Information Document
Northwest Area Transmission Constraint Management
ID #2011-004R

Information Documents are not authoritative. Information Documents are for information purposes only and are intended to provide guidance. In the event of any discrepancy between an Information Document and any Authoritative Document(s)[1] in effect, the Authoritative Document(s) governs.

1 Purpose

This Information Document relates to the following Authoritative Document:

- Section 302.1 of the ISO rules, *Real Time Transmission Constraint Management* ("Section 302.1").

The purpose of this Information Document is to provide additional information regarding the unique operating characteristics and resulting constraint conditions and limits in two (2) regions in the northwest area. In this Information Document the AESO has defined the northwest area as the area illustrated by the maps and diagrams in Appendix 2 and 3.

Section 302.1 sets out the general transmission constraint management protocol steps the AESO uses to manage transmission constraints in real time on the Alberta interconnected electric system. These steps are referenced in Table 1 of this Information Document as they are applied to the northwest area.

2 General

The northwest area consists of long 144 kV and 240 kV bulk transmission lines, generally with a low degree of redundancy of transmission paths. The northwest area total generating capacity is substantially less than the area load, leading to inflows of energy under normal operation.

The outage of a single bulk transmission line or a generating unit may result in voltage depressions outside of the acceptable system operating limits set out in Alberta Reliability Standard TPL-002-AB-0, *System Performance Following Loss of a Single BES Element*. The AESO can partially mitigate this risk by ensuring a sufficient minimum amount of transmission must-run generating unit capacity is available. The availability of transmission must-run services reduces the risk of losing firm load due to low voltages and of a voltage collapse for certain critical transmission or generation contingencies.

Appendix 2 provides a geographical map of the northwest area indicating bulk transmission lines, substations and cutplanes. Appendix 3 provides a detailed diagram of the generating units effective in managing the regional constraints through transmission must-run.

A cutplane is a common term used in engineering studies and is a theoretical boundary or plane crossing two (2) or more bulk transmission lines or electrical paths. The cumulative power flow across the cutplane is measured and can be utilized to determine flow limits that approximate conditions that would ensure the safe and reliable operation of the interconnected electric system.

3 Constraint Conditions and Limits

3.1 Non-Studied Constraints and Limits

For system conditions that have not been pre-studied, the AESO uses energy management system tools and dynamic stability tools to assess unstudied system operating limits in real time.

3.2 Studied Constraints and Limits

When managing a transmission constraint in the northwest area of Alberta that results from total generating capacity of the area being substantially less than the area load, the AESO uses regional

[1] "Authoritative Documents" is the general name given by the AESO to categories of documents made by the AESO under the authority of the *Electric Utilities* Act and regulations, and that contain binding legal requirements for either market participants or the AESO, or both. AESO Authoritative Documents include: the ISO rules, the Alberta reliability standards, and the ISO tariff.

cutplane inflow limits to manage area reliability. The AESO calculates the cutplane inflow limits for the Grande Prairie and Rainbow Lake cutplanes in accordance with voltage requirements and bulk transmission line transfer limits. A further description of the cutplane inflow limits for the Grande Prairie and Rainbow Lake cutplanes is set out below.

Cutplane Inflow Limits

There are 2 cutplanes in the northwest area: (1) the Grande Prairie region; and (2) the Rainbow Lake region. These cutplanes are reflected on the maps and diagrams in Appendices 2 and 3. The northwest area generation capacity is substantially less than the area load, which leads to inflows of energy into the northwest area under normal conditions. The specific contingency conditions and inflow limits for the Grande Prairie cutplane are set out in Appendix 4 and 5 of this Information Document.

The Rainbow Lake cutplane inflow limits are conditional based on summer and winter seasons and the status of the listed elements. The inflow limits are provided in Appendices 6, 7, 8 and 9.

Rainbow Area High Generation Mitigation (Export)

With high generation in the Rainbow area, there are transient concerns for RL1 and RB5.

If either 7L64 or 7L93 is out of service and Fort Nelson (FNG1 (units 1 and 2) and Rainbow Lake (RL1 and RB5 in service) RL1 is limited to 40 MW and RB5 is limited to 35 MW.

4 Application of Transmission Constraint Management Procedures

While the AESO manages transmission constraints in all areas of Alberta in accordance with the provisions of Section 302.1, not all of those provisions are effective in the northwest area due to certain unique operating conditions that exist in that area. This Information Document represents and clarifies the application of the general provisions of Section 302.1 to the northwest area.

The protocol steps which are effective in managing transmission constraints are outlined in Table 1 below, followed by additional steps which may be required.

Table 1 Transmission Constraint Management

Sequential Procedures for the Northwest Area

Section 302.1, subsection 2(1) protocol steps	Applicable to the Grande Prairie cutplane inflow?	Applicable to the Rainbow cutplane inflow?
(a) Determine effective pool assets	Yes	Yes
(b) Ensure maximum capability not exceeded	No	No
(c) Curtail effective downstream constraint side export service and upstream constraint side import service	No	No
(d) Curtail effective demand opportunity service on the downstream constraint side	No	No
(e)(i) Issue a dispatch for effective contracted transmission must-run	Yes	No
(e)(ii) Issue a directive for effective non-contracted transmission must-run	Yes	Yes
(f) Curtail effective pool assets in reverse energy market merit order followed by pro-rata curtailment	No	No
(g) Curtail effective loads with bids in reverse energy market merit order followed by pro-rata load curtailment	Yes	Yes

Applicable Protocol Steps

The first step in managing constraints in any area is to identify those generating units effective in managing the constraint. All generating units and loads operating in the northwest area are indicated in Appendix 3 (single line diagram), the generating units effective in managing constraints are identified in Appendix 1.

Step (a) in Table 1

The effective pool assets are as shown in Appendix 1.

Step (b) in Table 1

Ensuring maximum capabilities are not exceeded is not applicable to the northwest due to the deficiency of generation and inflow scenario.

Step (c) in Table 1

There is no effective export or import opportunity service to curtail for either the Grande Prairie or Rainbow cutplane.

Step (d) in Table 1

There is no demand opportunity service load in the area to curtail.

Steps (e)(i) and (ii) in Table 1

Issue dispatches to effective contracted pool assets or directives to effective non-contracted pool assets for transmission must-run.

Step (f) in Table 1

Reverse merit order curtailment is not effective and therefore not required because the constraint is caused by not having enough in-merit generation in the downstream constrained area.

Step (g) in Table 1

Curtailing effective loads with bids in reverse energy market merit order followed by pro-rata load curtailment is available for both Grande Prairie and Rainbow cutplanes.

5 Project Updates

As necessary, the AESO intends to provide information in this section about projects underway in the northwest area that are known to have an impact on the information contained in this Information Document.

6 Appendices to this Information Document

Appendix 1 – *Effective Pool Assets*

Appendix 2 –*Northwest Area Geographical Map*

Appendix 3 – *Northwest Area Transmission System*

Appendix 4: Grande Prairie Inflow Cutplane N-0 (System Normal) Thermal and Voltage Limits

Appendix 5: Grande Prairie Inflow Cutplane N-1 Thermal and Voltage Limits

Appendix 6: Rainbow Lake Inflow Cutplane N-0 (System Normal) Transient Limits

Appendix 7: Rainbow Lake Inflow Cutplane N-1 Transient Stability Limits

Appendix 8: Rainbow Lake Inflow Cutplane Thermal Limits

Appendix 9: Rainbow Lake Inflow Cutplane Voltage Stability Limits

Revision History

Posting Date	Description of Changes
2019-03-19	Amended Section 3.2 to include Rainbow Area High Generation Mitigation (Export) information.
2019-02-11	Updates to sections 1,2, 3 and 4
	Revised map in Appendix 2 to reflect metering point changes to the Grande Prairie Cutplane.
	Revised Appendix 5, Appendix 6, Appendix 7, Appendix 8 and Appendix 9 based on updated area studies.
2018-05-01	Revised Appendix 1.
	Revised Appendix 6 based on updated studies.
2018-03-07	Revised the Appendix 6 based on updated studies.
	Administrative updates.
2016-04-14	Added section 3.1 to describe how the AESO assesses unstudied system operating limits.
	Revised Table 1 and 2 of Appendix 4 to remove reference to maximum area load level used in studies.

	Revised Appendix 6 and added Appendix 7 based on updated studies.
2014-12-16	Appendices 1 and 3 were amended to reflect the addition of the asset WCD1. In addition typographical errors were amended in Note 2 in Appendix 6.
2014-07-29	Subsection 4.1 updated and Appendix 7 removed in its entirety to reflect the elimination of generation capacity limits for Poplar Hill and Northern Prairie Power Project.
2014-05-12	Appendix 2 amended to reflect the addition of Chickadee Creek 259S
2014-04-03	Appendices 1 and 3 amended to reflect the decommissioning of assets ST1 and ST2.
2013-02-14	Updated Table 4 to reflect changes to the Rainbow Lake Cutplane limit and Dynamic Reactive Reserve requirements. Minor drafting edit to geographical map.
2013-01-01	Updated to include minor drafting edits Updated to include Table 4 which reflects changes to the Rainbow Lake Cutplane limits and Dynamic Reactive Reserve requirements
2012-06-14	Updated to include material content from existing section 302.4 of the ISO rules, *Northwest Area Transmission Constraint Management*
2012-03-03	Updated to reflect transmission upgrades in the area
2011-06-30	Initial Release

Appendix 1 – Effective Pool Assets

The effective generation pool assets for the Grande Prairie cutplane, listed alphabetically by their pool IDs, are:

BCR2

BRCK

DAI1

GPEC

NPC1

NPP1

PH1

VVW1

WCD1

The effective generation pool assets for the Rainbow cutplane, listed alphabetically by their pool IDs, are:

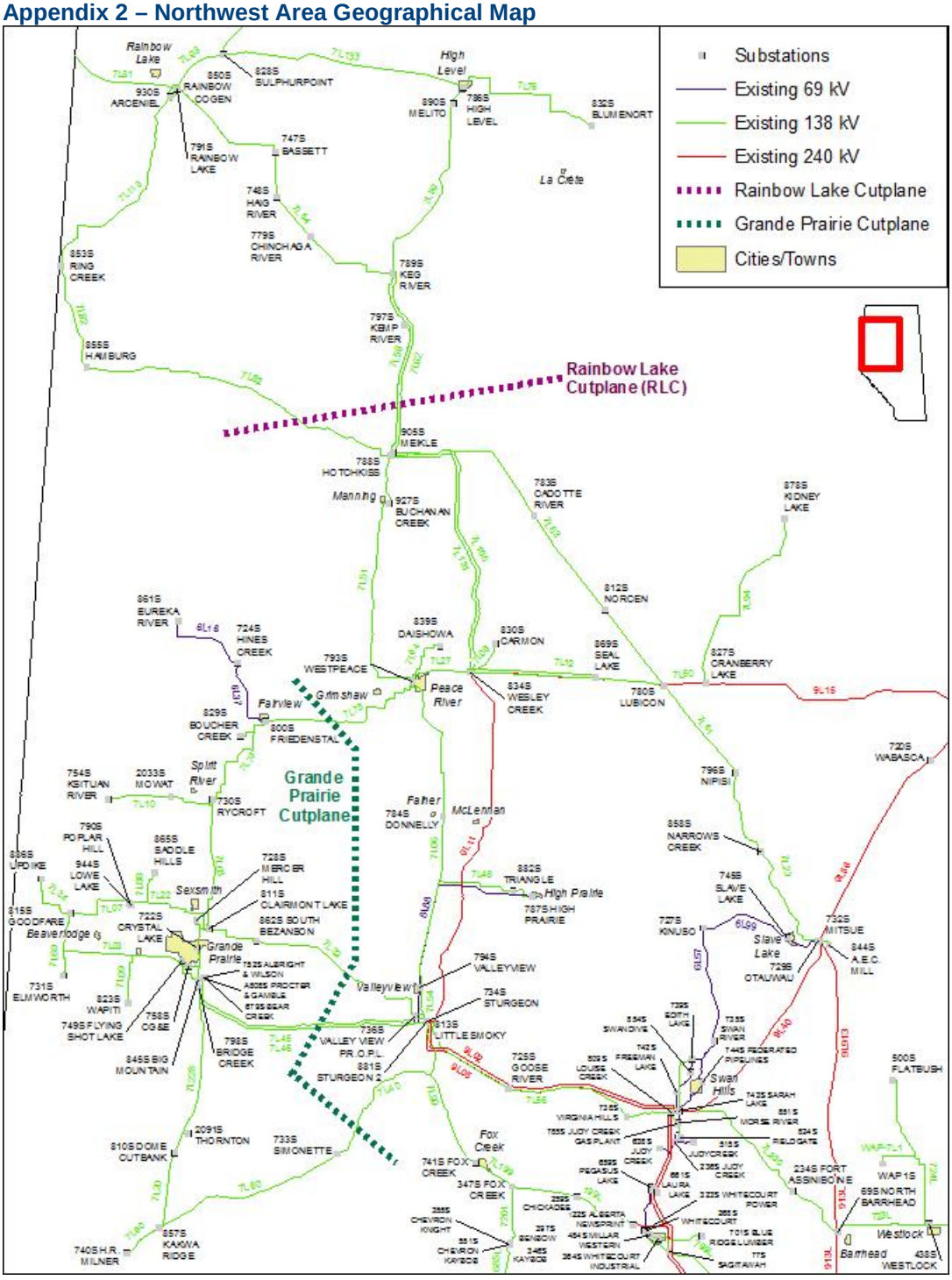
FNG1

FNG2

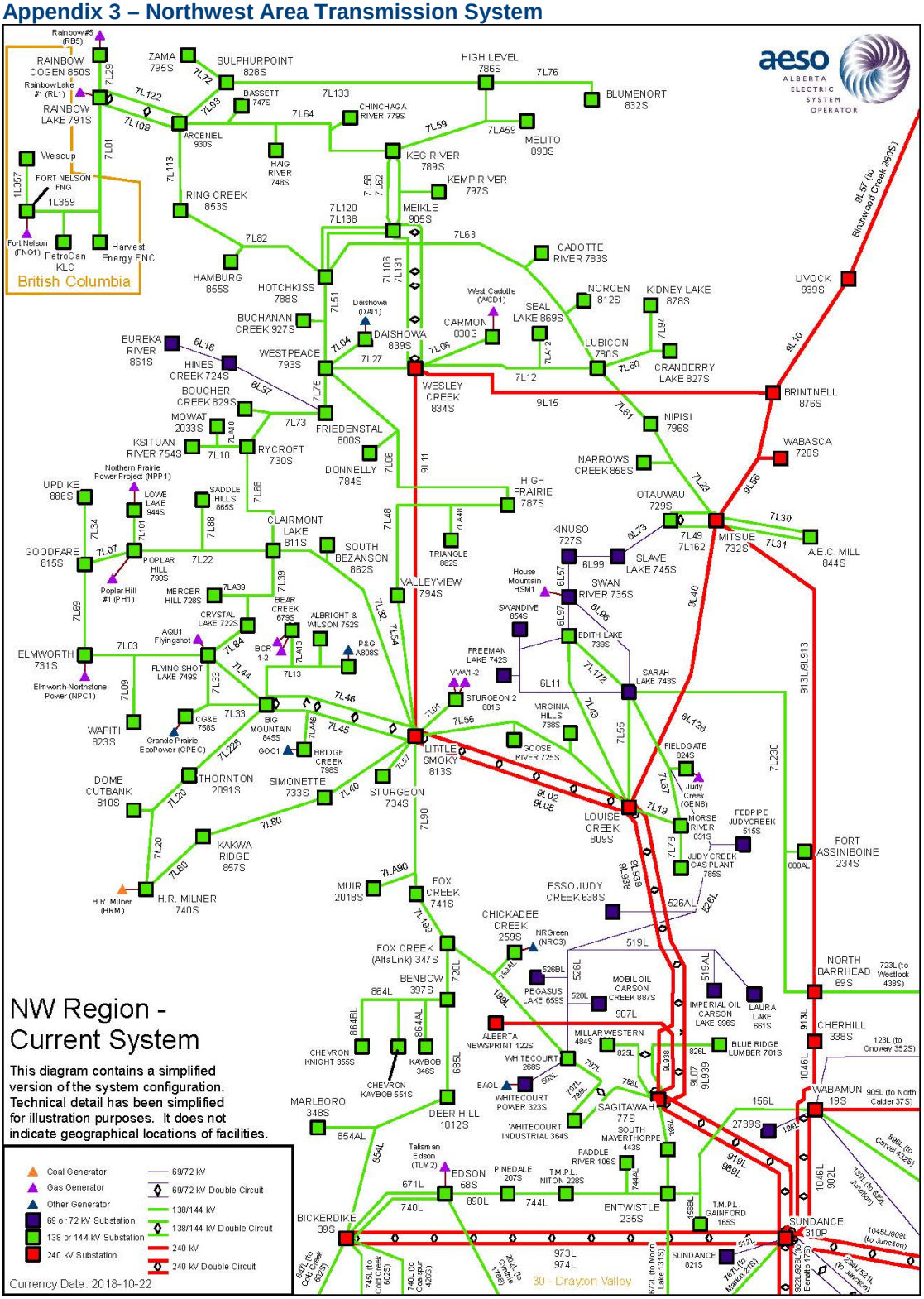
RB5

RL1

Appendix 2 – Northwest Area Geographical Map



Appendix 3 – Northwest Area Transmission System



Appendix 4: Grande Prairie Inflow Cutplane N-0 (System Normal) Thermal and Voltage Limits

Outage	Thermal (MW)		Voltage (MW)
	Summer May 1 – Oct. 31	**Winter** Nov 1 – April 30	
System Normal (N-0)	430		
		455	
			420

Appendix 5: Grande Prairie Inflow Cutplane N-1 Thermal and Voltage Limits

If real time contingency analysis or real time voltage stability analysis allows a higher thermal or voltage limit for the contingencies listed in the table below, the AESO operates to the higher limit.

Outage	Thermal (MW)		Voltage (MW)
	Summer May 1–Oct. 31	Winter Nov 1–April 30	
7L46	290	350	340
7L45	290	350	340
7L33	315	340	355
7L44	315	340	350
7L03	360	410	415
7L69	390	455	415
7L07	390	455	415
7L34	430	455	420
7L22	425	430	405
7L84	350	370	375
7L39	415	430	420
7L32	360	390	365
7L68	390	440	420
7L75	340	395	370
7L73	355	395	380
7L20	385	435	415
7L228	405	450	420
7L80	390	420	400
7L40	390	425	400
9L02	330	345	355
9L05	330	345	355

Appendix 6: Rainbow Lake Inflow Cutplane N-0 (System Normal) Transient Limits

Generator in Service[1]	Number of SC, ASVC, and HSVC in Service (MW)[2]	
	1	2 or 3
0	155	169
1	138	161
2	132	165
3	124	153
4	129	149

Note: [1] Rainbow area generators are FNG1, FNG2, RL1, and RB5.
[2] Rainbow area DRR equipment: Arcenciel Synchronous Condenser, Arcenciel SVC, and High Level SVC

Appendix 7: Rainbow Lake Inflow Cutplane N-1 Transient Stability Limits

Outage	Generator in Service[1]	Number of SC, ASVC, and HSVC in Service (MW)	
		1	2 or 3
N-7L51	0	120	141
	1	138	138
	2	131	155
	3	129	140
	4	129	140
N-7L63	0	122	143
	1	125	150
	2	132	160
	3	125	141
	4	105	135
N-7L82	0	115	136
	1	118	137
	2	102	122
	3	102	130
	4	105	130
N-7L106	0	116	139
	1	137	140
	2	110	129
	3	110	133
	4	95	130
N-7L113	0	116	136
	1	126	126
	2	111	128
	3	106	130
	4	100	128
N-7L131	0	116	139
	1	137	140
	2	110	129
	3	110	133
	4	95	130

Outage	Generator in Service[1]	Number of SC, ASVC, and HSVC in Service (MW)	
		1	2 or 3
N-7L58[2]	0	93	88
	1	74	81
	2	82	83
	3	100	87
	4	96	95
N-7L59[2]	0	100	99
	1	80	88
	2	85	84
	3	88	89
	4	75	89
N-7L62[2]	0	94	87
	1	80	82
	2	86	87
	3	100	90
	4	102	100
N-7L64[2]	0	105	98
	1	91	91
	2	85	87
	3	106	120
	4	95	112
N-7L93[2]	0	125	138
	1	118	150
	2	114	123
	3	90	100
	4	90	105

Outage	Generator in Service[1]	Number of SC, ASVC, and HSVC in Service (MW)	
		1	2 or 3
N-7L133[2]	0	121	127
	1	88	88
	2	86	116
	3	90	116
	4	95	89

Note: [1] Rainbow Lake area generators consist of FNG1, FNG2, RL1, and RB5.

[2] If FNG1 and FNG2 are out of service, the output for each individual Rainbow unit is limited to 35 MW.

Appendix 8: **Rainbow Lake Inflow Cutplane Thermal Limits**

If real time contingency analysis allows a higher thermal limit for the contingencies listed in the table below, the AESO operates to the higher limit.

Outage		**Thermal (MW)**	
		Summer May 1 – Oct. 31	**Winter** Nov 1 – April 30
System Normal (N-0)	None	125	145
N-1	7L51	123	138
	7L58	84	86
	7L59	75	86
	7L62	82	86
	7L63	123	140
	7L64	97	99
	7L82	82	86
	7L93	124	143
	7L106	113	118
	7L113	84	89
	7L131	113	118
	7L133	120	138

Appendix 9: Rainbow Lake Inflow Cutplane Voltage Stability Limits

If real time voltage stability analysis allows a higher voltage limit for the contingencies listed in the table below, the AESO operates to the higher limit.

Outage		Voltage (MW)
System Normal (N-0)	None	173
N-1	7L51	145
	7L58	90
	7L59	92
	7L62	90
	7L63	144
	7L64	93
	7L82	140
	7L93	150
	7L106	141
	7L113	142
	7L131	141
	7L133	143