With No U of A Generation Available) Following 72JM18 or Jasper TX 1 Contingency

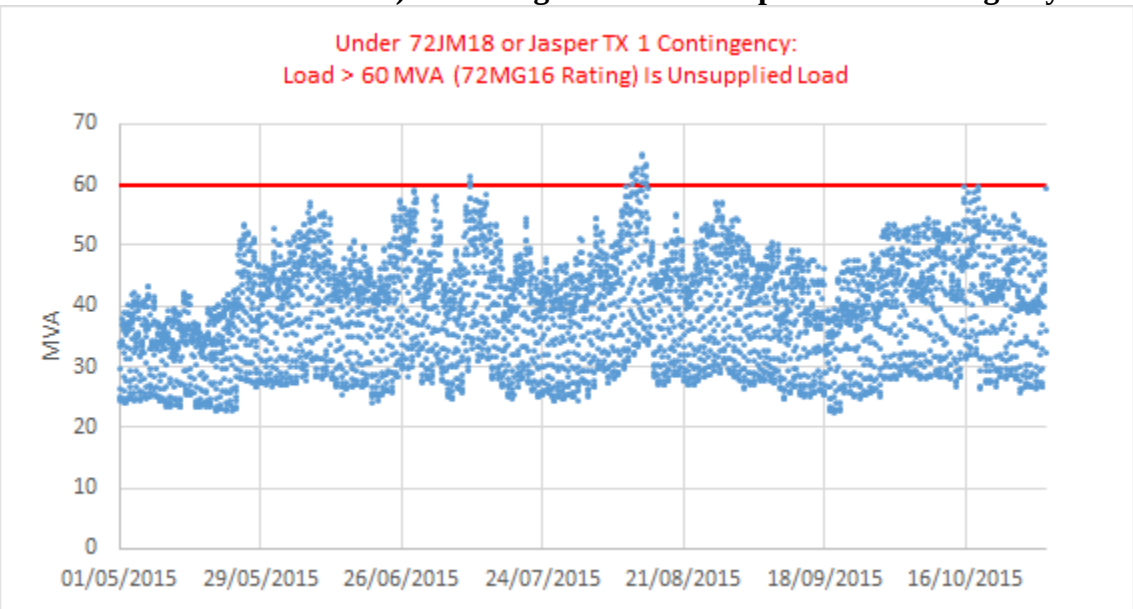


Figure EDTI-AESO-2019APR09-011 Attachment 1-37
2016 Summer Garneau+Meadowlark 72 kV Load and Limiting Transmission Rating (With No U of A Generation Available) Following 72JM18 or Jasper TX 1 Contingency

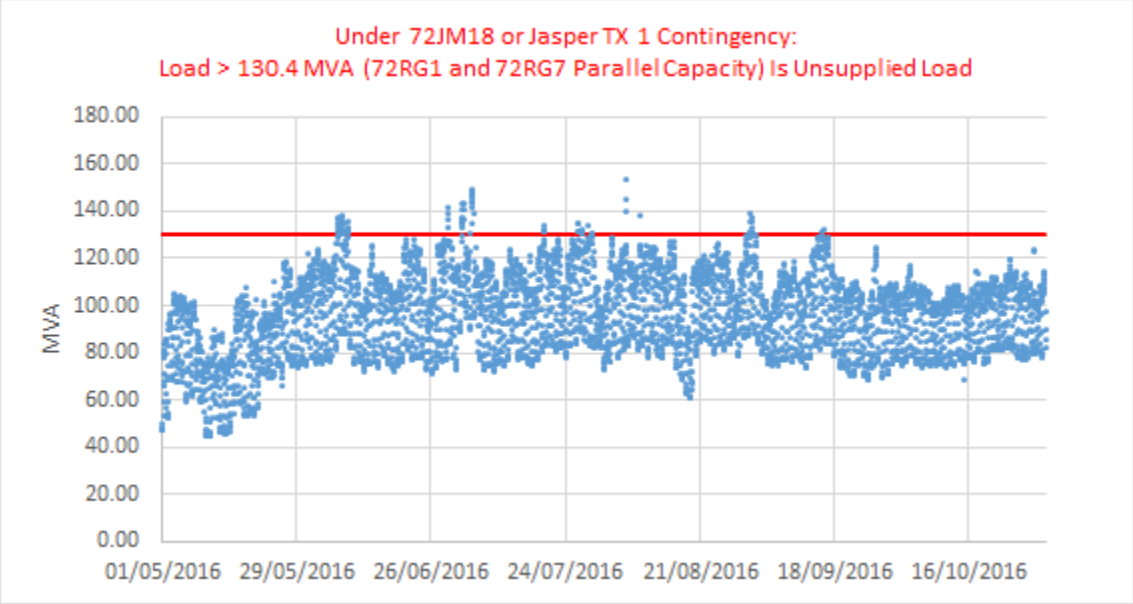


Figure EDTI-AESO-2019APR09-011 Attachment 1-38
2016 Summer Garneau+Meadowlark 72 kV Load and Limiting Transmission Rating (With Actual U of A Generation) Following 72JM18 or Jasper TX 1 Contingency

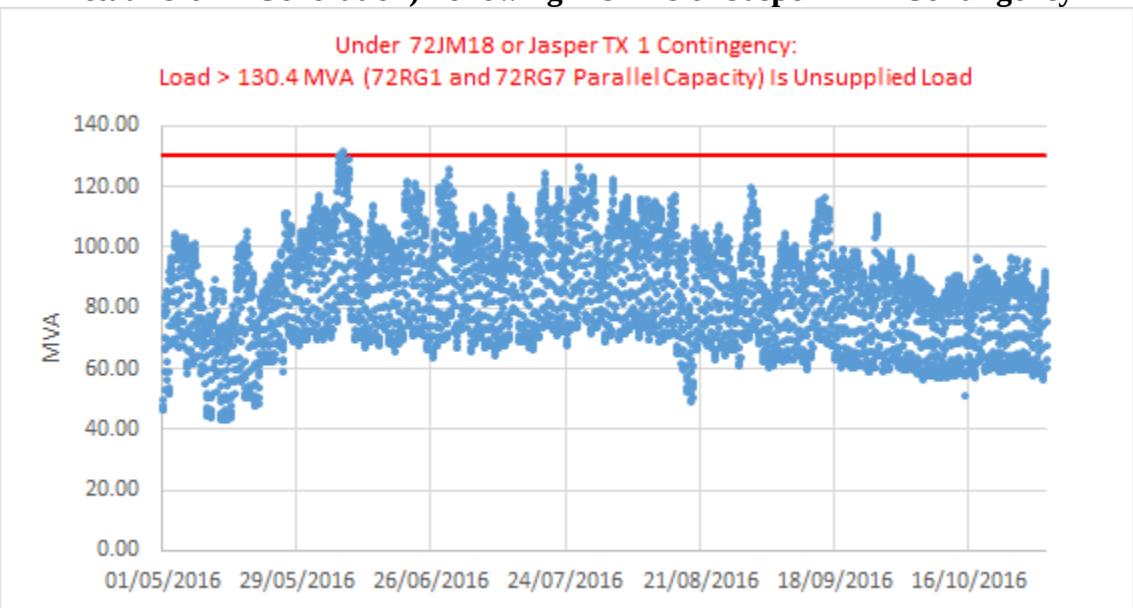


Figure EDTI-AESO-2019APR09-011 Attachment 1-39
2016 Summer Meadowlark 72 kV Load and Limiting Transmission Rating (With No U of A Generation Available) Following 72JM18 or Jasper TX 1 Contingency

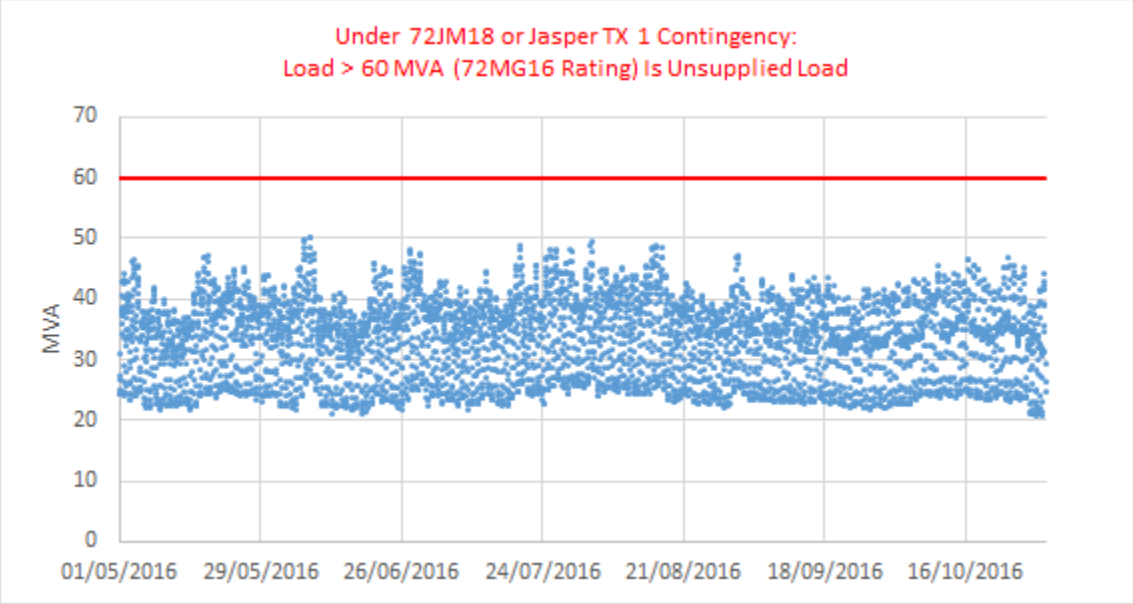


Figure EDTI-AESO-2019APR09-011 Attachment 1-40
2017 Summer Garneau+Meadowlark 72 kV Load and Limiting Transmission Rating (With No U of A Generation Available) Following 72JM18 or Jasper TX 1 Contingency

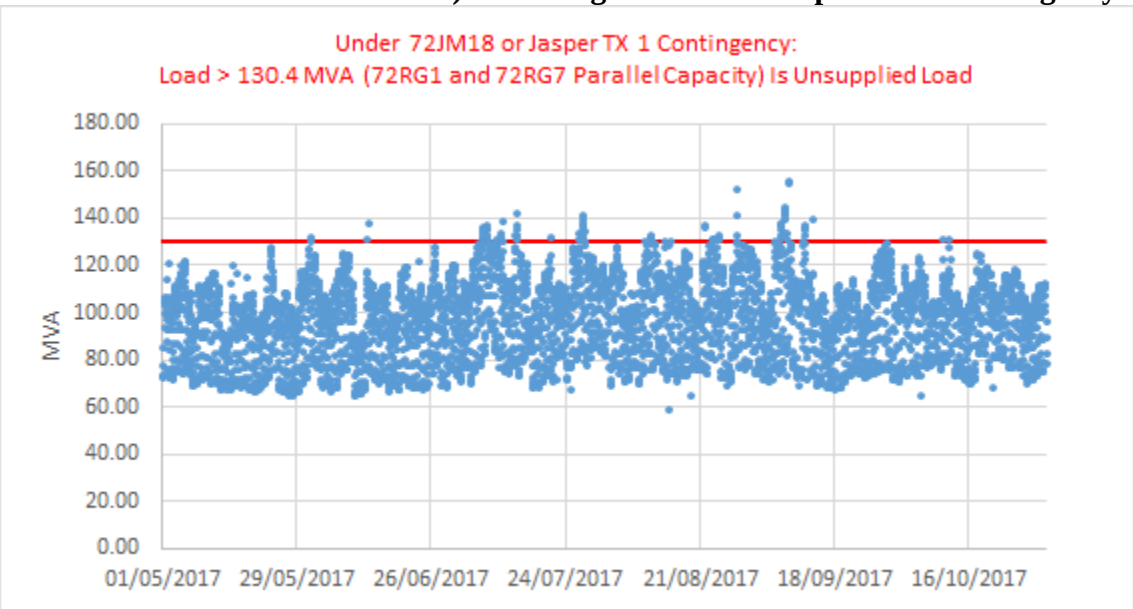


Figure EDTI-AESO-2019APR09-011 Attachment 1-41
2017 Summer Garneau+Meadowlark 72 kV Load and Limiting Transmission Rating (With Actual U of A Generation) Following 72JM18 or Jasper TX 1 Contingency

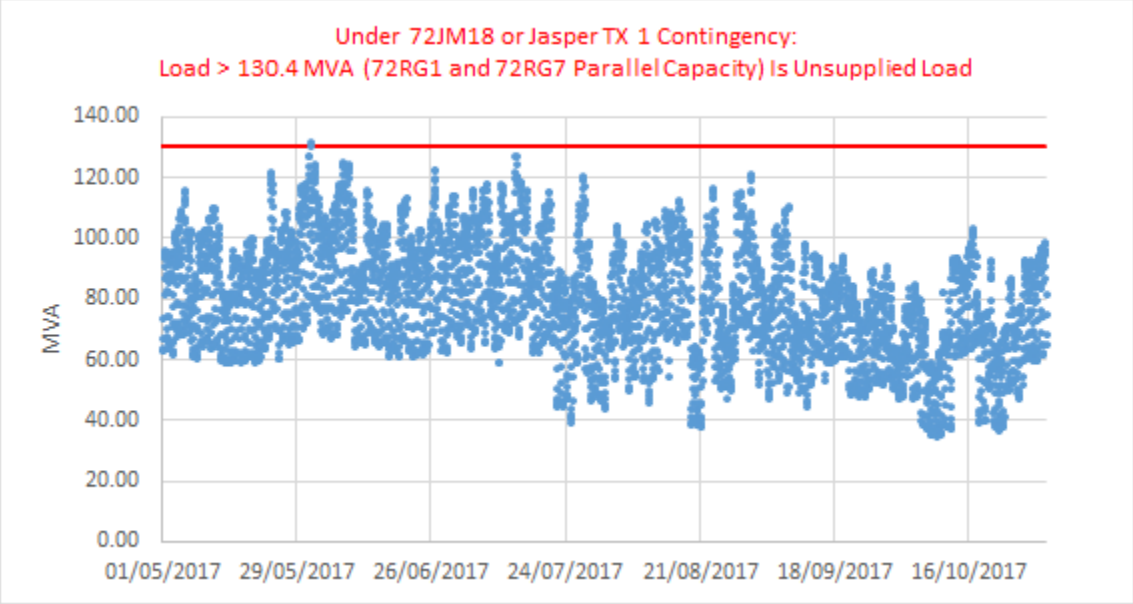


Figure EDTI-AESO-2019APR09-011 Attachment 1-42
2017 Summer Meadowlark 72 kV Load and Limiting Transmission Rating (With No U of A Generation Available) Following 72JM18 or Jasper TX 1 Contingency

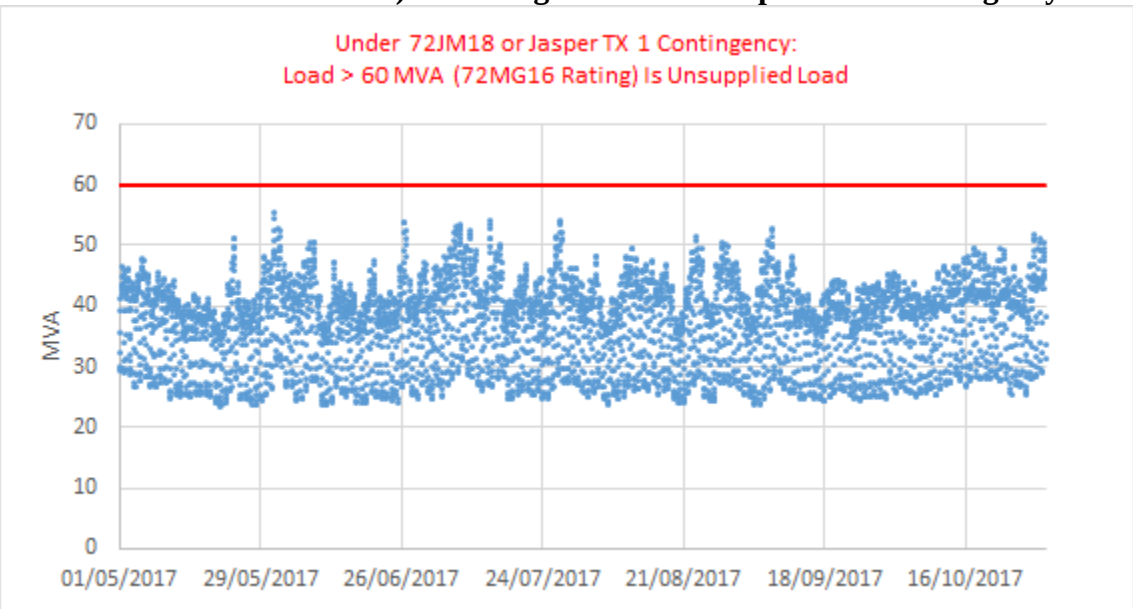


Figure EDTI-AESO-2019APR09-011 Attachment 1-43
2018 Summer Garneau+Meadowlark 72 kV Load and Limiting Transmission Rating (With No U of A Generation Available) Following 72JM18 or Jasper TX 1 Contingency

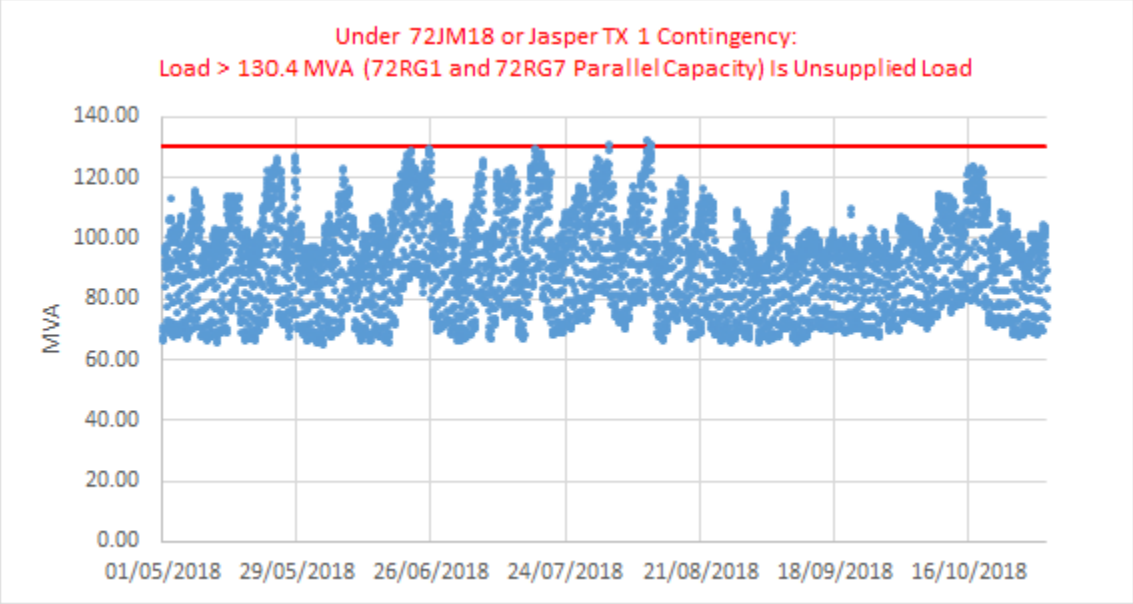


Figure EDTI-AESO-2019APR09-011 Attachment 1-44
2018 Summer Garneau+Meadowlark 72 kV Load and Limiting Transmission Rating (With Actual U of A Generation) Following 72JM18 or Jasper TX 1 Contingency

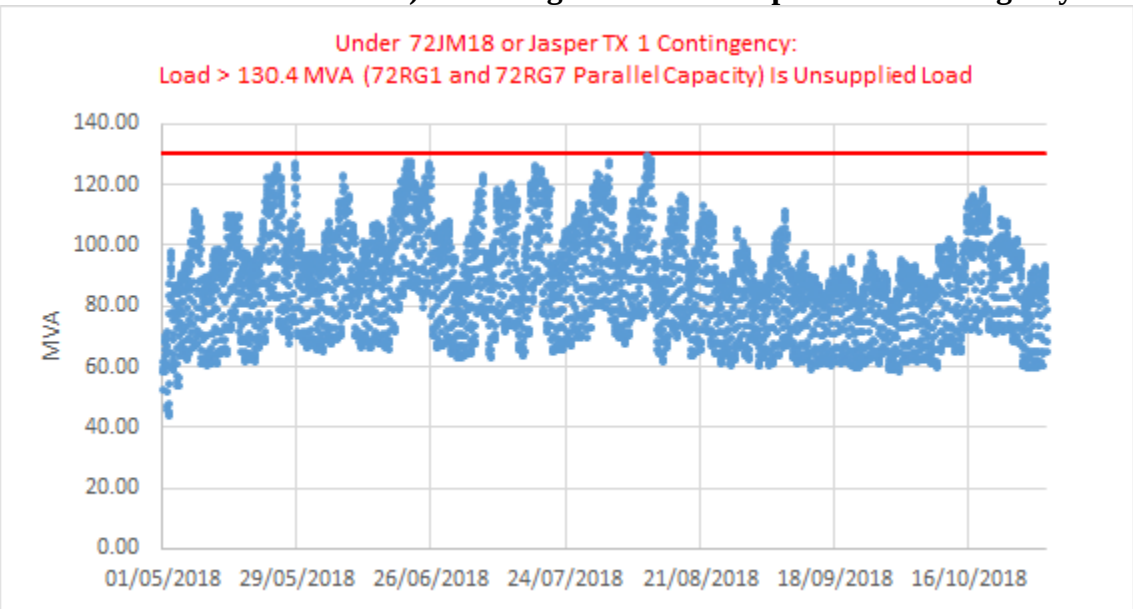


Figure EDTI-AESO-2019APR09-011 Attachment 1-45
2018 Summer Meadowlark 72 kV Load and Limiting Transmission Rating (With No U of A Generation Available) Following 72JM18 or Jasper TX 1 Contingency

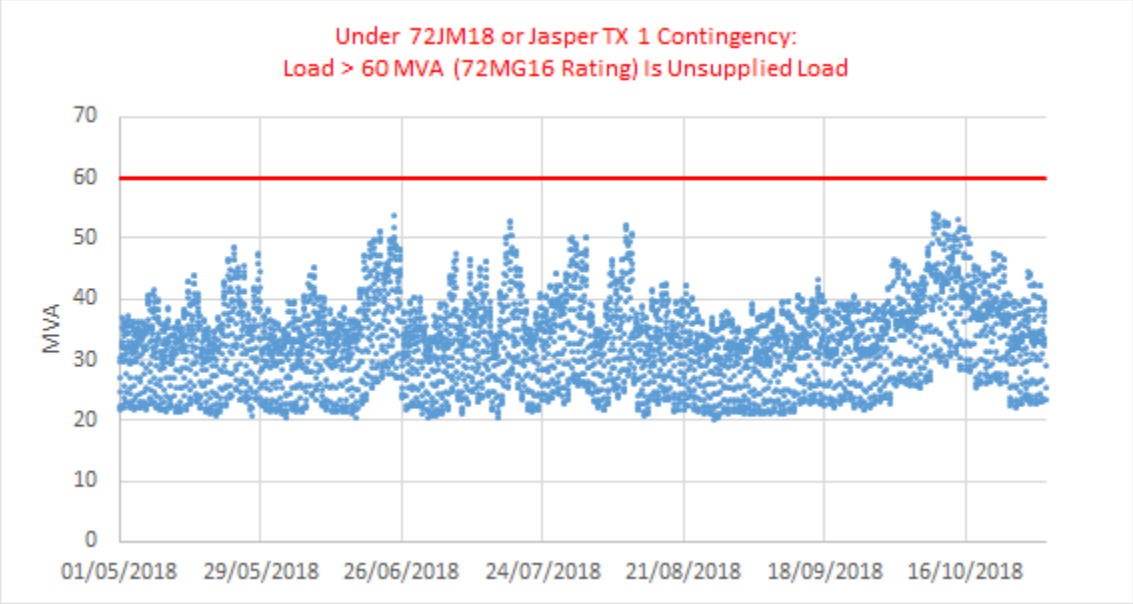


Figure EDTI-AESO-2019APR09-011 Attachment 1-46
2021 Forecast Summer Garneau+Meadowlark 72 kV Load and Limiting Transmission Rating (With No U of A Generation Available) Following 72JM18 or Jasper TX 1 Contingency

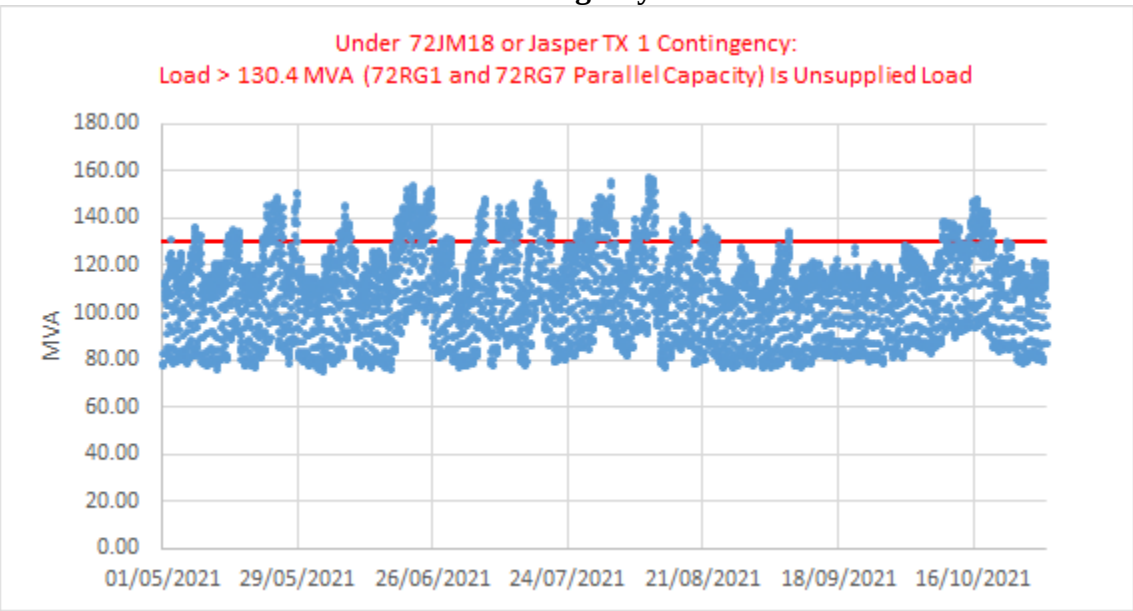


Figure EDTI-AESO-2019APR09-011 Attachment 1-47
2021 Forecast Summer Garneau+Meadowlark 72 kV Load and Limiting Transmission Rating (With Actual U of A Generation) Following 72JM18 or Jasper TX 1 Contingency

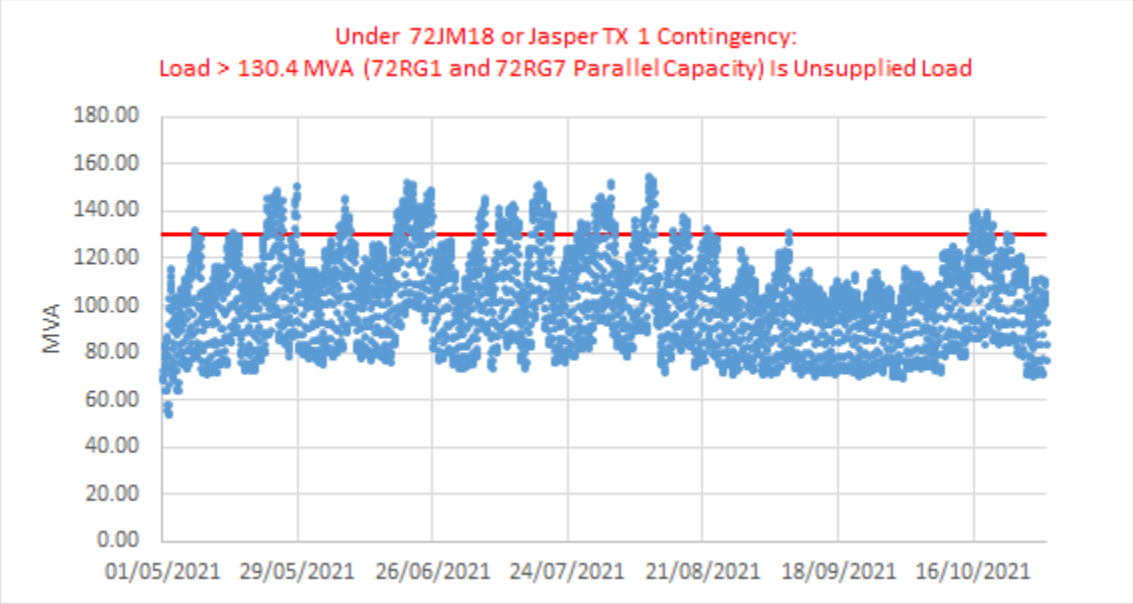


Figure EDTI-AESO-2019APR09-011 Attachment 1-48
2021 Forecast Summer Meadowlark 72 kV Load and Limiting Transmission Rating (With No U of A Generation Available) Following 72JM18 or Jasper TX 1 Contingency

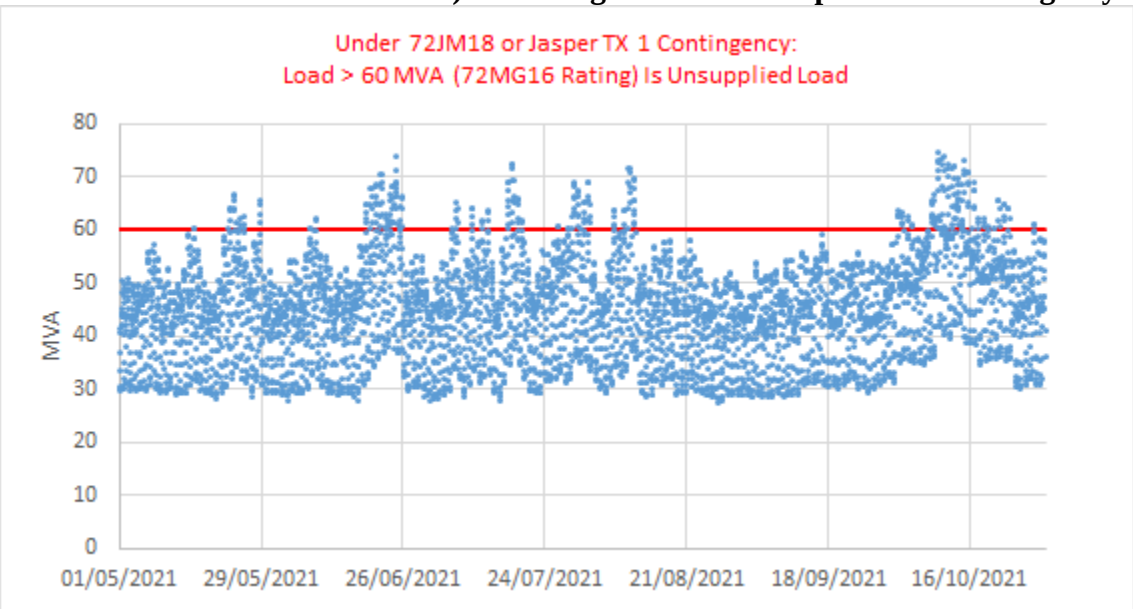


Figure EDTI-AESO-2019APR09-011 Attachment 1-49
2014 Summer Garneau 15 kV Load (With No U of A Generation Available) and Limiting Transmission Rating Following Garneau Transformer Contingency

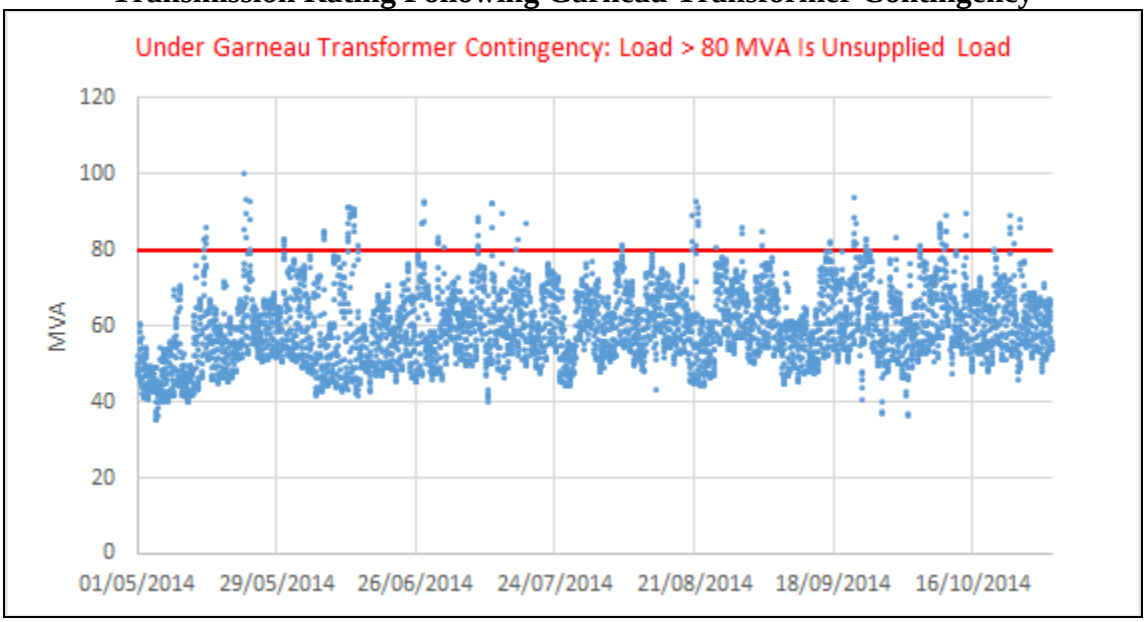


Figure EDTI-AESO-2019APR09-011 Attachment 1-50
2014 Summer Garneau 15 kV Load (With Actual U of A Generation) and Limiting Transmission Rating Following Garneau Transformer Contingency

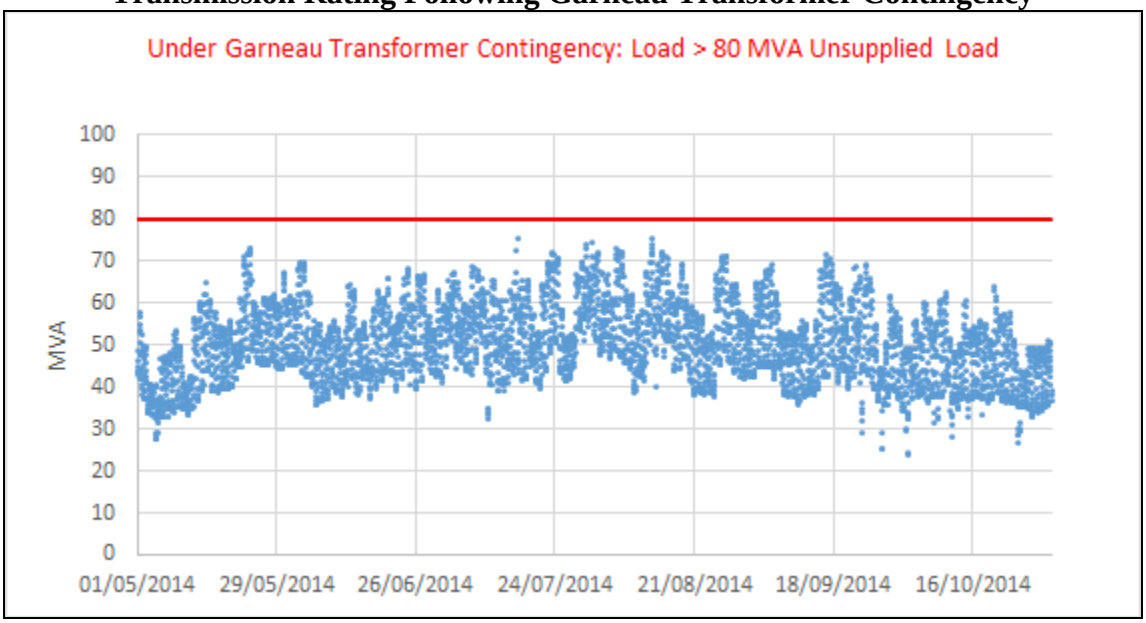


Figure EDTI-AESO-2019APR09-011 Attachment 1-51
2015 Summer Garneau 15 kV Load (With No U of A Generation Available) and Limiting Transmission Rating Following Garneau Transformer Contingency

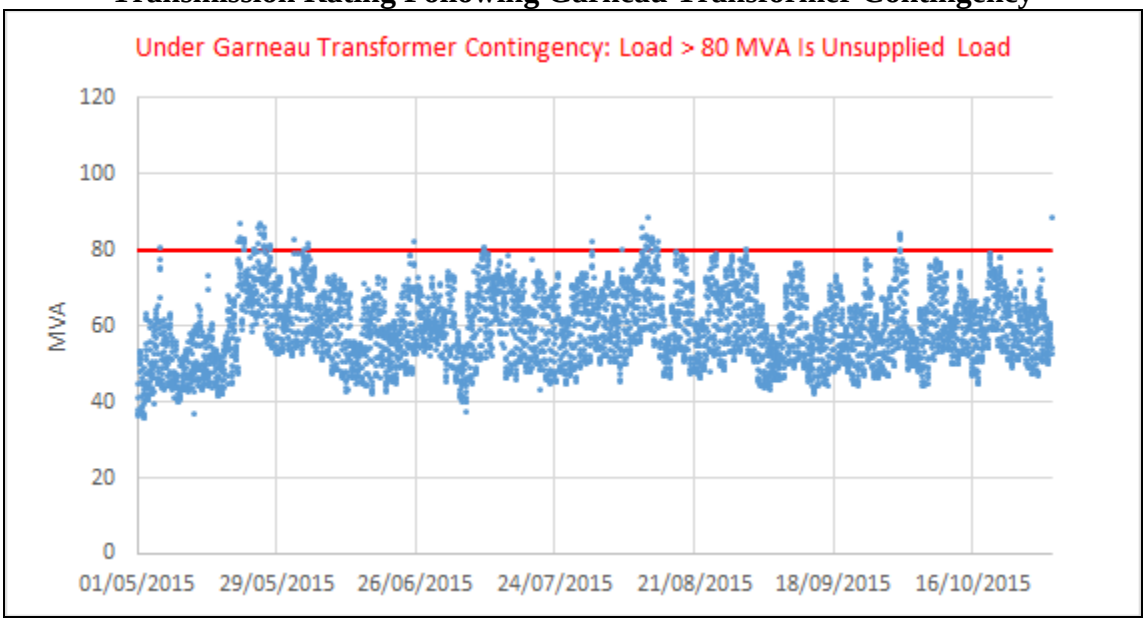


Figure EDTI-AESO-2019APR09-011 Attachment 1-52
2015 Summer Garneau 15 kV Load (With Actual U of A Generation) and Limiting Transmission Rating Following Garneau Transformer Contingency

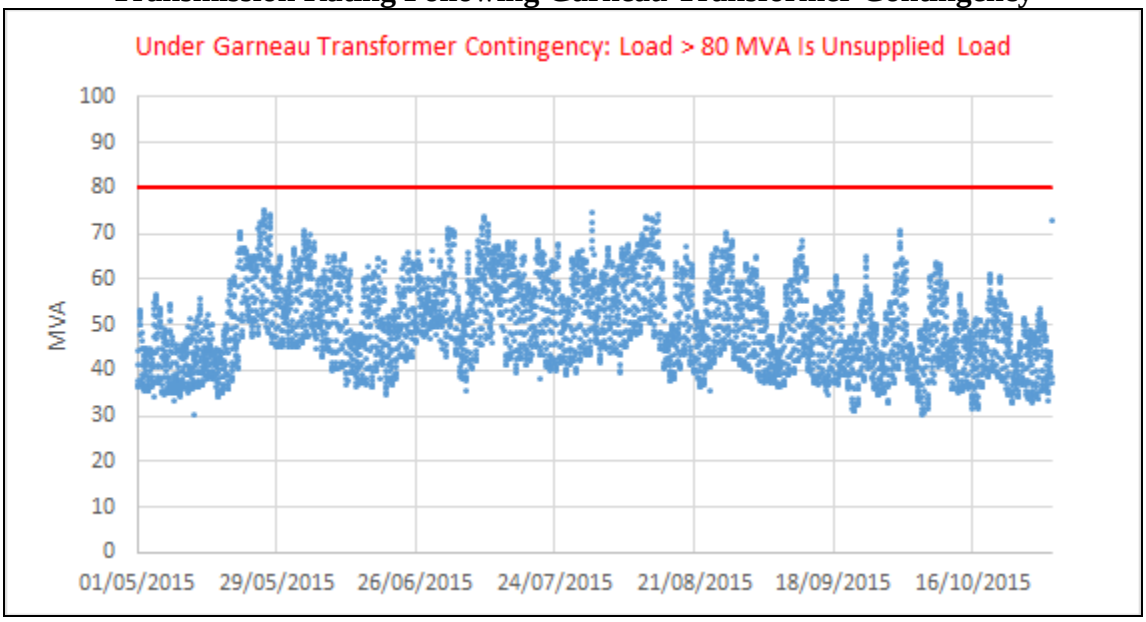


Figure EDTI-AESO-2019APR09-011 Attachment 1-53
2016 Summer Garneau 15 kV Load (With No U of A Generation Available) and Limiting Transmission Rating Following Garneau Transformer Contingency

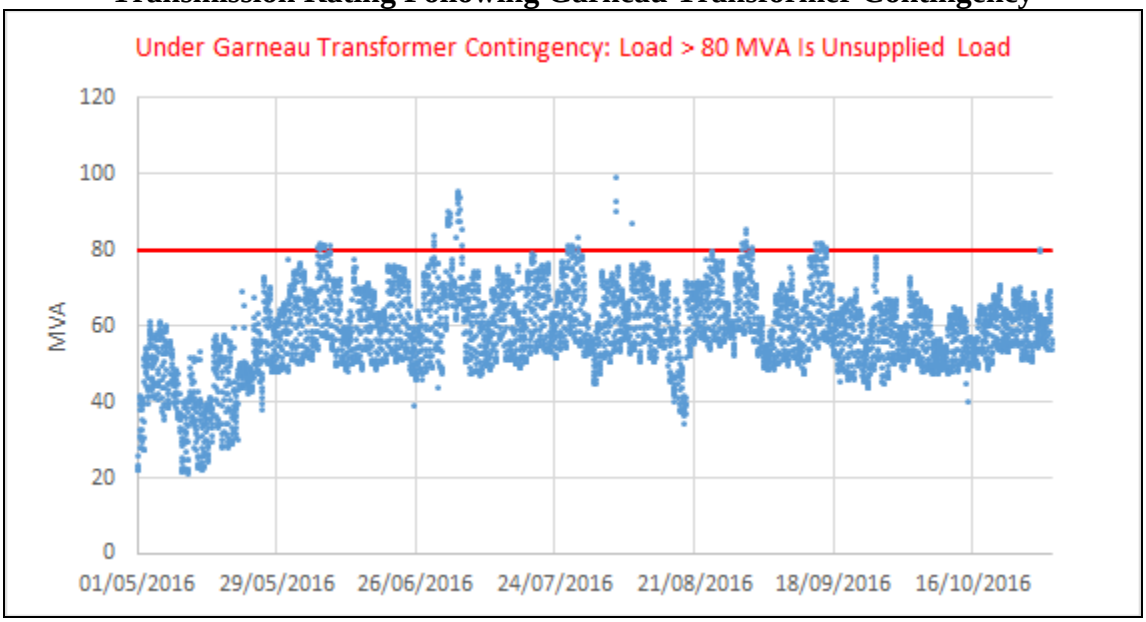


Figure EDTI-AESO-2019APR09-011 Attachment 1-54
2016 Summer Garneau 15 kV Load (With Actual U of A Generation) and Limiting Transmission Rating Following Garneau Transformer Contingency

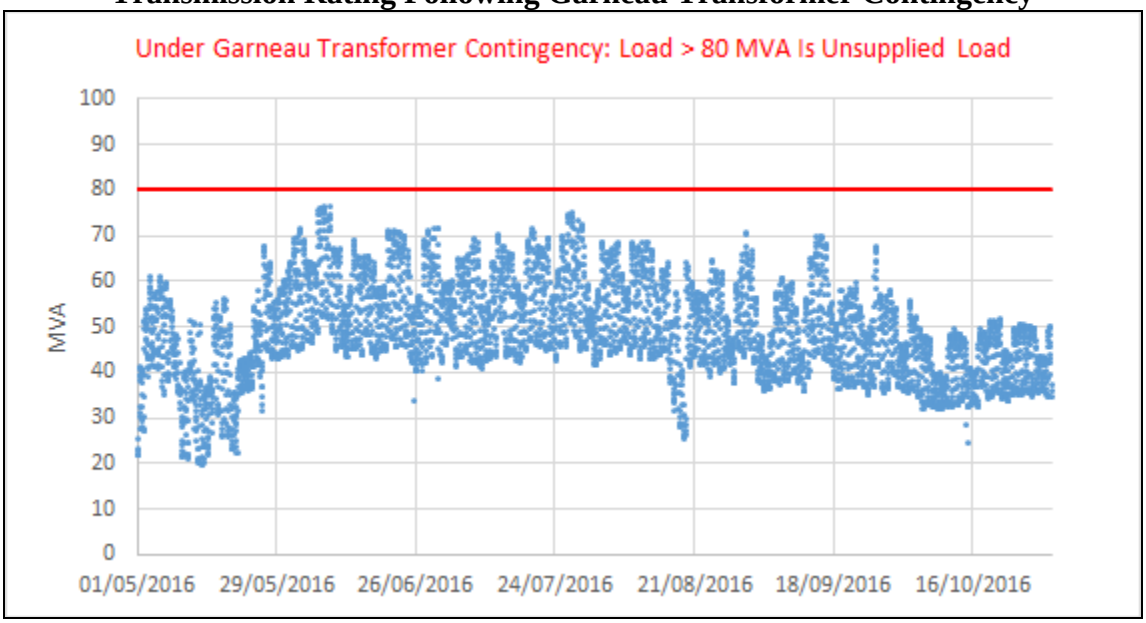


Figure EDTI-AESO-2019APR09-011 Attachment 1-55
2017 Summer Garneau 15 kV Load (With No U of A Generation Available) and Limiting Transmission Rating Following Garneau Transformer Contingency

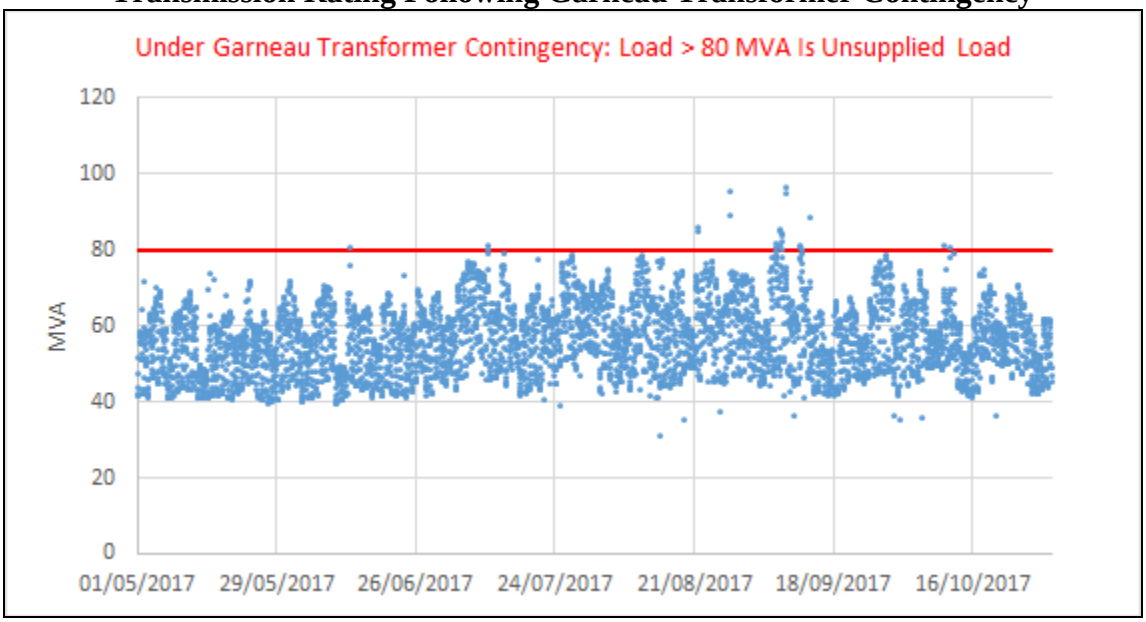


Figure EDTI-AESO-2019APR09-011 Attachment 1-56
2017 Summer Garneau 15 kV Load (With Actual U of A Generation) and Limiting Transmission Rating Following Garneau Transformer Contingency

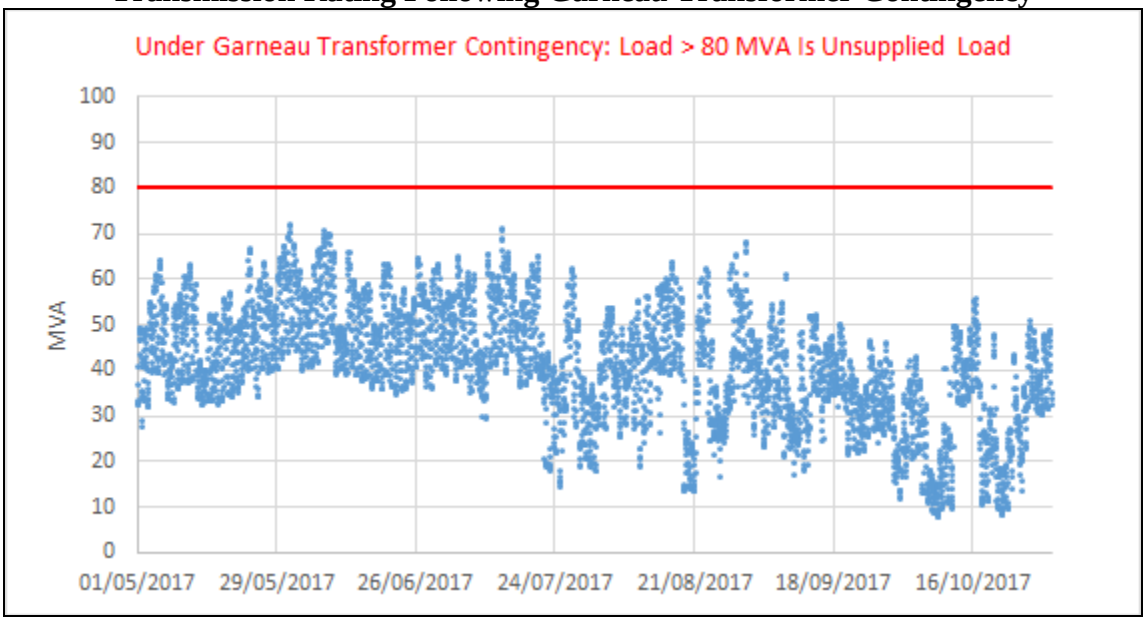


Figure EDTI-AESO-2019APR09-011 Attachment 1-57
2018 Summer Garneau 15 kV Load (With No U of A Generation Available) and Limiting Transmission Rating Following Garneau Transformer Contingency

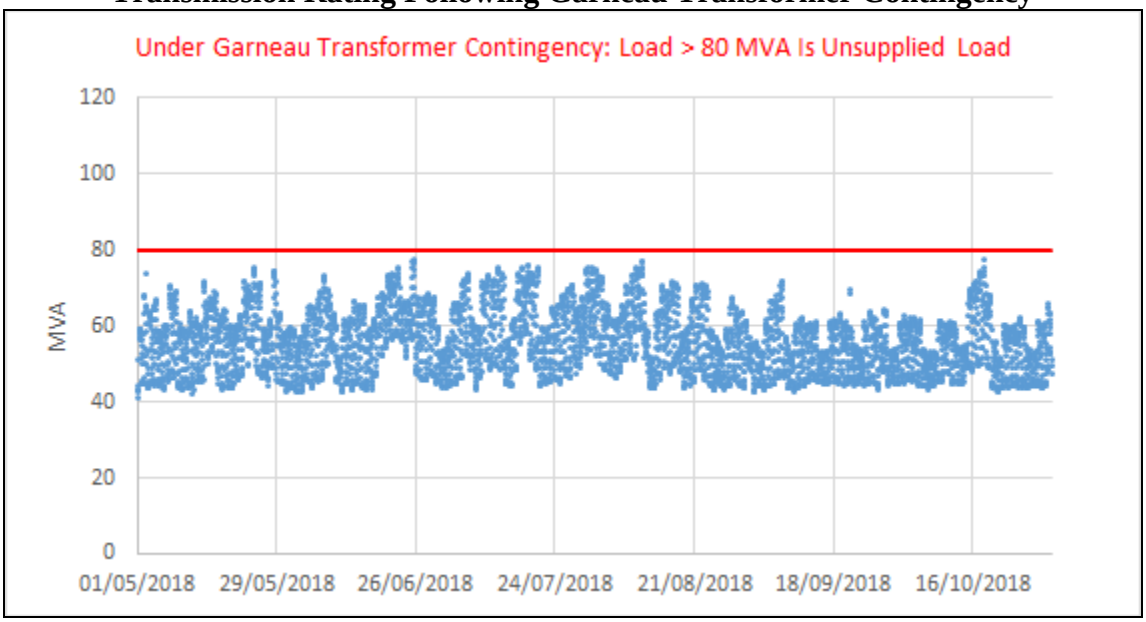


Figure EDTI-AESO-2019APR09-011 Attachment 1-58
2018 Summer Garneau 15 kV Load (With Actual U of A Generation) and Limiting Transmission Rating Following Garneau Transformer Contingency

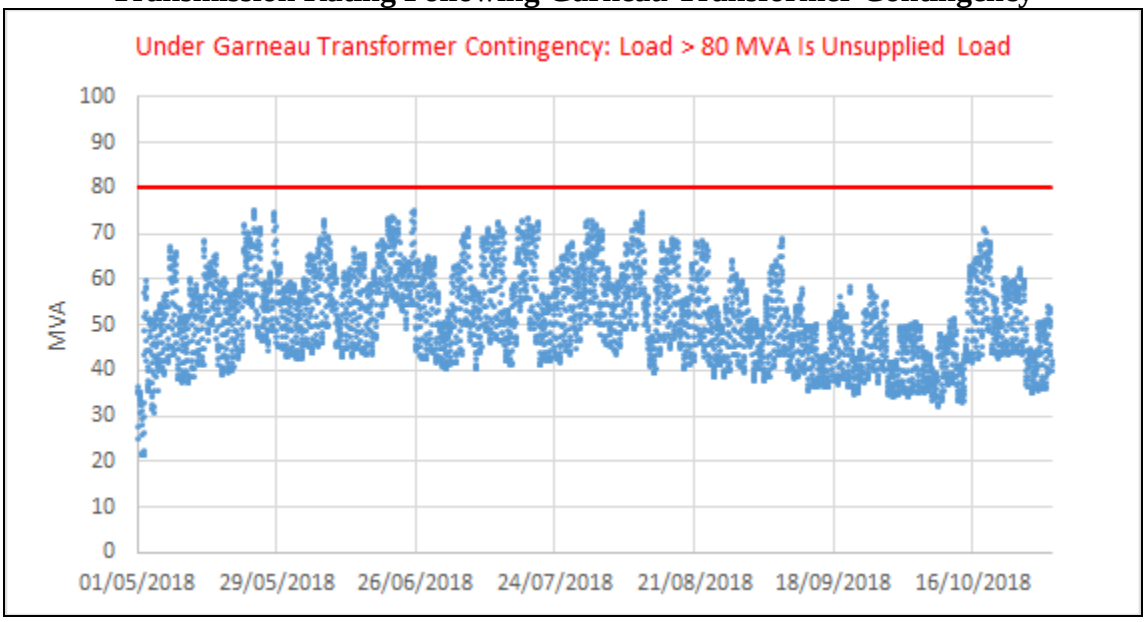


Figure EDTI-AESO-2019APR09-011 Attachment 1-59
2021 Forecast Summer Garneau 15 kV Load (With No U of A Generation Available) and Limiting Transmission Rating Following Garneau Transformer Contingency

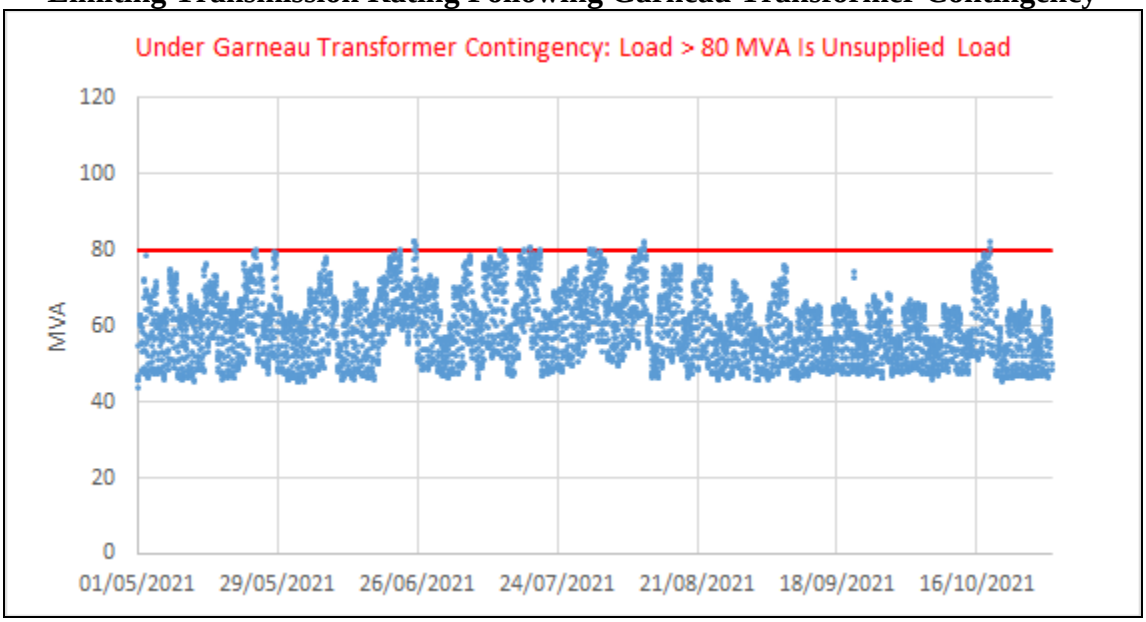
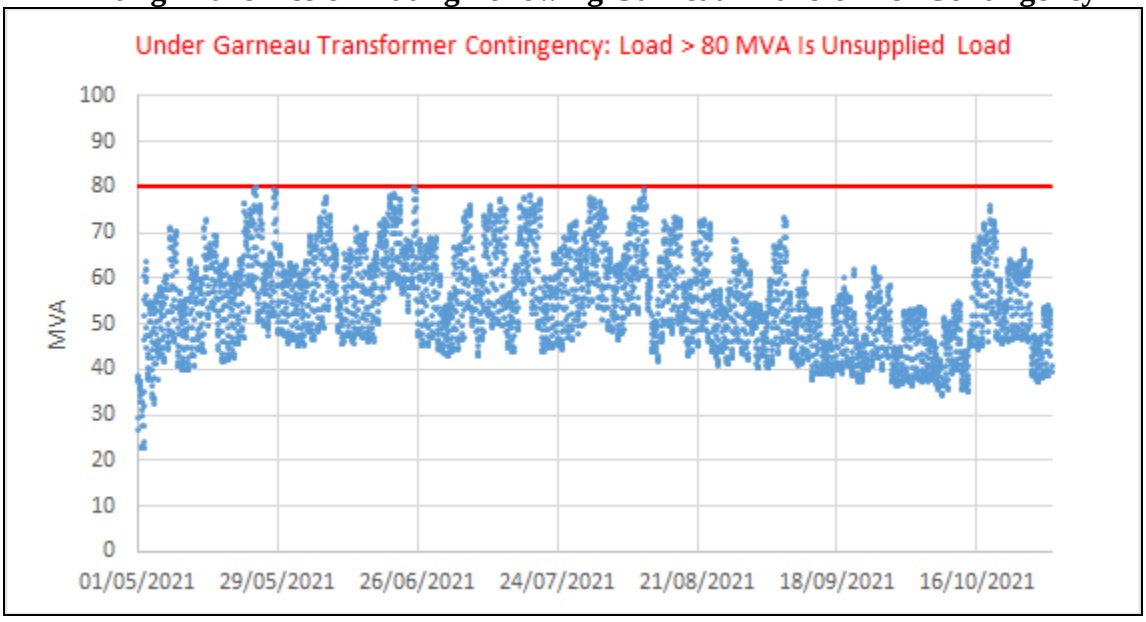


Figure EDTI-AESO-2019APR09-011 Attachment 1-60
2021 Forecast Summer Garneau 15 kV Load (With Actual U of A Generation) and Limiting Transmission Rating Following Garneau Transformer Contingency



EDTI-AESO-2019APR09-012
Reference: EDTI DFO

Request:

If an updated version of Table 3-1 is available showing 2018 actuals please provide under EDTI cover. Please confirm that the updated table does not alter EDTI's analysis or conclusions as presented in the September 19, 2018 DDR and addendum.

Response:

An updated version of the Table 3-1 showing 2018 actuals is attached as EDTI-AESO-2019APR09-12 Attachment 1. The updated Table 3-1 does not include an updated forecast, as EDTI's 2019 forecast is not yet available (currently scheduled for release at the end of May 2019).

In addition to the requested addition of 2018 actuals, EDTI has also updated Table 3-1 to include the following minor updates:

- The 12.5 MVA load transfers from Jasper to Meadowlark previously forecast to take place in 2020 has been delayed at least until 2021 as a result of conflicting projects taking place within west Edmonton. Coordination of the upcoming West LRT project requires significant ductline relocation from 87 Avenue – the alignment planned to be used for the Jasper to Meadowlark load transfers – resulting in the load transfer being deferred until after the ductline has been relocated.
- The Rossdale network feed rearrangements shown in Table 3-1 have been moved from the originally shown 2021 timeframe to 2019-2020 to better reflect EDTI's current schedule for the feeder rearrangements.

EDTI confirms that the updated Table 3-1 does not alter EDTI's analyses or conclusions presented in the September 19, 2019 DDR and addendum.

Additionally, Table EDTI-AESO-2019APR09-12-1 below provides a comparison of the measured 2018 actuals to the 2018 forecast.

Table EDTI-AESO-2019APR09-12-1
2018 Forecast to Actual Comparison

	2018 Compare			
	2018A	2018N90	|Diff|	2018F
N-1 Transmission Capacity MVA	60	60		60
Garneau POD (72 kV bus) MVA				93.4
N-1 Transformer Capacity MVA				80.0
Garneau POD (14.4 kV bus) MVA	77.2	83.0	0.33	83.3
Garneau POD (14.4kV bus) MW				77.2
Garneau POD power factor				0.93
Garneau T1 (MVA)				29.4
G1 MVA	7.2	6.8	0.28	6.5
G2 MVA	11.7	14.6	0.32	14.2
G3 MVA	10.9	10.6	0.16	10.4
(2,3) G4 MVA				0.0
Garneau T2 (MVA)				24.8
G5 MVA	14.0	13.0	0.11	13.1
(standby only) G6 MVA				0.0
G7 MVA	14.1	13.0	0.11	13.1
Garneau T3 (MVA)				29.1
G9 MVA	11.2	12.8	0.25	12.6
G10 MVA	11.3	12.7	0.24	12.5
(2,3) G11 MVA				0.0
G12 MVA	7.5	6.0	0.24	5.8
N-1 Transformer Capacity MVA	217.0	217.0		217.0
Rossdale POD (14.4 kV bus) MVA	137.7	143.4	0.05	143.4
Rossdale POD (14.4 kV bus) MW				131.0
Rossdale POD power factor				0.91
(4) R19 MVA	4.2	5.5	0.00	5.5
R23 MVA	6.8	6.6	0.29	6.3
R24 MVA	5.5	5.5	0.25	5.2
R39 MVA				0.0
R49 MVA				0.0
(4) R11 MVA	4.4	5.4	0.24	5.1
(4) R12 MVA	4.8	4.3	0.19	4.1
(4) R21 MVA	5.6	4.6	0.21	4.4
(4) R22 MVA	3.7	3.6	0.16	3.4
(4) R31 MVA	3.8	3.9	0.17	3.7
(4) R32 MVA	4.6	5.2	0.24	5.0
(4) R41 MVA	5.1	4.8	0.21	4.6
(4) R42 MVA	5.0	4.6	0.21	4.4
(5) N-1 Transmission Capacity MVA	37.0	37.0		37.0
Meadow lark POD (72 kV bus) MVA				53.7
Meadow lark POD (14.4kV bus) MVA	51.4	52.0	0.03	52.0
Meadow lark POD (14.4kV bus) MW				50.1
Meadow lark POD power factor				0.96
Meadow lark T1 (MVA)				17.0
Meadow lark T2 (MVA)				16.5
(6, 7) M26 (MVA)				0.0
Meadow lark T3 (MVA)				18.5
(7) M37 (MVA)				0.0

EDTI notes that the 2018 actual loads in some instances are marginally lower than the 2018 forecast values and considers that this difference is due to the lower than normal temperatures at peak load in 2018, as further explained below.

EDTI's forecast methodology considers the impact of ambient weather conditions on distribution loading. Based on the past seventeen years of daily temperature during system peak, EDTI has determined the 10th, 50th and 90th percentile ambient temperature at system peak, which are shown in Table EDTI-AESO-2019APR09-12-2 below. EDTI plans the needed capacity of the distribution and transmission system based on the 90th percentile, in line with industry best practices.

Table EDTI-AESO-2019APR09-12-2
Percentile Ambient Temperatures

		A **Summer**	B **Winter**
1	10th Percentile	28.3 ˚C	-16.4 ˚C
2	50th Percentile	30.7 ˚C	-26.3 ˚C
3	90th Percentile	34.0 ˚C	-32.8 ˚C

In 2018, the actual ambient temperatures during peak conditions for Garneau, Rossdale, and Meadowlark substations were approximately 28.0 ˚C, 31.0 ˚C, and 27 ˚C respectively. This is equivalent to a Garneau and Meadowlark peak at around the 10th percentile temperature, and a Rossdale peak at around the 50th percentile. In other words, the system loading peaks in 2018 occurred at low or average temperatures, and therefore are lower than the forecast peak loads (which, as described above, are forecast based on the 90th percentile).

In order to compare the 2018 actuals against the 90th percentile 2018 forecast provided in Table 3-1, the 2018 actuals must be normalized to 90th percentile values. As shown in Table EDTI-AESO-2019APR09-12-1, the difference between 2018 normalized actuals and 2018 forecast is small, which further supports EDTI's conclusion that the updated table does not alter the analysis or conclusions as presented in the September 19, 2018 DDR and addendum.

EXISTING SYSTEM HISTORICAL AND PROJECTED SUMMER PEAK LOADS

	Actual Peak Loading									2018 90th Percentile Forecast																							
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
N-1 Transmission Capacity MVA	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60
Garneau POD (72 kV bus) MVA	86.0	84.0	93.6	90.8	92.8	92.5	91.3	91.3	85.8	93.4	93.4	93.4	94.8	95.9	97.0	98.1	99.2	100.5	101.8	103.1	104.4	105.8	107.4	109.1	110.7	112.4	113.0	113.5	113.9	114.3	114.8	115.2
N-1 Transformer Capacity MVA	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0
Garneau POD (14.4 kV bus) MVA	77.3	75.8	83.5	81.2	82.8	82.6	81.6	81.6	77.2	83.3	83.3	83.3	84.4	85.3	86.2	87.1	88.0	89.0	90.0	91.0	92.1	93.1	94.4	95.7	97.0	98.3	98.8	99.2	99.5	99.9	100.2	100.5
Garneau POD (14.4kV bus) MW	71.7	69.7	76.8	75.0	76.8	76.3	74.8	75.4	71.3	77.2	77.2	77.2	78.2	79.0	79.8	80.6	81.5	82.4	83.4	84.3	85.3	86.2	87.4	88.6	89.9	91.1	91.5	91.8	92.1	92.5	92.8	93.1
Garneau POD power factor	0.93	0.92	0.92	0.92	0.93	0.92	0.92	0.92	0.92	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Garneau T1 (MVA)	32.7	29.6	31.4	30.6	33.8	31.3	30.5	28.9	26.2	29.4	29.4	29.4	29.8	30.1	30.4	30.7	31.0	31.3	31.7	32.0	32.4	32.7	33.2	33.6	34.1	34.5	34.7	34.7	34.8	34.9	35.0	35.0
G1 MVA	7.0	6.5	6.7	6.9	6.9	6.7	6.7	6.5	7.2	6.5	6.5	6.5	6.5	6.5	6.5	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.7	6.7	6.7	6.7	6.7	6.7	6.7
G2 MVA	10.5	15.3	14.9	14.8	14.4	12.7	12.1	14.0	11.7	14.2	14.2	14.2	14.4	14.6	14.7	14.9	15.0	15.2	15.4	15.5	15.7	15.9	16.1	16.3	16.5	16.7	16.8	16.8	16.8	16.8	16.8	16.8
G3 MVA	16.6	10.6	10.1	11.2	15.3	12.3	13.4	10.2	10.9	10.4	10.4	10.4	10.6	10.8	10.9	11.1	11.2	11.4	11.6	11.7	11.9	12.1	12.3	12.5	12.7	12.9	13.0	13.1	13.2	13.2	13.3	13.4
[2,3] G4 MVA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Garneau T2 (MVA)	28.4	22.7	26.8	24.6	23.9	23.7	25.2	24.2	24.6	24.8	24.7	24.7	25.1	25.4	25.7	26.0	26.2	26.6	26.9	27.3	27.6	27.9	28.4	28.8	29.2	29.6	29.8	29.9	30.1	30.2	30.3	30.4
G5 MVA	15.1	12.7	13.7	13.4	13.2	12.2	13.6	12.8	14.0	13.1	13.1	13.1	13.3	13.4	13.6	13.7	13.9	14.0	14.2	14.4	14.6	14.7	15.0	15.2	15.4	15.6	15.7	15.8	15.8	15.9	16.0	16.0
(standby only) G6 MVA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
G7 MVA	14.5	12.2	13.3	13.0	12.7	11.8	13.0	12.8	14.1	13.1	13.1	13.1	13.3	13.4	13.6	13.7	13.9	14.0	14.2	14.4	14.6	14.7	15.0	15.2	15.4	15.6	15.7	15.8	15.8	15.9	16.0	16.0
Garneau T3 (MVA)	16.2	23.4	25.3	26.0	25.1	27.6	25.9	28.6	26.3	29.1	29.1	29.1	29.5	29.8	30.1	30.4	30.7	31.1	31.4	31.8	32.1	32.5	32.9	33.3	33.8	34.2	34.4	34.5	34.6	34.8	34.9	35.1
G9 MVA	5.7	10.2	9.5	11.2	10.9	11.2	10.8	12.3	11.2	12.6	12.6	12.6	12.8	12.9	13.1	13.2	13.4	13.5	13.7	13.9	14.0	14.2	14.4	14.6	14.9	15.1	15.2	15.2	15.3	15.4	15.4	15.5
G10 MVA	5.9	10.3	9.7	11.2	10.8	11.3	10.8	12.2	11.3	12.5	12.5	12.5	12.7	12.8	13.0	13.1	13.3	13.4	13.6	13.8	13.9	14.1	14.3	14.5	14.8	15.0	15.1	15.1	15.2	15.3	15.3	15.4
[2,3] G11 MVA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
G12 MVA	5.2	5.2	6.4	5.4	5.5	5.4	5.7	5.8	7.5	5.8	5.8	5.8	5.8	5.8	5.8	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	6.0	6.0	6.0	6.0	6.0	6.0	6.0
N-1 Transformer Capacity MVA	217.0	217.0	217.0	217.0	217.0	217.0	217.0	217.0	217.0	217.0	217.0	217.0	217.0	217.0	217.0	217.0	217.0	217.0	217.0	217.0	217.0	217.0	217.0	217.0	217.0	217.0	217.0	217.0	217.0	217.0	217.0	217.0
Rossdale POD (14.4 kV bus) MVA	138.9	137.7	143.4	144.0	137.3	137.4	139.6	136.3	137.7	143.4	143.4	145.1	148.5	149.1	149.6	150.7	150.8	151.0	151.1	153.2	153.3	153.5	153.6	153.8	155.9	156.0	156.1	156.2	156.2	156.3	156.3	156.4
Rossdale POD (14.4 kV bus) MW	125.6	124.7	129.8	130.9	124.2	125.7	128.0	125.1	126.4	131.0	131.1	132.6	135.7	136.3	136.7	137.7	137.9	138.0	138.1	140.0	140.2	140.3	140.4	140.6	142.5	142.6	142.7	142.7	142.8	142.8	142.9	143.0
Rossdale POD power factor	0.90	0.91	0.90	0.91	0.90	0.92	0.92	0.92	0.92	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
[4] R19 MVA	0.0	0.0	0.0	0.0	0.0	0.0	5.0	5.5	4.2	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
R23 MVA	6.8	6.5	6.8	7.0	6.8	6.9	6.4	6.3	6.8	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3
R24 MVA	5.7	5.5	5.8	5.9	5.7	5.5	5.4	5.2	5.5	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2
R39 MVA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
R49 MVA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
[4] R11N MVA	5.7	6.2	6.4	6.2	6.4	6.3	5.3	5.1	4.4	5.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
[4] R12N MVA	4.1	4.1	4.4	4.6	4.4	3.9	4.2	4.1	4.8	4.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
[4] R21N MVA	5.7	5.8	5.8	5.3	5.9	5.3	5.0	4.4	5.6	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
[4] R22N MVA	4.9	3.9	4.4	4.6	3.8	4.1	4.1	3.4	3.7	3.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
[4] R31N MVA	4.5	3.8	4.7	4.4	3.8	3.6	4.0	3.7	3.8	3.7	3.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
[4] R32N MVA	5.3	4.7	5.1	5.4	5.6	5.8	5.2	5.0	4.6	5.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
[4] R41N MVA	4.9	5.0	5.2	5.1	4.9	4.9	4.6	4.6	5.1	4.6	4.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
[4] R42N MVA	5.4	5.4	5.6	5.7	5.2	5.0	4.9	4.4	5.0	4.4	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
[4] R601N MVA											5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1
[4] R602N MVA											4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1
[4] R603N MVA											4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4
[4] R604N MVA											3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4
[4] R605N MVA												3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7
[4] R606N MVA												5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
[4] R607N MVA												4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6
[4] R608N MVA												4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4
remaining 23 Rossdale feeders	85.9	86.7	89.3	89.9	84.7	86.1	85.5	84.4	84.1	91.5	91.6	93.3	96.7	97.3	97.7	98.9	99.0	99.1	99.3	101.4	101.5	101.7	101.8	102.0	104.1	104.2	104.3	104.3	104.4	104.5	104.5	104.6
[5] N-1 Transmission Capacity MVA	44.4	46.4	36.8	39.6	37.6	37.9	39.1	39.1	37.0	37.0	37.0	37.0	35.6	34.5	33.4	32.3	31.2	29.9	28.6	27.3	26.0	24.6	23.0	21.3	19.7	18.0	17.4	16.9	16.5	16.1	15.6	15.2
Meadowlark POD (72 kV bus) MVA	50.6	50.7	55.7	57.5	54.9	64.7	50.3	49.9	52.9	53.7	53.7	53.7	63.8	63.8	63.9	65.1	65.1	65.2	65.3	69.2	70.4	71.5	72.6	73.7	74.9	75.9	77.0	78.0	79.1	80.1	81.2	82.2
Meadowlark POD (14.4kV bus) MVA	49.3	49.3	53.9	55.5	53.2	62.2	49.0	48.7	51.4	52.0	52.0	52.1	61.3	61.4	61.5	62.5	62.6	62.7	62.8	66.5	67.6	68.7	69.8	70.8	71.9	73.0	74.0	75.1	76.1	77.1	78.2	79.2
Meadowlark POD (14.4kV bus) MW	46.8	46.9	51.2	53.1	51.0	59.7	47.0	47.4	50.0	50.1	50.1	50.1	59.0	59.1	59.1	60.2	60.2	60.3	60.4	64.0	65.0	66.1	67.1	68.1	69.2	70.2	71.2	72.2	73.2	74.2	75.2	76.2
Meadowlark POD power factor	0.95	0.95	0.95	0.96	0.96	0.96	0.96	0.97	0.97	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Meadowlark T1 (MVA)	17.2	17.3	18.9	19.4	18.6	21.8	17.2	17.0	18.0	17.0	17.0	17.1	20.1	20.2	20.2	20.5	20.6	20.6	20.6	21.9	22.2	22.6	23.0	23.3	23.7	24.0	24.4	24.7	25.1	25.4	25.8	26.1
Meadowlark T2 (MVA)	15.0	15.1	16.4	16.9	16.2	19.0	14.9	14.9	15.7	16.5	16.5	16.5	19.6	19.6	19.7	20.0	20.0	20.1	20.1	21.3	21.7	22.1	22.4	22.8	23.2	23.5	23.8	24.2	24.5	24.9	25.2	25.6
[6, 7] M26 (MVA)	0.0	0.0	0.0	0.0	0.0	7.2	0.0	0.0	0.0	0.0	0.0	0.0	5.4	5.4	5.4	5.4	5.4	5.4	5.4	7.5	8.1	8.7	9.2	9.8	10.4	11.0	11.5	12.1	12.7	13.3	13.9	14.4
Meadowlark T3 (MVA)	17.0	17.1	18.6	19.2	18.4	21.5	17.0	16.9	17.8	18.5	18.5	18.5	21.6	21.6	21.7	22.0	22.0	22.1	22.1	23.3	23.7	24.1	24.4	24.8	25.1	25.5	25.8	26.2	26.5	26.9	27.2	27.6
[7] M37 (MVA)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.2	6.2	6.2	6.2	6.2	6.2	6.2	8.7	9.4	10.0	10.7	11.4	12.0	12.7	13.4	14.0	14.7	15.4	16.0	16.7

Notes:

1) Distribution circuit summer peaks in this table are non-coincident with POD peaks. Garneau POD load in this table includes University of Alberta (U of A) load supplied by U of A Distributed Generation (i.e., U of A's Behind-the-Fence load).

2) In June 2010, Garneau G4 and G11 loads (5.4 MVA and 5.0 MVA) were temporarily transferred to Rossdale circuits R23 and R24 (2010-06-14 to 2010-11-20). This is reflected in Rossdale and Garneau summer peaks.

3) In May 2011, Garneau G4 and G11 loads were permanently transferred to Rossdale circuits R24 and R24.

4) New R19 feeder to new downtown Arena complex in service June 2016. New Rossdale 15 kV bus section (see AUC Proceeding 23165, EDTI 2018-2019 TFO Tariff Application). Planned in service date: 2019 Q4. R11N, R12N, R21N, R22N, R31N, R32N, R41N, R42N will be transferred to new bus section (feeders R601N to R608N).

5) N-1 Transmission Capacity at Meadowlark is lesser of: i) 60 MVA capacity of 72JM18 or 72MG16; or ii) 130.4 MVA parallel capacity of 72RG1 and 72RG7 less Garneau 72kV load

6) In July 2015, Meadowlark M26 circuit temporarily supplied Jasper J72 circuit load

7) In 2021: Jasper J72 circuit load is expected to be transferred to Meadowlark M37 circuit; Jasper J82 circuit load is expected to be transferred to Meadowlark M26 circuit.