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CONNECTION ASSESSMENT & APPROVAL PROCESS

PRELIMINARY ASSESSMENT REPORT - Addendum

For a Proposed Increase in the Maximum Load that can be supplied at the Musselwhite Mine

Applicant: Placer Dome (Canada) Ltd.

CAA ID No. 2002-083

Transmission Assessments & Performance Department

FINAL Version

Date: 20th February 2007

PLACER DOME (Canada) Ltd. - Musselwhite Mine

ADDENDUM TO THE PA REPORT:

For a Proposed Increase in the Maximum Load that can be supplied at the Mine

1. Introduction

In the Preliminary Assessment Report, dated 16th July 2003, the IESO had concluded that the maximum load that could be supplied at the mine with the existing SVC configuration would be 16MW at a power factor of 90%.

A formal Notification of Approval of the Connection Proposal was issued on 18th July 2003 for the increase to 16MW.

The analysis summarised in the Report also confirmed that should the power factor at the mine be improved to 94%, then this would also allow the expected 1MW load at the North Caribou Lake First Nation (NCLFN) community to be supplied.

Placer Dome (Canada) Ltd. has notified the IESO that since the mine requires an enhanced supply beyond the 16MW that has been approved, permission for the NCLFN to connect to the Placer Dome line between Placer Junction and the mine site would not be granted.

In addition, Placer Dome (Canada) Ltd. has informed the IESO that they plan to increase the rating of each of the +7.0/-13.5MVAr SVCs at the mine site to +11.0/-13.5MVAr through the addition of a 4MVAr capacitor bank to each SVC.

Placer Dome (Canada) Ltd. is seeking approval for the maximum load that can be supplied at the mine to be increased to 19MW. In addition, since the future load at the mine load is expected to exceed 19MW, they have asked the IESO to identify what measures would need to be implemented to maximise the load-meeting capability of the existing transmission facilities.

2. Rating of the existing transmission facilities

The thermal ratings that were used in the assessment have been summarised in the following Table:

Circuit	*Conductor*	*Approximate Length*	*Maximum Conductor Operating Temperature*	*Thermal Rating at 30°C ambient & 4km/hr wind*	
E1C	167.8kcmil	260km	60°C	220A	47MVA at 124kV
M1M	336.4kcmil	185km	93°C	500A	107MVA at 124kV
E4D	Predominantly 477kcmil	98km	71°C	470A	101MVA at 124kV

3. Existing Loads supplied from 115kV circuit E1C

The same peak loads that had been used in the analysis for the original PA Report were used for this study. They have been summarised in the following Table:

Location	*Peak Load*
Slate Falls DS	0.4MW
Cat Lake TS	1.0MW
Crow River DS	2.4MW

4. Analysis

Existing condition

Diagram 1 shows the results from the load flow analysis for the existing system condition with a mine load at the approved maximum value of *16MW, at an assumed power factor of 90%*.

This shows that the existing SVCs would need to be operating close to their maximum output to maintain the voltage at the mine at an acceptable level (a target voltage of 120.0kV has been assumed throughout the accompanying analysis). The results show that only 0.3MVAr remains available on each bank.

It also shows that with a load of 16MW at the mine and a further 3.8MW of load supplied from the DSs connected to circuit E1C, that the accumulated losses would be 6.4MW, representing 32.3% of the total load supplied.

The voltages at Ear Falls GS & Crow River DS are shown as 124.4kV & 118.8kV, respectively.

Condition with the rating of the SVCs increased

The results from the load flow analysis with the rating of each of the two SVCs increased to +11.0/-13.5MVAr have been summarised in the following Diagrams:

Diagram 2:

Load at the Musselwhite mine *19.0MW at a power factor of 90%*

With the mine load increased to 19.0MW, the results show that the SVCs would still have a combined capacity of approximately 1.7MVAr available for further voltage support at the mine.

The results also show that for the 3MW increase in the load supplied, the losses over the system from Ear Falls GS would increase by 3.3MW. In addition, even though capacity remains available in the SVCs to maintain the voltage at 120.0kV at the mine, the voltage at Crow River DS is shown to decrease to 116.2kV.

Diagram 3:

Load at the Musselwhite mine *19.5MW at a power factor of 90%*

Increasing the load by only 0.5MW is shown to result in an increase of 0.7MW in the transmission losses to a total of 10.4MW.

The output of the SVCs is also shown to be at their maximum at this load level and when the study was repeated with a load of 20MW at the mine the load flow failed to converge.

In addition the voltage at Crow River DS is shown to decline to 115.6kV, although it would still satisfy the Market Rule minimum of 113.0kV.

The study was therefore repeated for a load of 20MW at the mine with its power factor improved to 94%.

Diagram 4:

Load at the Musselwhite mine *20.0MW at a power factor of 94%*

This additional 0.5MW increase in the load at the mine is shown to increase the transmission losses by 0.8MW and even with the improved power factor, the voltage at Crow River declines to 114.9kV.

The SVCs are also shown to be close to their maximum output with only a combined capacity of 0.6MVAr remaining available for voltage support.

The study performed by AREVA T&D Inc. for Placer Dome (Canada) Ltd. concluded that any increase in the rating of the existing SVCs should be limited to a 4.0MVAr filter, tuned to the 11th harmonic to complement the existing 3.5MVAr filters that are tuned to the 5th and 7th harmonics, respectively. Consequently, since there is little scope for increasing the support available at the mine site (except by installing a third SVC), a study was performed with a new SVC assumed to be connected to the LV busbar at Crow River DS. The rating of this SVC was assumed to be identical to that of the existing SVCs at the mine, namely +7.0/-13.5MVAr.

Diagram 5:

Load at the Musselwhite mine *21.0MW at a power factor of 94%*

This shows that the SVC at Crow River DS would need to be operating at its maximum output to maintain a target voltage of 118.0kV. However, the improved voltage at that location is shown to reduce the burden on the two SVCs at the mine site. These are shown to have a combined capacity of 3.8MVAr remaining available for continued voltage support.

However, the 1.0MW increase in the load at the mine would result in an increase of 1.6MW in the accumulated losses on the transmission system from Ear Falls GS. At this load level, the total losses would represent 51.6% of the entire load supplied from circuit E1C.

Furthermore, the flow on circuit E1C would be approximately 42MVA which is approaching the thermal rating of 47MVA for this circuit.

5. Conclusions

The studies confirm that with an increase in the rating of the SVCs at the mine site, the existing transmission facilities would be capable of supplying a maximum mine load of 19.5MW at a power factor of 90%. This would require a minimum voltage of 124.0kV to be maintained at Ear Falls GS. It would also preclude any further increase in the loads supplied from the DSs connected to circuit E1C.

The studies also show that at these load levels the losses over the existing transmission facilities from Ear Falls GS would be excessive: for a mine load of 19MW the losses total 42.5% of the combined load supplied via circuit E1C; while at 19.5MW, these would increase to 44.6%.

Although an improvement in the power factor of the mine load to 94% would allow a further 0.5MW (to 20MW) to be supplied at the mine, it would be achieved at the expense of excessive losses, which would increase to 47.1% of the load supplied via circuit E1C.

Installing an SVC at Crow River DS would allow the maximum load that could be supplied at the mine to increase to 21MW, at an assumed power factor of 94%, but this would increase the losses to 51.6% of the load supplied via circuit E1C.

6. Recommendation

It is therefore recommended that approval be given to limit the increase in the maximum load at the mine site to 19MW. With the mine load at a power factor of 90%, this would provide a margin of approximately 0.5MW to be maintained to accommodate future load growth at the existing DSs connected to 115kV circuit E1C.

It is also recommended that even if the power factor of the load at the mine were to be improved to 94% that no further increases in the maximum load be entertained since the losses are already considered excessive for a mine load of 19MW.

Any requirement for further increases in the maximum load that could be supplied at the mine would therefore necessitate the development of local generation facilities or the installation of additional transmission facilities.

7. Further Increases in the Mine Load

The 167.8kcmil conductors with which circuit E1C is equipped severely constrain the maximum load that can be supplied via this circuit, particularly once the accumulated losses begin to exceed 40%. While the installation of additional reactive support would allow acceptable voltages to be maintained, it would not address the fundamental limitation imposed by the small conductors. Reconductoring the line with larger conductors is assumed to be impractical, particularly since a supply needs to be maintained to the mine, as well as to communities supplied from the DSs connected to circuit E1C.

Installing a second 115kV line, equipped with larger conductors, along the same right-of-way as circuit E1C would significantly enhance the supply meeting capability of the system. However, the supply would remain exposed to contingencies involving the common 115kV E4D between Dryden TS and Ear Falls GS.

Since a parallel line from Ear Falls GS to Placer Junction would involve approximately 260km of new line construction, it is the IESO's opinion that it would be more effective if the new line were to originate from Valora Junction on the 115kV circuit 29M1. This would involve approximately 180km of new line construction following the route of Highway 599 between Ignace and Pickle Lake.

Circuit 29M1, which is equipped with 336.4kcmil conductors, is tapped on to the 115kV circuit M2D that runs between Moose Lake TS and Dryden TS, at Ignace Junction. The proposed connection point for the new line on to circuit 29M1 would be at Valora Junction; approximately 70km from Ignace Junction.

Diagram 6 shows the existing facilities in the area together with the proposed new line between Valora Junction and Placer Junction.

Preliminary Analysis with a 2nd 115kV Line terminated at Placer Junction

Some preliminary studies for different loading conditions at the mine were performed with a new 115kV line assumed to be in-service between Valora Junction and Placer Junction. The new line was assumed to have a length of 180km and to be equipped with 336.4kcmil conductors - the same size as on circuits 29M1 and M1M.

The results of these studies have been summarised on the following Diagrams:

Diagram 7:

Load at the Musselwhite mine *19.0MW at a power factor of 90%*

This condition corresponds to that shown in Diagram 2, without the new line in-service.

This shows a marked improvement in the voltage profile, with the voltage at Placer Junction increasing to 124.5kV from its earlier value of 116.2kV. Furthermore this improvement has been achieved with the SVCs at the mine site 'backed-off' and providing a combined output of only + 9.5MVAr (compared to + 21.6MVAr for the original study).

In addition the total losses on circuits E1C & 29M1 are shown to fall to 3.3MW, compared to the 9.7MW that arose on circuit E1C alone.

Diagram 8:

Load at the Musselwhite mine *24.0MW at a power factor of 90%*

Although the voltage profile at this load level remains very good with the voltage at the Musselwhite mine remaining at the study target of 120kV, the SVCs at the mine are shown to have a combined capacity of only 0.8MVAr available for further voltage support. A load of 24MW at a power factor of 90% therefore represents the maximum load that could be supplied at the mine within the enhanced rating of the SVCs.

At this load level, the combined losses on circuits E1C & 29M1 are shown to total 5.2MW; an increase of 1.9MW for a load increase of 5MW.

Diagram 9:

Load at the Musselwhite mine *28.0MW at a power factor of 90%*

This study shows the effect on the voltage at the mine site of the SVCs reaching their maximum output. With the mine load at 28MW the voltage is shown to decline to just 112.2kV. However, the voltages on the rest of the immediate system remain acceptable, with a minimum voltage of 118.5kV being recorded at Placer Junction/Crow River DS.

For this load, the combined losses on circuits E1C & 29M1 are shown to be 7.0MW; representing an increase of 1.8MW for a load increase of 4MW.

Diagram 10:

Load at the Musselwhite mine *28.0MW at a power factor of 94%*

With the power factor at the mine improved to 94%, this study shows that the SVCs would still have 0.9MVAr of capacity available to control the voltage and consequently the voltage at the mine is shown at its target value of 120kV.

The improved voltage profile is also shown to result in reduced losses of 0.3MW.

8. Supplementary Recommendations

The studies have shown that in order the retain a limited amount of capacity for future load growth at the existing DSs connected to circuit E1C, the maximum load that could be supplied at the Musselwhite Mine has to be limited to 19MW. Any future requirements for additional capacity at the mine would therefore have to be met through the development of local generation or the installation of new transmission facilities.

In order to provide some diversity in the supply to the mine and to avoid the dependency on circuit E4D between Dryden TS and Ear Falls GS, the IESO has therefore examined the performance of a notional new line between Valora Junction and Placer Junction; connected to the existing 115kV circuit 29M1.

The results show that this new line would allow a load of at least 24MW, at a power factor of 90%, to be supplied at the mine. Improving the power factor to 94% would increase this figure to 28MW. Furthermore the presence of a new connection between Valora Junction and Placer Junction would benefit the existing system significantly by reducing the transmission losses.

With two, independent supplies into Placer Junction, not only would the security of the mine's supply be improved but the presence of a second connection would permit outages to be taken while allowing a limited supply to the various loads to be maintained.

The studies also show that with the new line equipped with 336.4kcmil conductors, the expected losses on it for a mine load of 28MW would total approximately 1.0MW. If 477kcmil conductors were installed instead, the losses on the new line would reduce by approximately 0.4MW. Depending on the premium that would be incurred and the expected future demand at the mine site, it may therefore be possible to justify using the larger conductor.

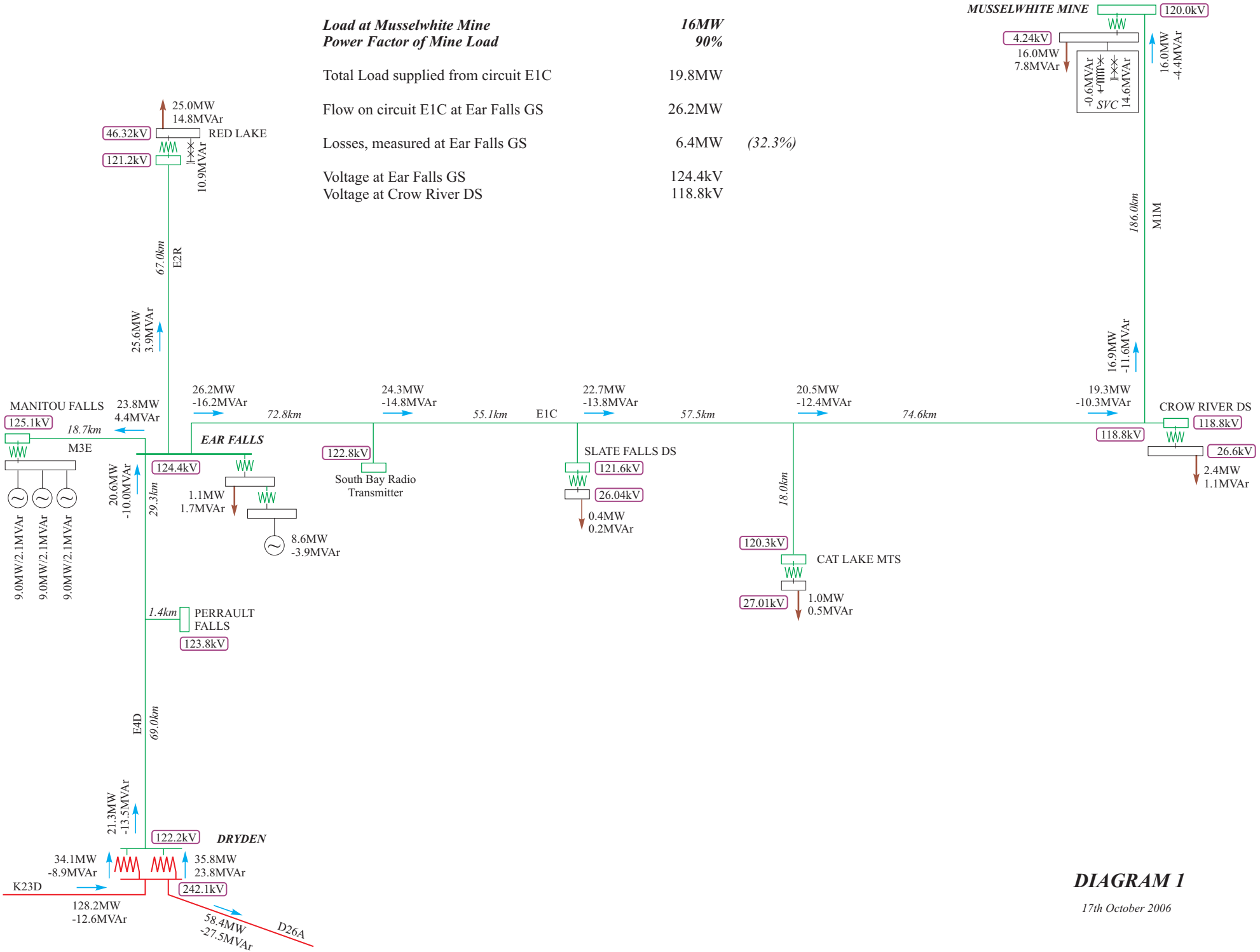


DIAGRAM 1

17th October 2006

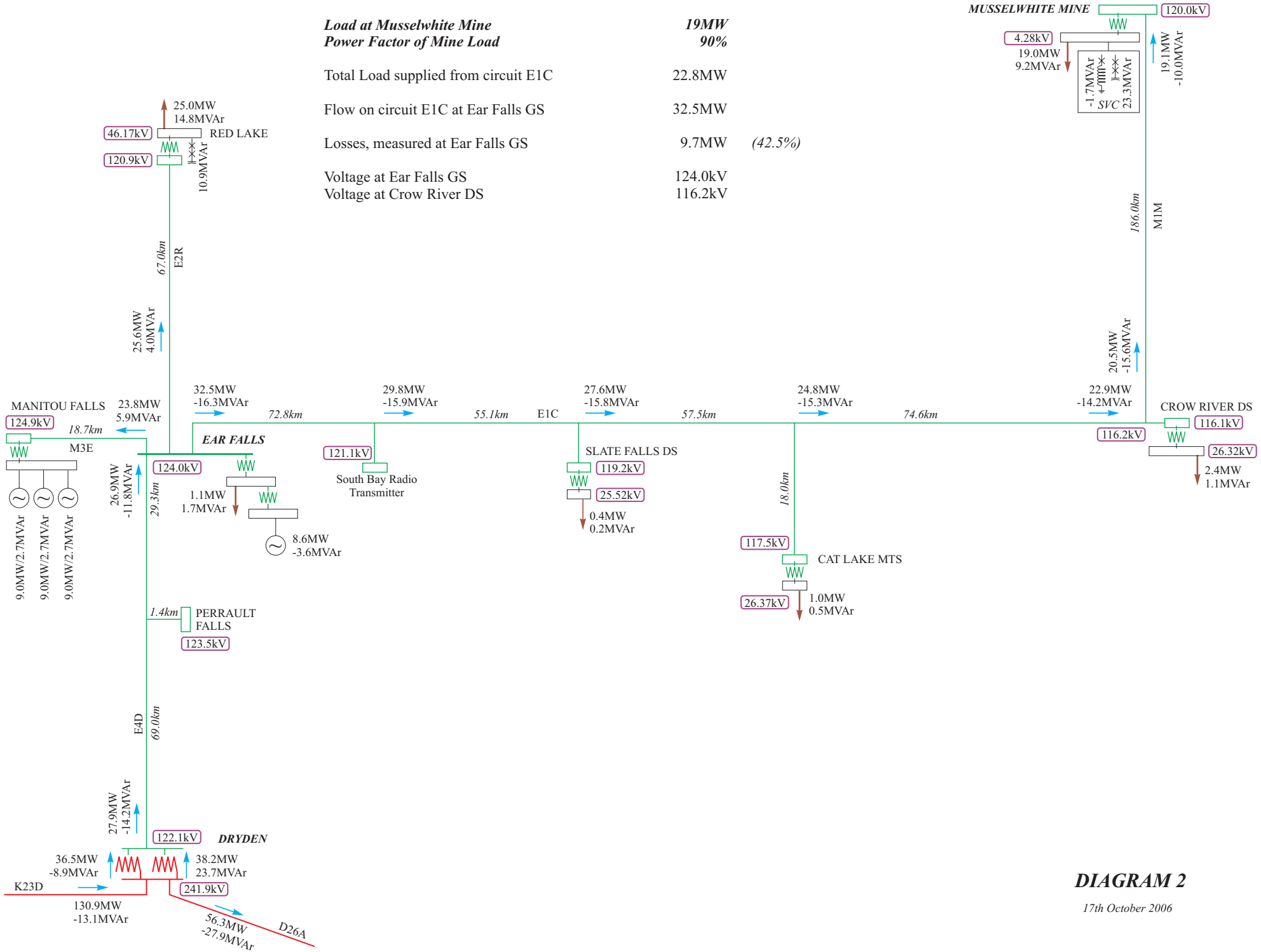


DIAGRAM 2

17th October 2006

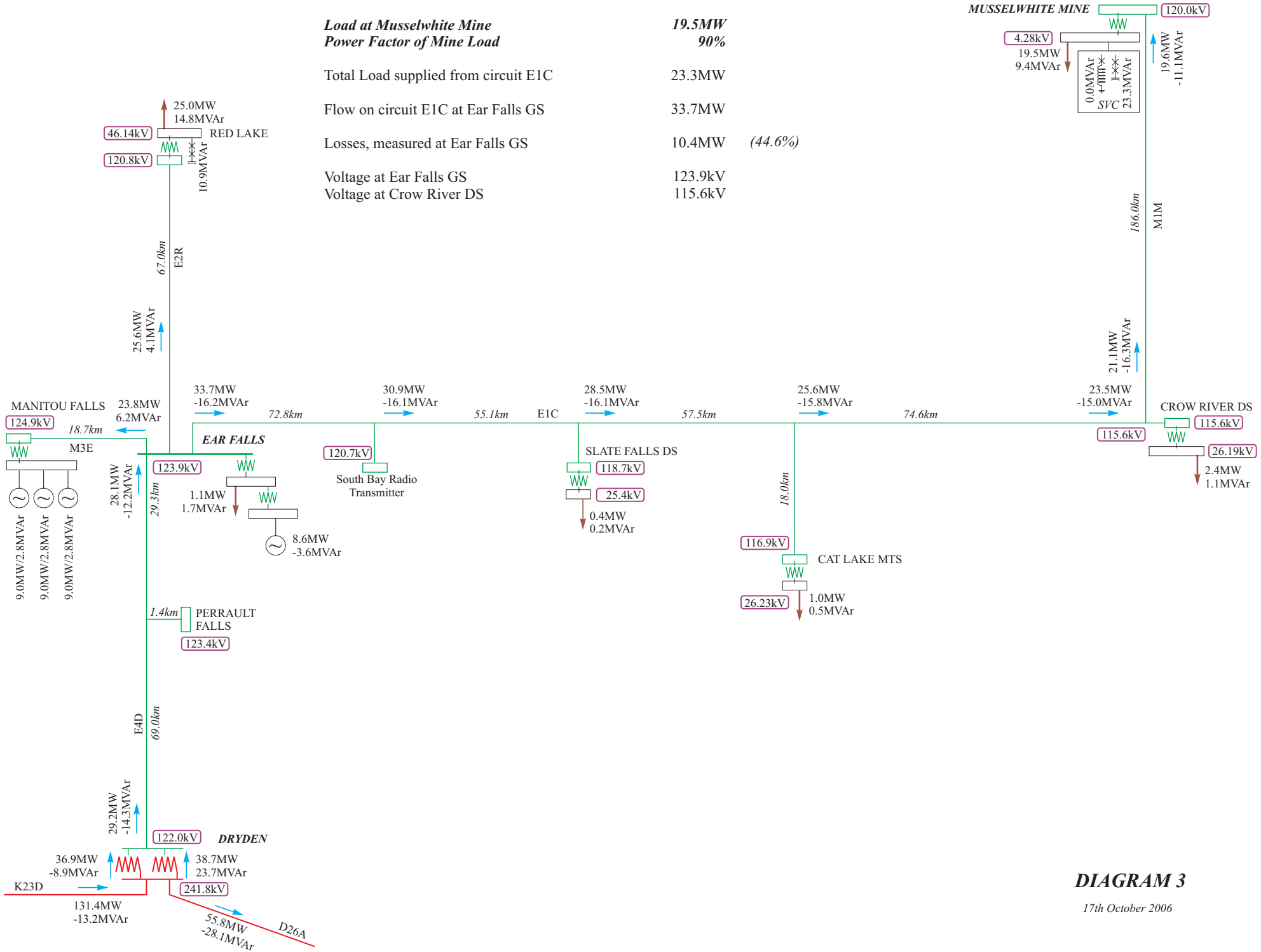
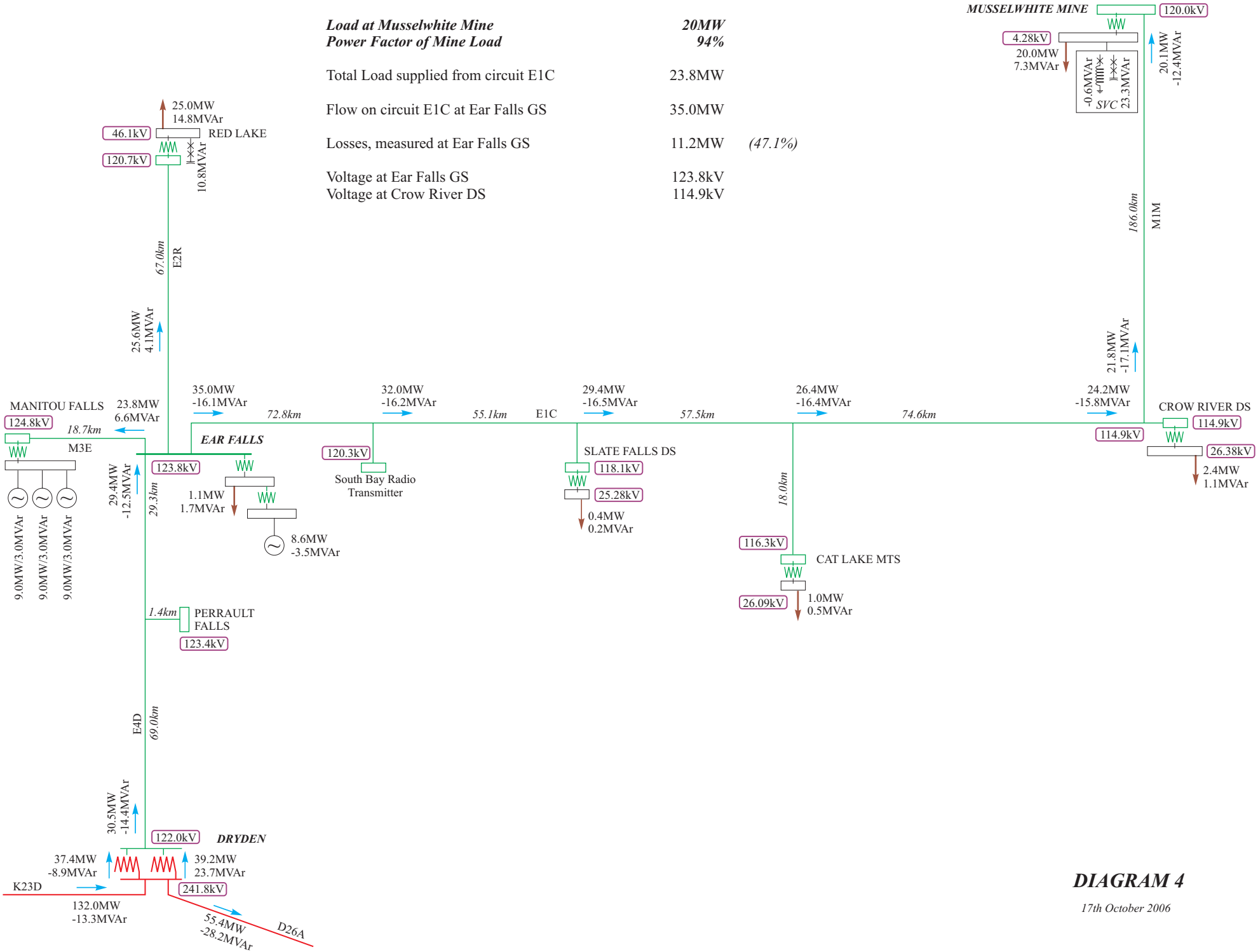


DIAGRAM 3

17th October 2006



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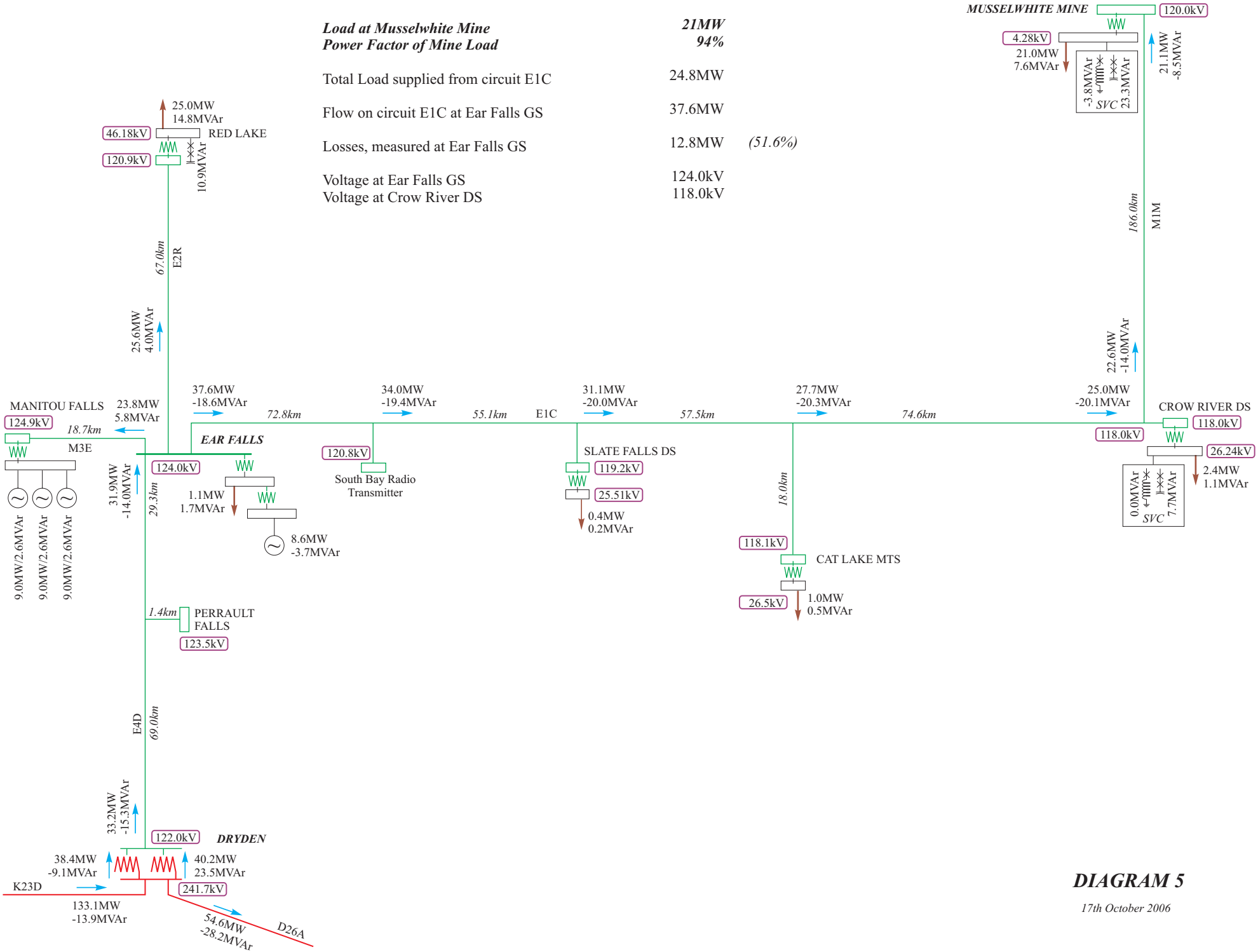
17th October 2006



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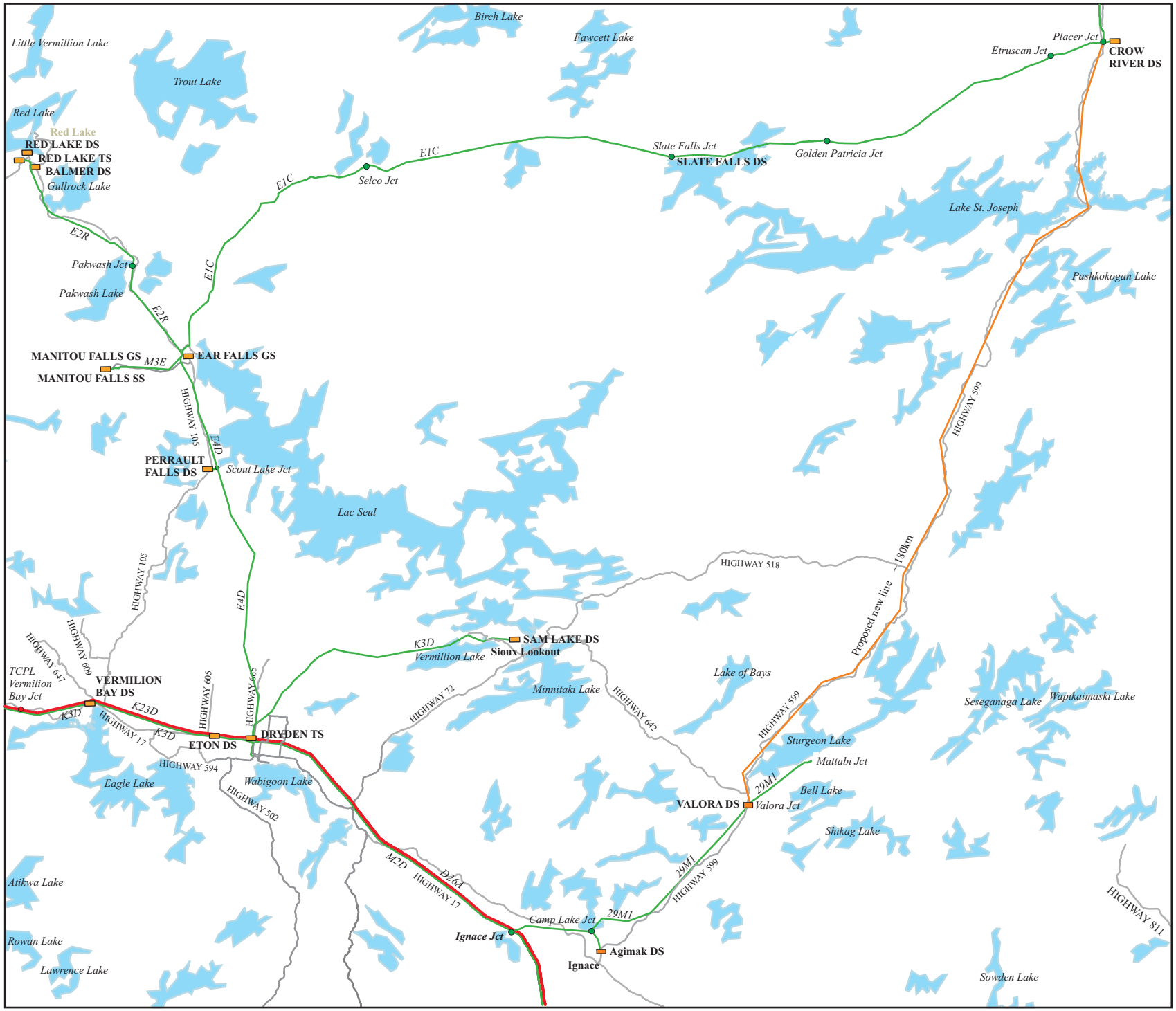


Existing:

230kV Lines

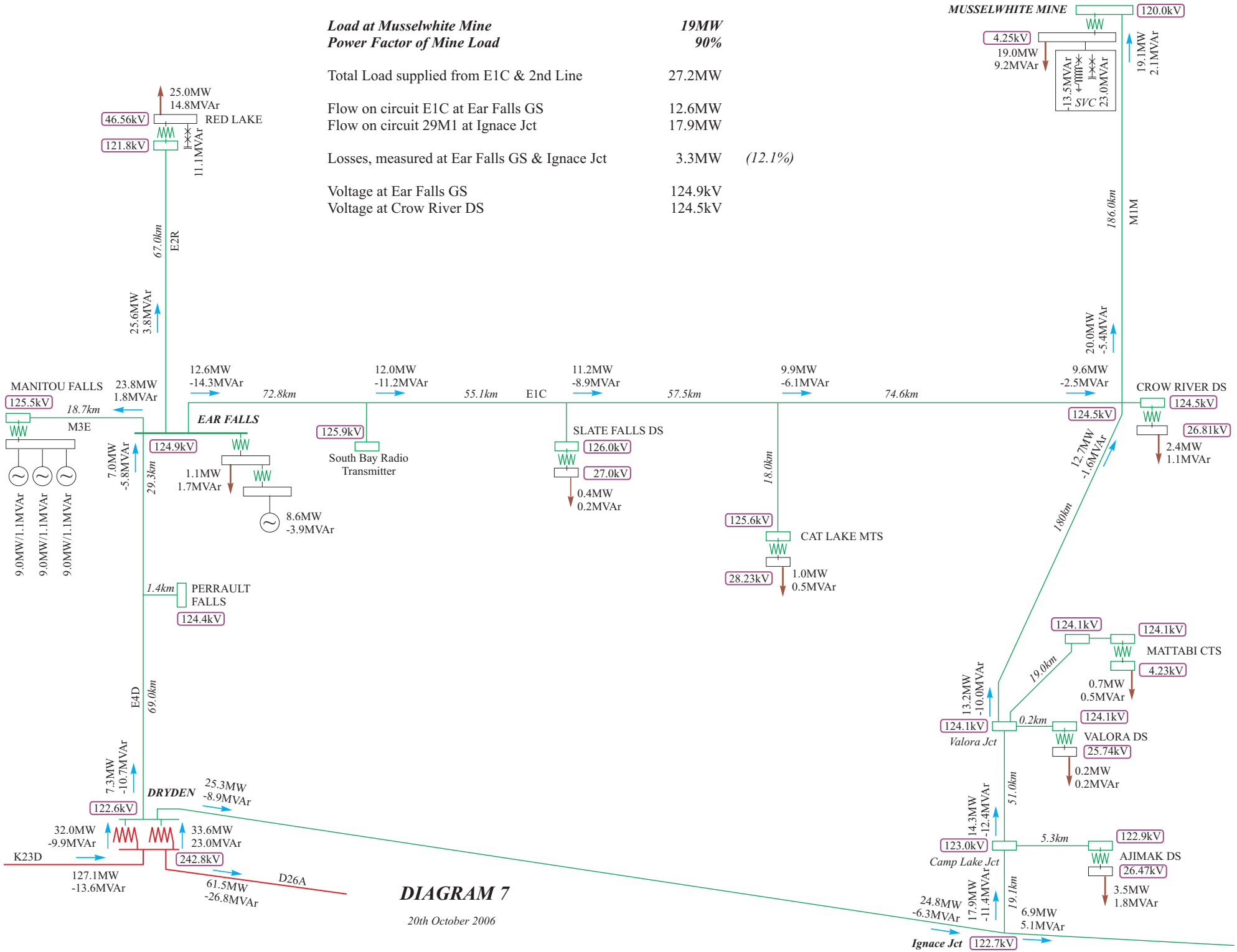
115kV Lines

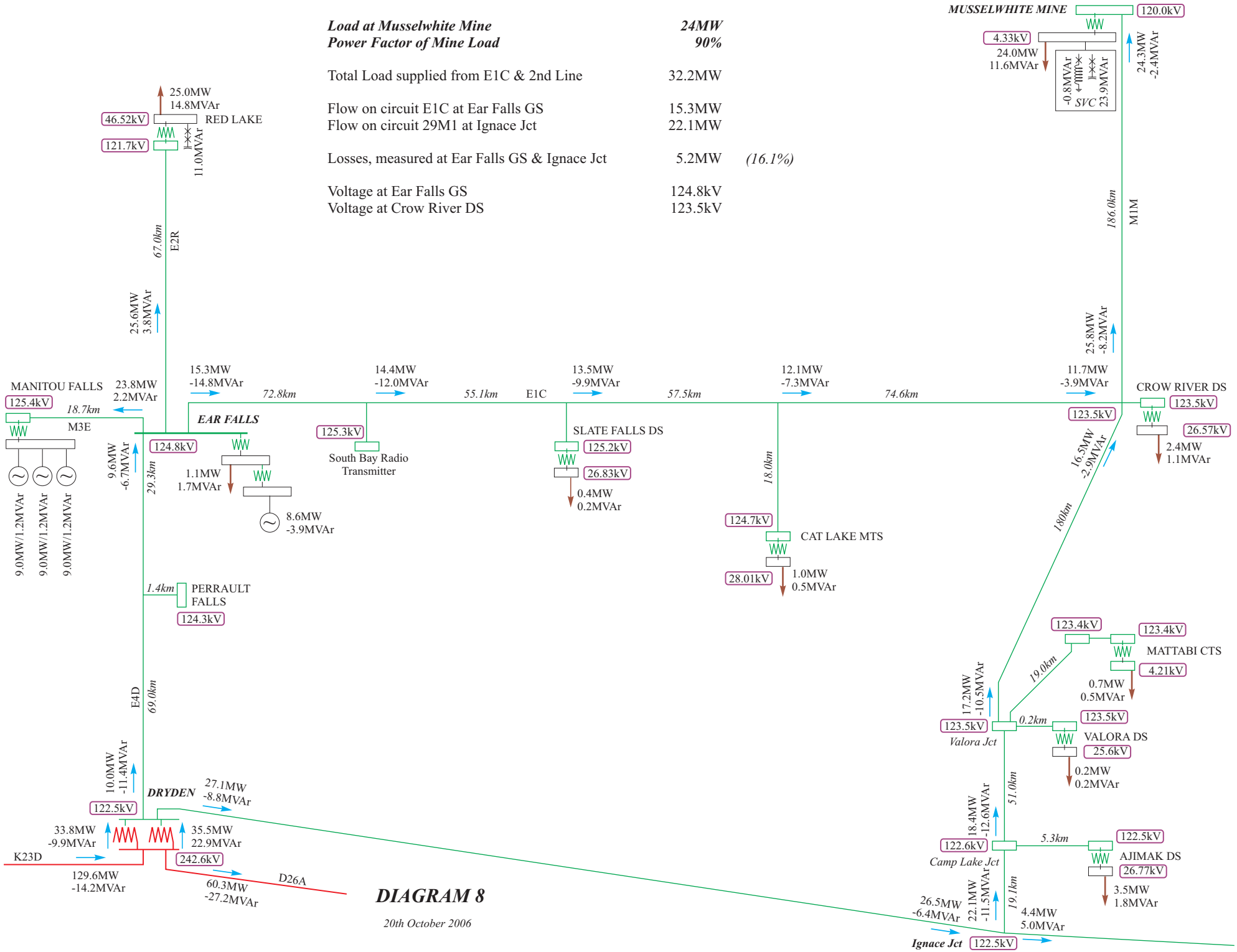
Proposed:

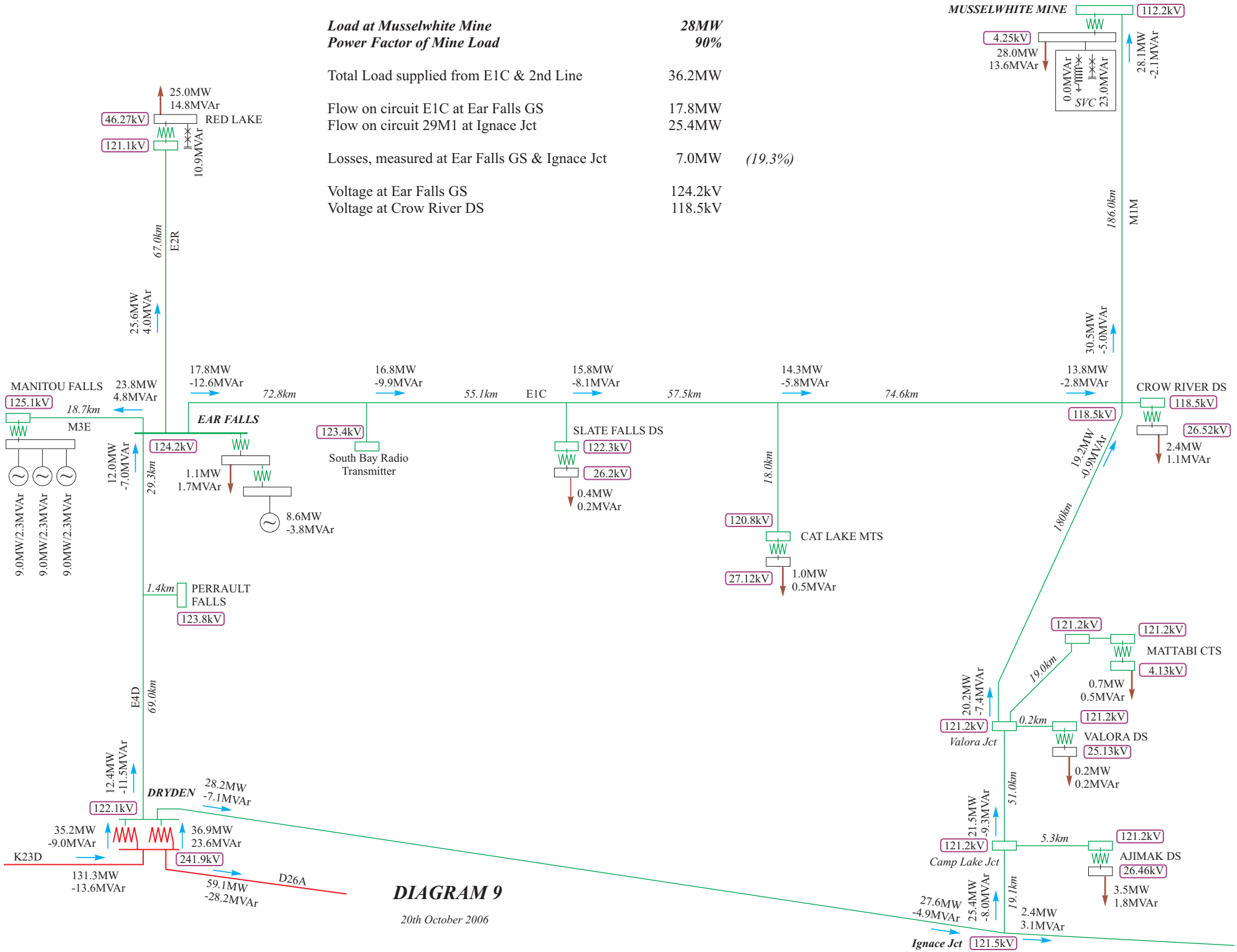
115kV Lines

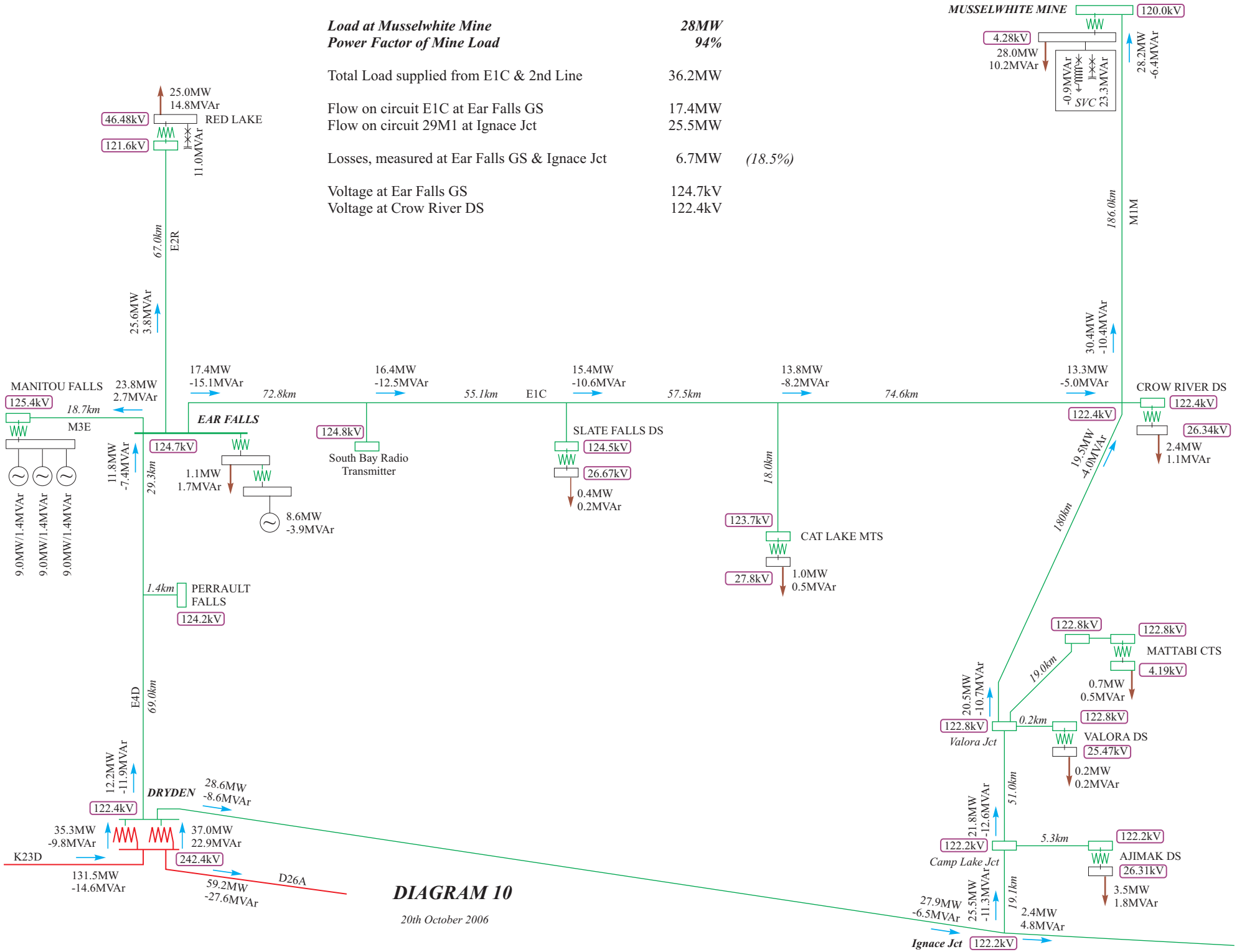
DIAGRAM 6

19th October 2006


Load at Musselwhite Mine 19MW
Power Factor of Mine Load 90%
Total Load supplied from E1C & 2nd Line 27.2MW
Flow on circuit E1C at Ear Falls GS 12.6MW
Flow on circuit 29M1 at Ignace Jct 17.9MW
Losses, measured at Ear Falls GS & Ignace Jct 3.3MW (12.1%)
Voltage at Ear Falls GS 124.9kV
Voltage at Crow River DS 124.5kV
MUSSELWHITE MINE
120.0kV
4.25kV
19.0MW
9.2MVAr
-13.5MVAr SVC 23.0MVAr
19.1MW
2.1MVAr
186.0km
M1M
25.0MW
14.8MVAr
46.56kV
RED LAKE
121.8kV
11.1MVAr
67.0km
E2R
25.6MW
3.8MVAr
20.0MW
-5.4MVAr
MANITOU FALLS
125.5kV
23.8MW
1.8MVAr
18.7km
M3E
9.0MW/1.1MVAr
9.0MW/1.1MVAr
9.0MW/1.1MVAr
12.6MW
-14.3MVAr
72.8km
EAR FALLS
124.9kV
7.0MW
-5.8MVAr
29.3km
1.1MW
1.7MVAr
8.6MW
-3.9MVAr
12.0MW
-11.2MVAr
55.1km
E1C
125.9kV
South Bay Radio
Transmitter
11.2MW
-8.9MVAr
57.5km
SLATE FALLS DS
126.0kV
27.0kV
0.4MW
0.2MVAr
9.9MW
-6.1MVAr
18.0km
125.6kV
CAT LAKE MTS
28.23kV
1.0MW
0.5MVAr
74.6km
9.6MW
-2.5MVAr
CROW RIVER DS
124.5kV
124.5kV
26.81kV
2.4MW
1.1MVAr
12.7MW
-1.6MVAr
180km
1.4km
PERRAULT
FALLS
124.4kV
E4D
69.0km
7.3MW
-10.7MVAr
DRYDEN
122.6kV
25.3MW
-8.9MVAr
32.0MW
-9.9MVAr
33.6MW
23.0MVAr
K23D
242.8kV
127.1MW
-13.6MVAr
61.5MW
-26.8MVAr
D26A
124.1kV
124.1kV
MATTABI CTS
4.23kV
0.7MW
0.5MVAr
19.0km
13.2MW
-10.0MVAr
124.1kV
Valora Jct
0.2km
124.1kV
VALORA DS
25.74kV
0.2MW
0.2MVAr
51.0km
14.3MW
-12.4MVAr
123.0kV
Camp Lake Jct
5.3km
122.9kV
AJIMAK DS
26.47kV
3.5MW
1.8MVAr
19.1km
17.9MW
-11.4MVAr
24.8MW
-6.3MVAr
6.9MW
5.1MVAr
Ignace Jct
122.7kV
DIAGRAM 7
20th October 2006


Load at Musselwhite Mine 24MW
Power Factor of Mine Load 90%
Total Load supplied from E1C & 2nd Line 32.2MW
Flow on circuit E1C at Ear Falls GS 15.3MW
Flow on circuit 29M1 at Ignace Jct 22.1MW
Losses, measured at Ear Falls GS & Ignace Jct 5.2MW (16.1%)
Voltage at Ear Falls GS 124.8kV
Voltage at Crow River DS 123.5kV
MUSSELWHITE MINE
120.0kV
4.33kV
24.0MW
11.6MVAr
-0.8MVAr
SVC
23.9MVAr
24.3MW
-2.4MVAr
186.0km
M1M
25.0MW
14.8MVAr
46.52kV
RED LAKE
121.7kV
11.0MVAr
67.0km
E2R
25.6MW
3.8MVAr
25.8MW
-8.2MVAr
MANITOU FALLS
125.4kV
23.8MW
2.2MVAr
18.7km
M3E
9.0MW/1.2MVAr
9.0MW/1.2MVAr
9.0MW/1.2MVAr
15.3MW
-14.8MVAr
72.8km
EAR FALLS
124.8kV
9.6MW
-6.7MVAr
29.3km
1.1MW
1.7MVAr
8.6MW
-3.9MVAr
14.4MW
-12.0MVAr
55.1km
E1C
125.3kV
South Bay Radio
Transmitter
13.5MW
-9.9MVAr
57.5km
SLATE FALLS DS
125.2kV
26.83kV
0.4MW
0.2MVAr
12.1MW
-7.3MVAr
74.6km
18.0km
124.7kV
CAT LAKE MTS
28.01kV
1.0MW
0.5MVAr
11.7MW
-3.9MVAr
CROW RIVER DS
123.5kV
123.5kV
26.57kV
2.4MW
1.1MVAr
16.5MW
-2.9MVAr
180km
1.4km
PERRAULT
FALLS
124.3kV
E4D
69.0km
10.0MW
-11.4MVAr
DRYDEN
122.5kV
27.1MW
-8.8MVAr
33.8MW
-9.9MVAr
35.5MW
22.9MVAr
K23D
129.6MW
-14.2MVAr
242.6kV
60.3MW
-27.2MVAr
D26A
123.4kV
123.4kV
MATTABI CTS
4.21kV
0.7MW
0.5MVAr
19.0km
17.2MW
-10.5MVAr
123.5kV
Valora Jct
0.2km
123.5kV
VALORA DS
25.6kV
0.2MW
0.2MVAr
51.0km
18.4MW
-12.6MVAr
122.6kV
Camp Lake Jct
5.3km
122.5kV
AJIMAK DS
26.77kV
3.5MW
1.8MVAr
19.1km
22.1MW
-11.5MVAr
26.5MW
-6.4MVAr
4.4MW
5.0MVAr
Ignace Jct
122.5kV
DIAGRAM 8
20th October 2006


Load at Musselwhite Mine 28MW
Power Factor of Mine Load 90%
Total Load supplied from E1C & 2nd Line 36.2MW
Flow on circuit E1C at Ear Falls GS 17.8MW
Flow on circuit 29M1 at Ignace Jct 25.4MW
Losses, measured at Ear Falls GS & Ignace Jct 7.0MW (19.3%)
Voltage at Ear Falls GS 124.2kV
Voltage at Crow River DS 118.5kV
MUSSELWHITE MINE
112.2kV
4.25kV
28.0MW
13.6MVAr
0.0MVAr
SVC
23.0MVAr
28.1MW
-2.1MVAr
186.0km
M1M
25.0MW
14.8MVAr
46.27kV
RED LAKE
121.1kV
10.9MVAr
67.0km
E2R
25.6MW
4.0MVAr
30.5MW
-5.0MVAr
MANITOU FALLS
125.1kV
23.8MW
4.8MVAr
18.7km
M3E
9.0MW/2.3MVAr
9.0MW/2.3MVAr
9.0MW/2.3MVAr
17.8MW
-12.6MVAr
72.8km
EAR FALLS
124.2kV
12.0MW
-7.0MVAr
29.3km
1.1MW
1.7MVAr
8.6MW
-3.8MVAr
16.8MW
-9.9MVAr
55.1km
E1C
123.4kV
South Bay Radio
Transmitter
15.8MW
-8.1MVAr
57.5km
SLATE FALLS DS
122.3kV
26.2kV
0.4MW
0.2MVAr
14.3MW
-5.8MVAr
74.6km
18.0km
120.8kV
CAT LAKE MTS
27.12kV
1.0MW
0.5MVAr
13.8MW
-2.8MVAr
CROW RIVER DS
118.5kV
118.5kV
26.52kV
2.4MW
1.1MVAr
19.2MW
-0.9MVAr
180km
1.4km
PERRAULT
FALLS
123.8kV
E4D
69.0km
12.4MW
-11.5MVAr
DRYDEN
122.1kV
28.2MW
-7.1MVAr
35.2MW
-9.0MVAr
36.9MW
23.6MVAr
K23D
241.9kV
131.3MW
-13.6MVAr
59.1MW
-28.2MVAr
D26A
121.2kV
121.2kV
MATTABI CTS
4.13kV
0.7MW
0.5MVAr
19.0km
20.2MW
-7.4MVAr
121.2kV
Valora Jct
0.2km
121.2kV
VALORA DS
25.13kV
0.2MW
0.2MVAr
51.0km
21.5MW
-9.3MVAr
121.2kV
Camp Lake Jct
5.3km
121.2kV
AJIMAK DS
26.46kV
3.5MW
1.8MVAr
19.1km
25.4MW
-8.0MVAr
27.6MW
-4.9MVAr
2.4MW
3.1MVAr
Ignace Jct
121.5kV
DIAGRAM 9
20th October 2006


Load at Musselwhite Mine 28MW
Power Factor of Mine Load 94%
Total Load supplied from E1C & 2nd Line 36.2MW
Flow on circuit E1C at Ear Falls GS 17.4MW
Flow on circuit 29M1 at Ignace Jct 25.5MW
Losses, measured at Ear Falls GS & Ignace Jct 6.7MW (18.5%)
Voltage at Ear Falls GS 124.7kV
Voltage at Crow River DS 122.4kV
MUSSELWHITE MINE
120.0kV
4.28kV
28.0MW
10.2MVAr
-0.9MVAr
SVC
23.3MVAr
28.2MW
-6.4MVAr
186.0km
M1M
25.0MW
14.8MVAr
46.48kV
RED LAKE
121.6kV
11.0MVAr
67.0km
E2R
25.6MW
3.8MVAr
30.4MW
-10.4MVAr
MANITOU FALLS
125.4kV
23.8MW
2.7MVAr
18.7km
M3E
9.0MW/1.4MVAr
9.0MW/1.4MVAr
9.0MW/1.4MVAr
17.4MW
-15.1MVAr
72.8km
EAR FALLS
124.7kV
11.8MW
-7.4MVAr
29.3km
1.1MW
1.7MVAr
8.6MW
-3.9MVAr
16.4MW
-12.5MVAr
124.8kV
South Bay Radio
Transmitter
55.1km
E1C
15.4MW
-10.6MVAr
SLATE FALLS DS
124.5kV
26.67kV
0.4MW
0.2MVAr
57.5km
18.0km
13.8MW
-8.2MVAr
123.7kV
CAT LAKE MTS
27.8kV
1.0MW
0.5MVAr
74.6km
13.3MW
-5.0MVAr
CROW RIVER DS
122.4kV
122.4kV
26.34kV
2.4MW
1.1MVAr
19.5MW
4.0MVAr
180km
1.4km
PERRAULT
FALLS
124.2kV
E4D
69.0km
122.8kV
122.8kV
MATTABI CTS
4.19kV
0.7MW
0.5MVAr
19.0km
20.5MW
-10.7MVAr
122.8kV
Valora Jct
0.2km
122.8kV
VALORA DS
25.47kV
0.2MW
0.2MVAr
51.0km
12.2MW
-11.9MVAr
DRYDEN
122.4kV
28.6MW
-8.6MVAr
35.3MW
-9.8MVAr
37.0MW
22.9MVAr
K23D
242.4kV
131.5MW
-14.6MVAr
59.2MW
-27.6MVAr
D26A
21.8MW
-12.6MVAr
122.2kV
Camp Lake Jct
5.3km
122.2kV
AJIMAK DS
26.31kV
3.5MW
1.8MVAr
19.1km
27.9MW
-6.5MVAr
25.5MW
-11.3MVAr
2.4MW
4.8MVAr
Ignace Jct
122.2kV
DIAGRAM 10
20th October 2006