IMO_REP_0082

CONNECTION ASSESSMENT & APPROVAL PROCESS

PRELIMINARY ASSESSMENT REPORT: Addendum

For the Revised Location of Markham MTS No. 4

CAA ID No. 2002-054

Consistent Information Set Department, and
Long Term Forecasts & Assessments Department

Date: 15th July 2002

Station A Box 4474 Toronto ON M5W 4E5 Canada **tel** 905.855.6100 **fax** 905.855.6372 **www.theIMO.com**

Addendum to the Preliminary Assessment Report for the Proposed Markham MTS No. 4

Revised Location for the New MTS

Introduction

In their original application for a Connection Assessment, Markham Hydro had indicated that their new MTS No. 4 would be located adjacent to the existing right-of-way, at a site approximately 9.5km from Cherrywood TS.

Since it has not been possible to acquire the required property, Markham Hydro has therefore decided to construct the new MTS adjacent to MTS No. 3 on Kennedy Road. The new MTS will now be approximately 15.5km from Cherrywood TS.

Diagrams 2 to 6 inclusive have been revised to show the proposed connection arrangement of MTS No. 4 in relation to the existing Markham Hydro facilities.

Distribution of Loads

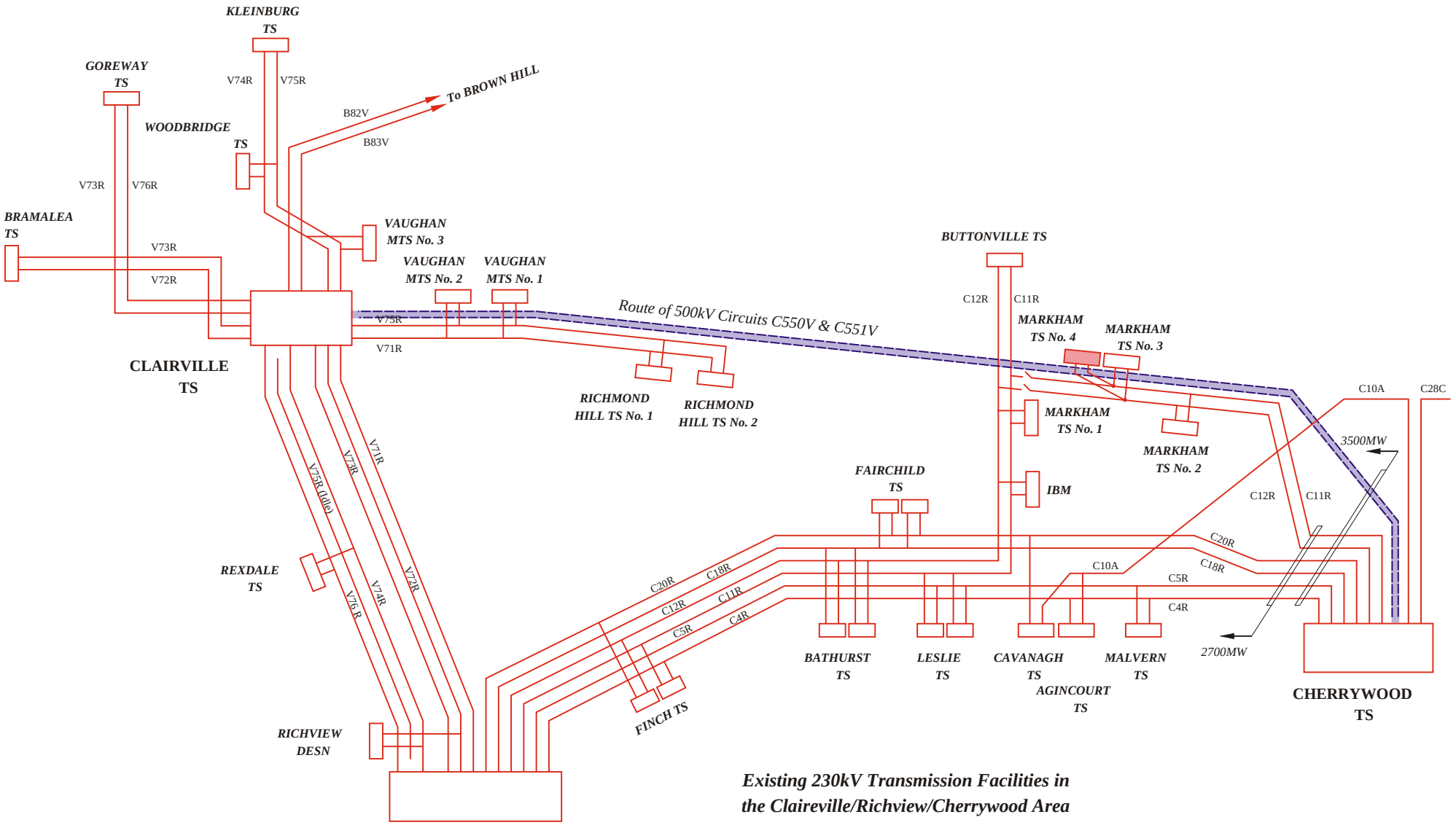
Once MTS No. 4 is placed in-service, the load that is presently supplied from MTS No. 3 is to be redistributed between the two stations. This will then allow a portion of the existing load at MTS No. 2, the most easterly of the Markham Hydro facilities, to be transferred to these two stations. The subsequent reduction in the load on MTS No. 2 will then allow it to be used to supply the area that was to have been supplied from the original location of MTS No.4.

Impact of the revised location on the IMO-controlled grid

Since the revised location of MTS No. 4 will not effect the total load that is to be supplied from the section of circuits C11R and C12R between Cherrywood TS and Parkway Junction, the results of the Preliminary Assessment will remain valid.

Notification of Approval to Connect

It has therefore been concluded that the proposed change in the location of MTS No. 4 will have no adverse impact on the IMO-controlled grid and the original Notification of Approval to Connect, dated 24th June 2002, will also remain valid.

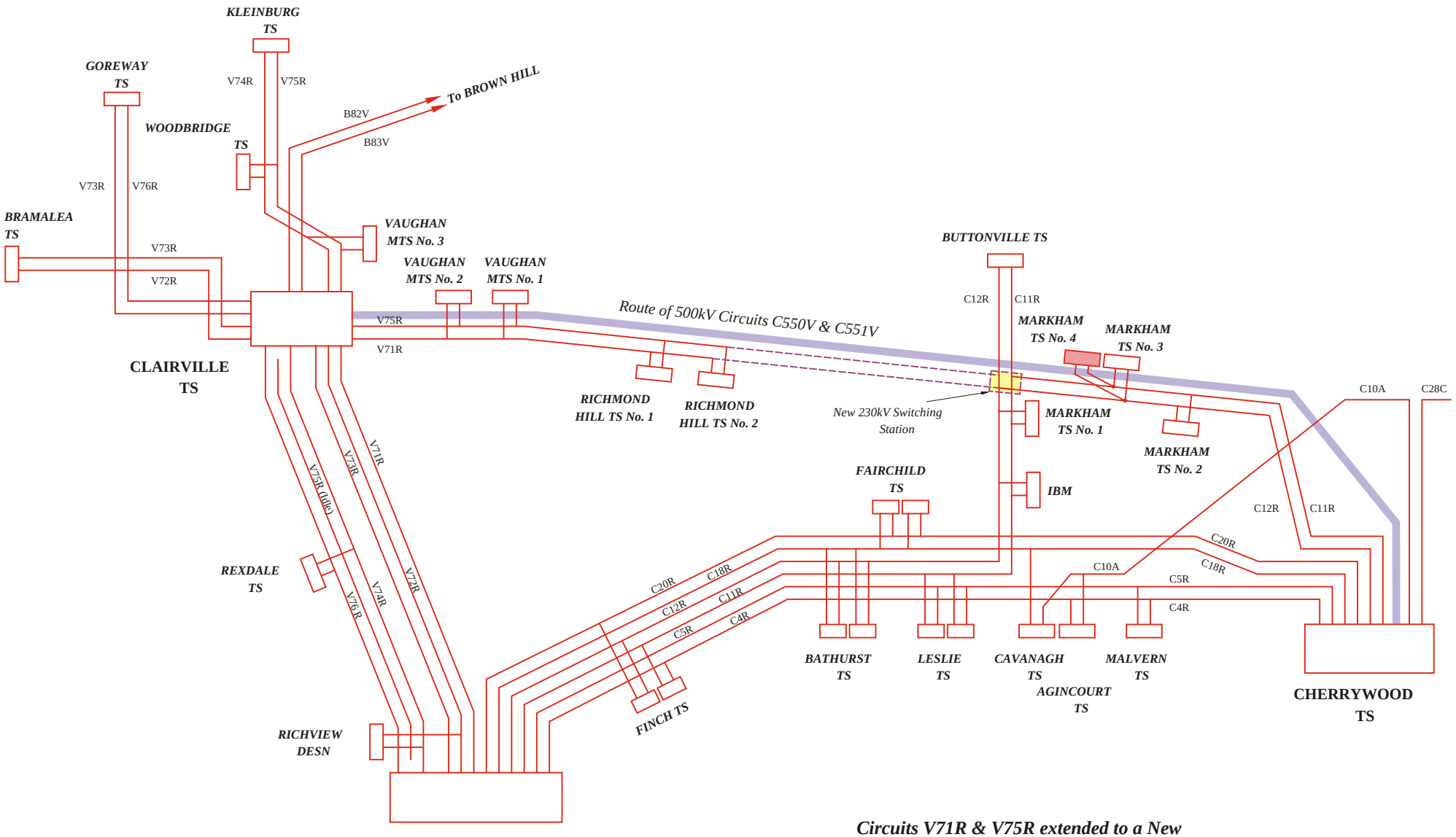


Existing 230kV Transmission Facilities in the Claireville/Richview/Cherrywood Area

Proposed Location of Markham MTS No. 4 added

DIAGRAM 2

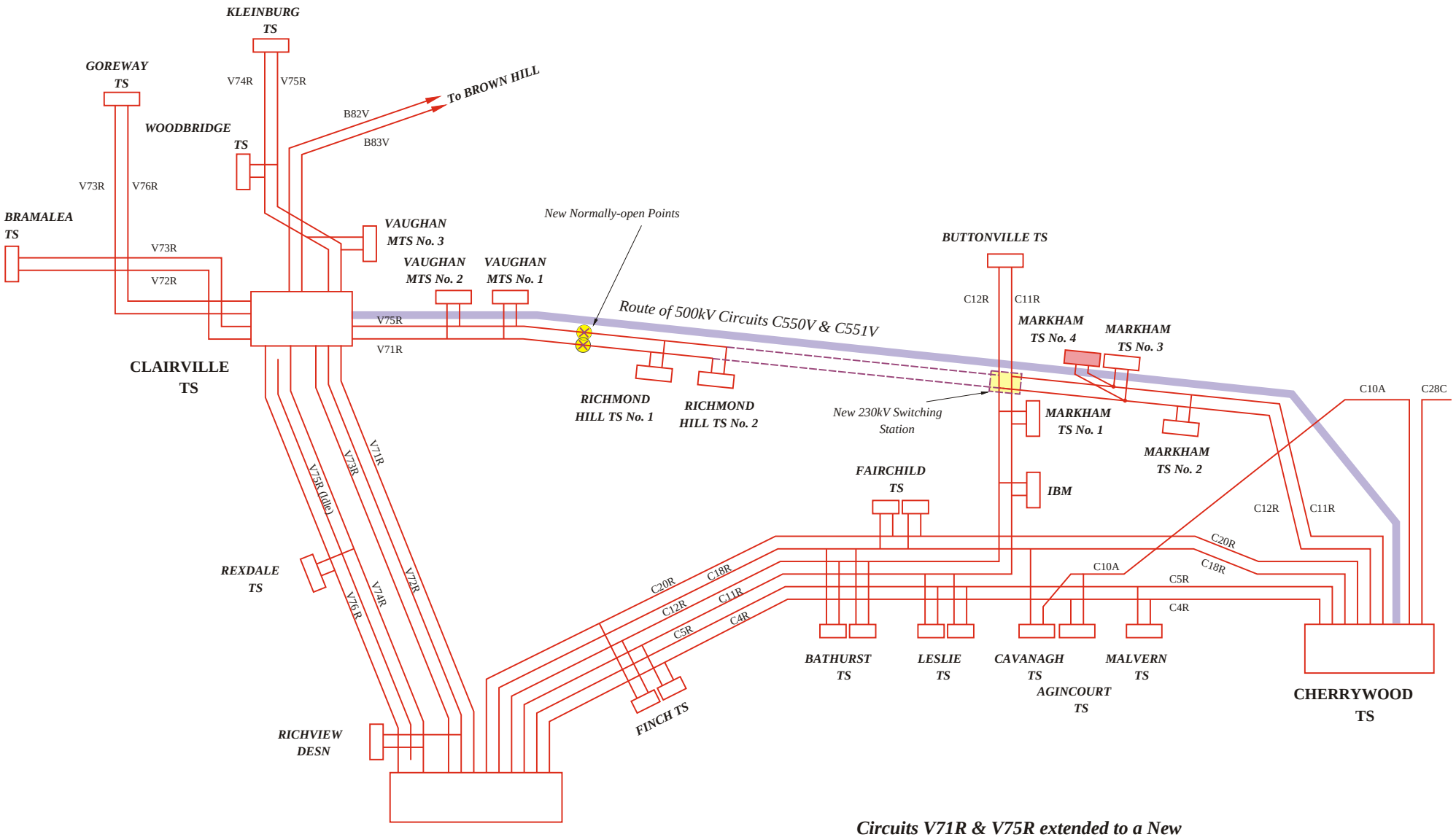
10th June 2002
Revised 16th July 2002



Circuits V71R & V75R extended to a New Switching Station at Parkway Junction

DIAGRAM 3

10th June 2002
Revised 16th July 2002

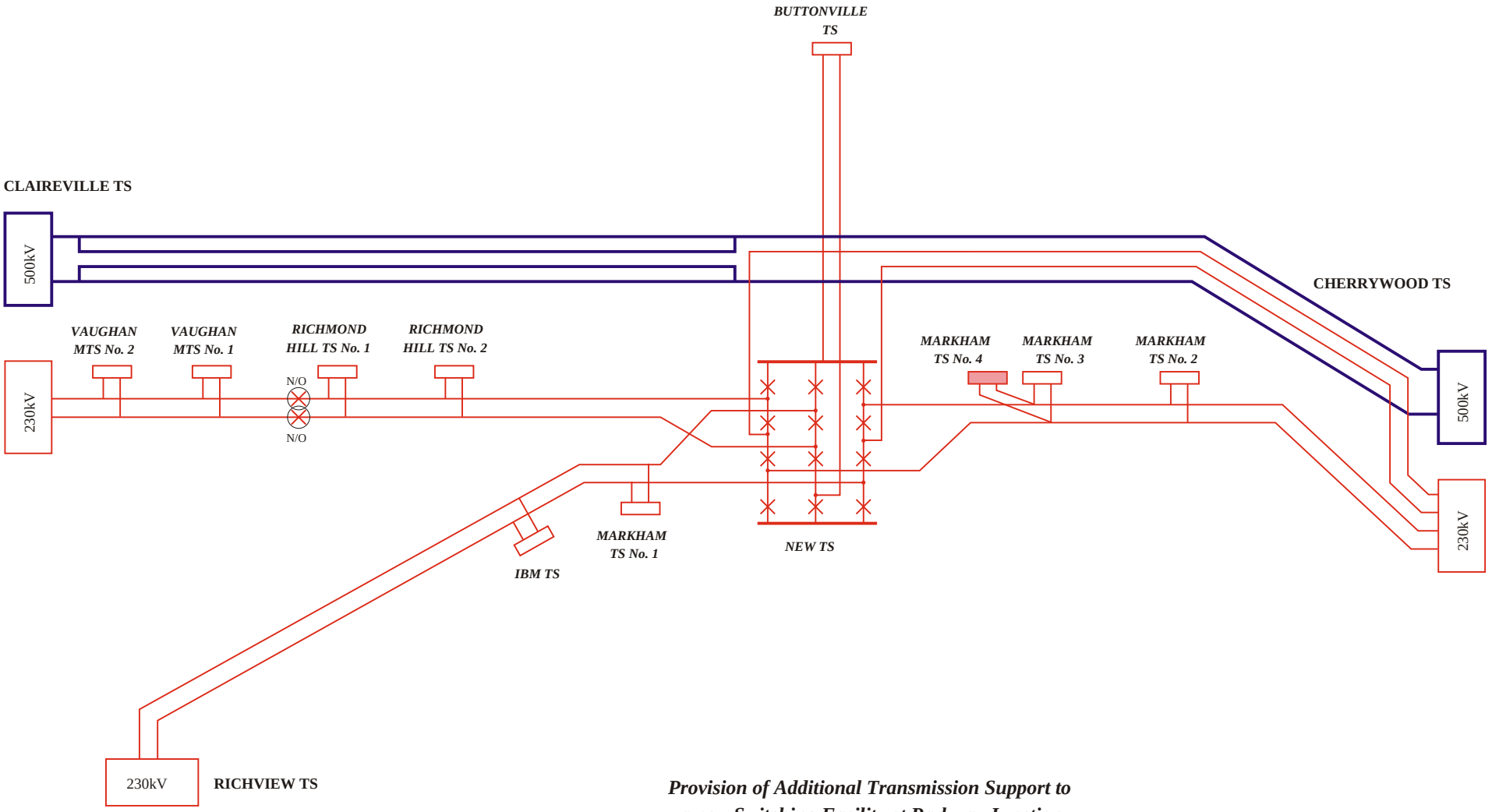


Circuits V71R & V75R extended to a New Switching Station at Parkway Junction

With new normally-open points in circuits V71R & V75R

DIAGRAM 4

10th June 2002
Revised 16th July 2002

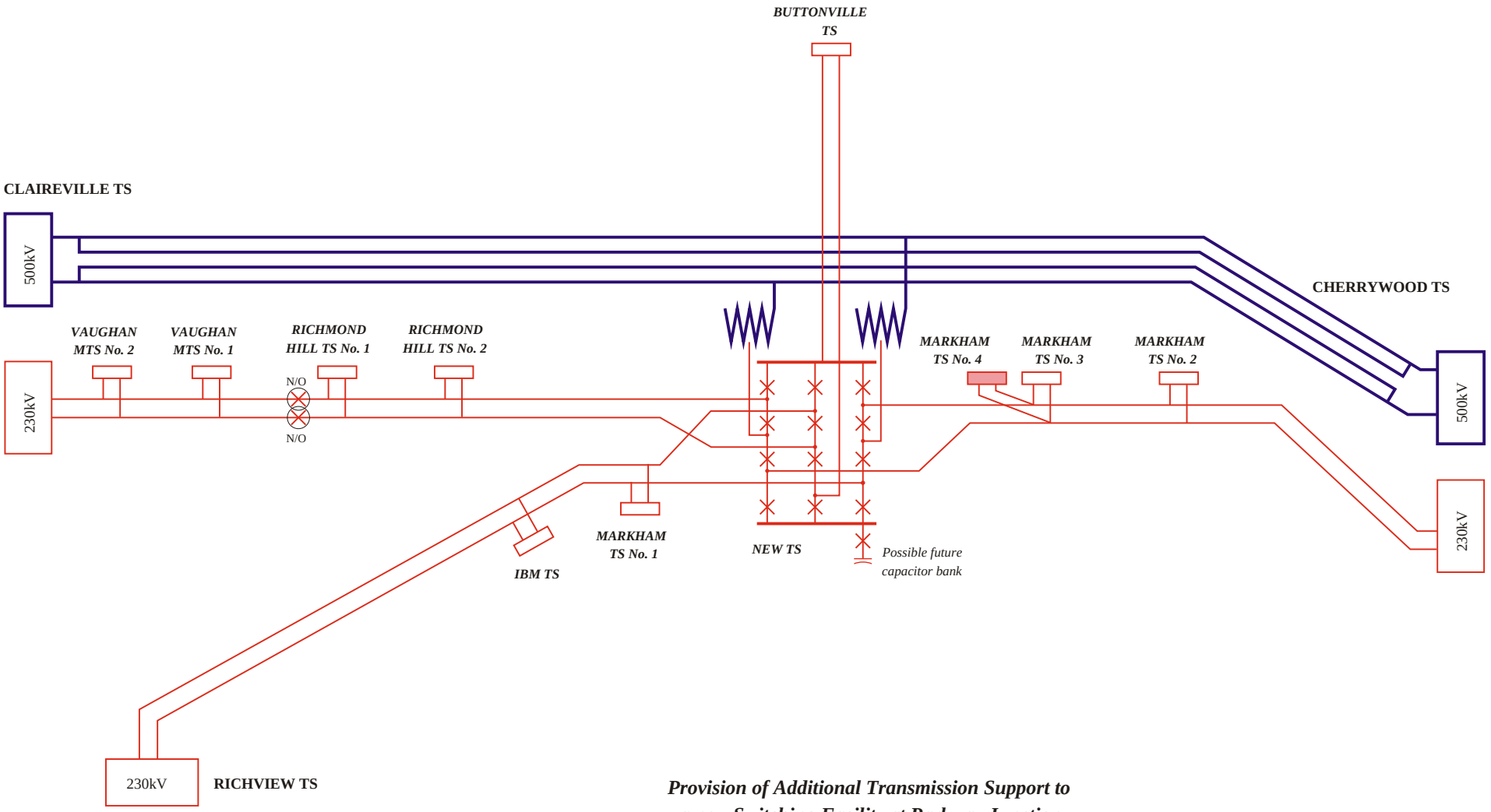


Provision of Additional Transmission Support to a new Switching Facility at Parkway Junction

(230kV Option)

DIAGRAM 5

10th June 2002
Revised 16th July 2002



Provision of Additional Transmission Support to a new Switching Facility at Parkway Junction

(500kV Option)

DIAGRAM 6

10th June 2002
Revised 16th July 2002

IMO_REP_0082

CONNECTION ASSESSMENT & APPROVAL PROCESS

PRELIMINARY ASSESSMENT REPORT

For the Proposed Markham MTS No. 4

CAA ID No. 2002-054

Consistent Information Set Department, and
Long Term Forecasts & Assessments Department

FINAL Version

Date: 24th June 2002

Station A Box 4474 Toronto ON M5W 4E5 Canada **tel** 905.855.6100 **fax** 905.855.6372 **www.theIMO.com**

Preliminary Assessment Report

For the Proposal by Markham Hydro Distribution Inc. to Install Markham MTS No. 4

Acknowledgement

The IMO wishes to acknowledge the assistance of Hydro One in completing some of the studies for this assessment.

Disclaimers

IMO

This report has been prepared solely for the purpose of assessing whether the connection applicant's proposed connection with the IMO-controlled grid would have an adverse impact on the reliability of the integrated power system and whether the IMO should issue a notice of approval or disapproval of the proposed connection under Chapter 4, Section 6 of the Market Rules. This report has not been prepared for any other purpose and should not be used or relied upon by any person for another purpose. In particular, this report does not address any other Market-related or any commercial aspects of the connection proposal. This report has been prepared solely for use by the connection applicant and the IMO in accordance with Chapter 4, Section 6 of the Market Rules. The IMO assumes no responsibility to any third party for any use which it makes of this report. Any liability which the IMO may have to the connection applicant in respect of this report is governed by Chapter 1, Section 13 of the Market Rules. The IMO reserves the right to revise this report at any time, at its sole discretion, without notice to the connection applicant. Although the IMO will use its best efforts to advise the connection applicant of such changes, it is the responsibility of the connection applicant to ensure that the most recent version of this report is being used.

Hydro One

Special Notes and Limitations of Study Results

The results reported in this preliminary feasibility study are based on the information available to Hydro One, at the time of the study, suitable for a preliminary assessment of a new generation or load connection proposal.

The short circuit and thermal loading levels have been computed based on the information provided by the connection proponent at the time of the study. These levels may be higher or lower if the connection information changes as a result of, but not limited to, subsequent design modifications or when more accurate test measurement data is available.

This study does not assess the short circuit or thermal loading impact of the proposed connection on facilities owned by other load and generation (including OPGI) customers.

In this preliminary feasibility study, short circuit adequacy is assessed only for Hydro One breakers and does not include other Hydro One facilities. The short circuit results are only for the purpose of assessing the capabilities of existing Hydro One breakers and identifying upgrades required to incorporate the proposed connection. These results should not be used in the design and engineering of new facilities for the proposed connection. The necessary data will be provided by Hydro One and discussed with the connection proponent upon request.

The ampacity rating of Hydro One facilities are established based on assumptions used in Hydro One for power system planning studies. The actual ampacity ratings during operations may be determined in real-time and are based on actual system conditions, including ambient temperature, wind speed and facility loading, and may be higher or lower than those stated in this study.

The additional facilities or upgrades, which are required to incorporate the proposed connection, have been identified to the extent permitted by a preliminary assessment. Additional facility studies may be necessary to confirm constructability and the time required for construction. System impact or further studies at more advanced stages of the project development may identify additional facilities that need to be provided or that require upgrading.

PRELIMINARY ASSESSMENT REPORT

For the New Markham MTS No. 4 DESN Station

1. Introduction

Markham Hydro Distribution Inc. is proposing to build a fourth transformer station, Markham MTS No. 4 that will be used to off-load the existing three Markham MTSs while also providing capacity to supply the increasing load in the area.

The new MTS is to be identical to the three existing MTSs which are each equipped with two 50/66.7/83MVA 230/27.6kV step-down transformers. The 10-day limited-time-rating for each TS (with one transformer out-of-service) is approximately 112MVA under summer conditions. Since the combined peak load that was supplied from the three existing MTSs during the summer-2001 was 360MVA, each station is operating close to, or above, its 10-day LTR.

The three existing Markham MTSs, as well as Buttonville TS and IBM TS, are supplied exclusively from the 230kV double-circuit line, C11R/C12R, between Cherrywood TS and Richview TS. It is proposed that the new TS will also be supplied from these circuits.

2. Connection Arrangement

Diagram 1 shows the proposed configuration of the new MTS and its connection on to circuits C11R & C12R.

Each transformer is to be switched via a 230kV SF_6 circuit switcher with the following ratings:

- continuous rating 1200A rms
- fault interrupting capability 20kA rms symmetrical
- maximum operating voltage 260kV

Each of the two 50/66.7/83MVA Wye : Zig-zag step-down transformers is to be equipped with under-load tap-changers, with a range of 253kV to 207kV in 16 steps. The HV winding is to be solidly grounded, while the LV winding is to be grounded via a 1.5 ohm reactor with a continuous rating of 1000A.

Each transformer is to be equipped with a 2,000A, 1500MVA 27.6kV SF_6 breaker and two manually-operated 2000A 100kA disconnect switches. An identical arrangement is to be installed for the bus-section position, which is to be operated normally-closed.

Each of the eight 27.6kV feeder positions are to be equipped with 1200A, 1500MVA 27.6kV breakers and two manually-operated 1200A 40kA disconnect switches.

Provision has been made for the future installation of two LV shunt capacitor banks.

Under-frequency load-shedding facilities are to be installed to trip selected LV feeders.

Facilities are also to be installed to allow voltage reductions of 3% & 5% to be initiated remotely in order to achieve load reductions during periods when limited supply resources are available.

Since the fault levels at the new Markham MTS No. 4 are expected to exceed the fault interrupting capability of the new 230kV circuit switchers, it will therefore not be possible to use them to isolate transformer faults. Isolation of transformer faults would therefore need to be achieved by sending remote trip signals to the terminal stations to trip the main 230kV circuit. However, apart from routine switching of the transformers, either into service or out-of-service, the circuit switchers could be used as back-up for the clearance of LV faults in the event that the LV breakers should maloperate.

Line faults are to be isolated using the associated 230kV circuit switcher via a transfer trip signal from the terminal stations.

Duplication of the remote trip and transfer trip signals will be required, as specified in the Transmission System Code.

3. Power Factor

Reference 1 of Appendix 4.3 of the Market Rules requires the power factor for Connected Wholesale Customers and Distributors to be within the range of 0.90 lagging and 0.90 leading as measured at the defined meter point. Since the defined meter point is required to be at a voltage greater than 50kV, this means that the power factor at the 230kV terminals of the new MTS will be required to exceed 0.90 lagging.

While it is acknowledged that the load on the new MTS is expected to be relatively light during the initial years of operation, Markham Hydro should consider installing at least one of the new capacitor banks at the outset, and to partially equip it with a reduced number of capacitor cans to provide a lower initial value. This would ensure compliance with the Market Rules while also allowing a more prompt response should the load develop at a faster rate.

4. Impact on Reliability

Apart from concerns regarding the increasing amount of load that is to be supplied from the double-circuit line C11R/C12R, to which it is proposed to connect the new Markham MTS No. 4, the proposed connection of the new DESN station is not expected to materially reduce the reliability of the IMO-controlled grid.

5. Reliability Criterion

Since the incorporation of the new MTS will not significantly increase the frequency and/or duration of system outages, the proposed transformer station is not expected to materially reduce the level of reliability of the existing loads that are supplied from circuits C11R & C12R. However, with the present system arrangement the connection of the new transformer station to these two circuits would increase the amount of load that would be exposed to a possible supply interruption as a result of a double-circuit contingency.

The criterion that the IMO applies when assessing the reliability of the IMO-controlled grid in response to double-circuit contingencies is as follows:

- *Any recognised contingency must not result in the simultaneous loss of 500MW or more of load.*

Diagram 2 shows the arrangement of the existing 230kV circuits between Claireville TS, Cherrywood TS and Richview TS, while Table 1 shows the loads that are supplied exclusively by the most critical double-circuit lines in the area represented in the Diagram.

Circuits V71R & V75R

This double-circuit line supplies the existing loads at Vaughan MTS Nos. 1 & 2 and at Richmond Hill TS Nos. 1 & 2. Since the total peak load at these four transformer stations exceeds 500MW and a double-circuit contingency involving this line would result in a total loss of supply to all of this load, the present supply arrangement would not comply with the IMO's supply-availability criterion.

Furthermore, since these circuits are radial out of Claireville TS, any protracted outage involving this double-circuit transmission line would not allow the load to be restored until at least one of the circuits could be returned to service.

Circuits C11R & C12R

The situation for circuits C11R & C12R is somewhat better in that they are not connected radially to a single supply point. However, while the present arrangement includes a disconnect switch in each circuit at Parkway Junction these switches cannot be operated remotely. This would therefore delay the sectionalising of these circuits to allow part of the load to be restored in the event of a protracted outage involving this double-circuit line.

This double-circuit line is the exclusive point of supply for Markham MTS Nos. 1, 2 & 3, Buttonville TS and IBM TS. It also provides part of the supply for the following DESN stations:

- Leslie TS (Each of the two DESN stations derives one of its supplies from circuit C11R)
- Bathurst TS (Each of the two DESN stations derives one of its supplies from circuit C12R)
- Finch TS (One of the two DESN stations derives one of its supplies from circuit C11R while the other DESN station derives one of its supplies from circuit C12R)

The total peak load of the existing five TSs that rely on this double-circuit line for their sole point of supply exceeds 500MW. Since a double-circuit contingency would result in a supply interruption to all of these loads, the present arrangement would not comply with the IMO's criterion for reliability of supply. Furthermore, in the event of a protracted outage, the time required to sectionalise the line to allow the supply to be restored to at least some of the loads is expected to be extensive.

The connection of the proposed Markham MTS No. 4 to these two circuits would further aggravate the situation.

6. Loading of the Transmission Circuits

Reference to Diagram 2 shows that of the six circuits between Richview TS and Cherrywood TS, circuits C11R & C12R have the greatest number of connection points that rely solely on these circuits for their supply. These two circuits are also the most heavily loaded.

For the critical section between Cherrywood TS and Markham MTS No. 3, these circuits are rated as follows:

Circuit	Conductor	Max. conductor operating temperature	Thermal Ratings		
			Continuous (30°C ambient) (MVA at 242kV)		15-minute Limited-time-rating *for a pre-load of 1400A (587MVA)*
			93°C	127°C	
C11R	1924kcmil 69/19	127°C	1450A 608MVA	1860A 780MVA	2380A 998MVA
C12R	1843.2kcmil 72/7	127°C	1420A 595MVA	N/A * N/A *	2220A 931MVA

*Note: * The 1843.2kcmil conductors on circuit C12R have a high aluminum content and are therefore restricted to a maximum operating temperature of 93°C for continuous operation.*

Analysis of the arrangement shown in Diagram 2 with the loads at the levels forecast for 2008 and with the following generation resources in-service, results in the flows shown in the following Table:

- All eight units at Pickering NGS
- All four units at Darlington NGS
- All four units at Lennox TGS, and
- With a 1200MW transfer into Ontario across the proposed Ontario-Quebec Interconnection

For this situation the total flow westwards from Cherrywood TS on the two 500kV circuits to Claireville TS and the six 230kV circuits to Richview TS was approximately 5300MVA, of which approximately 2600MVA flowed on the two 500kV circuits, while the remaining 2700MVA flowed on the six 230kV circuits.

The flows on the two most critical 230kV circuits, C11R & C12R are shown in the Table below:

Flows for the Existing System Configuration: Forecast loads for the summer of 2008 - including Markham 4				
Circuit	*Flow from Cherrywood TS*	*Ratings at 245kV: 30°C & 4km/hr wind*		
		Section	*Continuous*	*15-min LTR (127°C)*
C11R	474MVA	Cherrywood TS to Richview TS	608/780MVA	998MVA
C12R	512MVA	Cherrywood TS to Markham MTS No. 2	595MVA	931MVA

Circuit C5R was the next most-heavily loaded circuit at 425MVA, while the remaining circuits were loaded to less than 380MVA.

Since circuits C12R has a continuous summer rating of only 595MVA over the critical section between Cherrywood TS and Markham MTS No. 4, this circuit would be loaded to approximately 86% of its continuous rating, pre-contingency.

Furthermore, since circuits V71R & V75R are equipped with the same high-aluminum-content conductors as circuit C12R they therefore have the same thermal rating as that circuit. Consequently, under single-circuit contingency conditions involving either of these circuits, for the loads that have been forecast for 2008 (that are given in Table 1), the companion circuit is expected to be overloaded.

Contingencies involving circuit C20R were also found to result in the continuous rating of circuit C12R being exceeded because this contingency would result in half the load at Finch TS being transferred to circuit C12R.

6.1 Impact of Establishing Parkway Junction

The earlier review of the potential exposure to supply interruptions due to double-circuit contingencies indicated that the existing system arrangement would benefit from the following modifications:

- the installation of additional switching to allow the circuits to be more readily sectionalised. This should hastening the restoration of supply (to at least some of the load).

and

- the extension and termination of the sections of circuits V71R & V75R from Claireville TS so that they are no longer radial. This would provide the loads that are connected to these circuits with an alternative source of supply.

One possible option that would meet some of these requirements would be to establish a new 230kV switching station at Parkway Junction and to extend circuits V71R & V75R to terminate at the new switching station.

Further analysis was therefore performed to determine the effect that a new switching station would have on system flows and also whether it would influence the preferred location for connecting the new Markham MTS No. 4 to circuits C11R & C12R.

With the arrangement shown in Diagram 3, the pre-contingency flows were as shown in the following Table:

Flows for the Arrangement in Diagram 3: Forecast loads for the summer of 2008 - including Markham 4				
Circuit	*Flow from Cherrywood TS*	*Ratings at 245kV: 30°C & 4km/hr wind*		
		Section	*Continuous*	*15-min LTR (127°C)*
C11R	565MVA	Cherrywood TS to Richview TS	608/780MVA	998MVA
C12R	603MVA	Cherrywood TS to Markham MTS No. 2	595MVA	931MVA

This shows that establishing Parkway Junction switching station and providing a direct connection at 230kV between Cherrywood TS and Claireville TS via circuits V71R & V75R would increase the individual flows on circuits C11R & C12R by approximately 90MVA. This increase would result in the pre-contingency flow on circuit C12R exceeding its continuous rating.

Furthermore, while the post-contingency flow on circuit C12R of approximately 810MVA would remain within its 15-minute limited-time-rating for a contingency involving circuit C11R, there does not appear to be an appropriate control action, other than generation rejection, that could be initiated to reduce the flow to its continuous rating within 15-minutes.

The situation would also be similar for circuit C11R under contingency conditions involving circuit C12R. For this case, the post-contingency flow is projected to be approximately 790MVA, which would be within the 15-minute limited-time-rating of the circuit. However, the absence of a suitable control action that could be used to reduce the flow to the continuous rating within 15-minutes would also be a concern.

Double-circuit contingencies involving circuits C4R & C5R would also result in post-contingency flows on circuits C11R & C12R of 790MVA & 657MVA, respectively. These would exceed the continuous ratings of these circuits, while remaining within the 15-minute limited-time-ratings. Again, suitable control actions do not appear to be available to reduce these flows to the continuous ratings of these circuits within the required 15-minute interval.

Normally-open Points

Examination of the load flow results shows that the flows on the section of circuits V71R & V75R between Richmond Hill TS No. 1 and Vaughan MTS No. 1 would be approximately zero. This indicates that should a new switching station be established at Parkway Junction and circuits V71R & V75R be extended through to the new busbar then the normal point of supply for the two Richmond Hill TSs would effectively be transferred from Claireville TS to Cherrywood TS.

Establishing new normally-open points in circuits V71R & V75R at a convenient location between Vaughan MTS No. 1 and Richmond Hill TS No. 1 would reduce the respective loads that would be interrupted in the event of a double-circuit contingency to less than 500MW, and would have only a minor impact on the normal flow distribution with all elements in-service. Furthermore, this arrangement would allow the supply to be restored by closing these normally-open points.

Operating with new normally-open points in circuits V71R and V75R would have the added benefit of limiting the increase in the fault levels at Claireville TS due to the development of the new switching station and the extension of circuits V71R & V75R. Without the new normally-open points, the new facilities would have created a new, direct 230kV connection between Claireville TS and Cherrywood TS.

Diagram 4 shows the proposed arrangement with a new switching station established at Parkway Junction, together with new normally-open points located in circuits V71R & V75R.

While the introduction of normally-open points into circuits V71R & V75R would have a negligible effect on the normal flow distribution, with all elements in-service, it would result in an increase in the post contingency flows on circuits C11R & C12R for contingencies involving the companion circuit. This is due to the interruption of the path through circuits V71R & V75R, preventing a greater proportion of the load on these circuits being supplied post-contingency from Claireville TS via the two 500kV circuits.

Additional Transmission Facilities

Irrespective of whether new normally-open points are introduced into circuits V71R & V75R, additional transmission facilities are expected to be required to address the overloading of circuit C11R that is expected to occur pre-contingency as well as the post-contingency overloading of the companion circuit for single-circuit contingencies involving either circuit C11R or C12R.

With a new switching station established at Parkway Junction, and with new normally-open points introduced into circuits V71R & V75R following the extension of these circuits to terminate at Parkway Junction SS, the respective exposure to double-circuit contingencies would then be as follows:

Exposure to Double-circuit Contingencies			
Double-circuit Contingency: Line Section		*Loads Affected*	*Total Load*
V71R & V75R	Claireville TS to New N/O Point	Vaughan MTS No. 1 Vaughan MTS No.2	350MW
	New N/O Points to Parkway Junction SS	Richmond Hill TS No. 1 Richmond Hill TS No. 2	225MW
C11R & C12R	Cherrywood TS to Parkway Junction SS	Markham MTS No. 2 Markham MTS No. 3 Markham MTS No. 4	250MW
	Richview TS to Parkway Junction SS	Markham MTS No. 1 IBM TS	135MW
	Parkway Junction SS to Buttonville TS	Buttonville TS	150MW

Since all of the grouped loads above total to less than 500MW the proposed arrangement would meet the IMO's criterion. In addition with the introduction of the new switching facilities and new normally-open points it would then be possible to restore all, or most, of the load through switching.

6.2 Loading on the 500/230kV Auto-transformers at Claireville TS and Cherrywood TS

Establishing a new switching station at Parkway Junction and extending circuits V71R & V75R to terminate at the new busbar (with or without the introduction of new normally-open points) would transfer approximately 180MVA of load from Claireville TS to Cherrywood TS.

While this would be beneficial at Claireville TS by providing further capacity to meet future load growth in the area served by that transformer station, it could advance the requirement to terminate each of the auto-transformers at Cherrywood TS on to separate positions on the 500kV busbar.

The present arrangement has auto-transformers T14 & T15, and auto-transformers T16 & T17 switched as pairs through their 500kV breakers and this means that two transformers could be lost simultaneously. Once the four units at Pickering 'A' NGS have been returned to service, the transfers through the auto-transformers at Cherrywood TS would be reduced, so the consequences of losing two transformers simultaneously would become less of a concern. However, during the next vacuum building outage at Pickering NGS the transfers through the transformers could increase sufficiently to become a potential problem.

The IMO had therefore raised concerns regarding the existing connection arrangement for the four 500/230kV auto-transformers at Cherrywood TS in their 10-year Outlook for the period January 2003 to December 2012, that was issued on 3rd April 2002.

Transferring additional load from Claireville TS on to Cherrywood TS would therefore make the situation worse.

6.3 Overloads on circuits C11R & C12R

Diagrams 5 & 6 show two possible arrangements for providing the required transmission reinforcement to address the overloads that have been identified on circuits C11R & C12R. While it is recognised that there will be other options available for reinforcing the transmission system, these two arrangements have been presented as an indication of the type of measures that would appear to be required to meet the IMO's reliability criterion.

Diagram 5 shows an arrangement that uses two of the 'paired' 500kV circuits between Parkway Junction and Cherrywood TS to provide additional 230kV connections into Parkway Junction switching station. These two circuits would need to be reterminated on to the appropriate 230kV busbar at Cherrywood TS and on to the new busbar at Parkway Junction SS so that they can then be operated at 230kV.

These circuits would provide relief for circuits C11R & C12R and allow for possible future growth in the area. Furthermore, since the rating of each of the 500kV circuits between Claireville TS and Cherrywood TS is limited by their respective terminations, there would be no serious reduction in the thermal performance from operating one of the 'paired' circuits of each transmission line at 230kV.

Diagram 6 shows an arrangement with two 500/230kV auto-transformers, connecting the new Parkway Junction switching station directly to the 500kV system.

Either arrangement is expected to provide the relief required to avoid overloading circuits C11R & C12R. However, it is recognised that other solutions will be available and these proposals are only intended to provide an indication of possible measures that would be acceptable to the IMO.

The relative merits of each option:

Arrangement shown in Diagram 5

- Although it would require additional 230kV breakers to be installed at Cherrywood TS together with some additional line work, it would avoid the cost of installing the two new 500/230kV auto-transformers.
- It would have less of an impact on fault levels than the arrangement shown in Diagram 6.
- The two auto-transformers could be installed at a later date when justified by increasing load in the area and/or the need to restore the two circuits to 500kV operation.

Arrangement shown in Diagram 6

- The two new 500/230kV auto-transformers would reduce the loading on the existing 500/230kV auto-transformers at Cherrywood TS.

Common attributes of the arrangements shown in Diagrams 5 & 6

- With additional supply sources introduced into Parkway Junction SS, new normally-open points could be introduced into the section of circuits C11R & C12R at a suitable location between Parkway Junction SS and Cherrywood TS to reduce the amount of load exposed to a supply interruption in the event of a double-circuit contingency.

Any decision regarding the particular arrangement to implement for addressing the overloads that are expected to occur on circuits C11R & C12R should also take account of the IMO's concerns regarding the present termination arrangement of the four 500/230kV auto-transformers at Cherrywood TS.

7. Preferred Point of Connection for Markham MTS No. 4

The IMO has concluded that additional switching facilities are required to allow circuits C11R & C12R to be sectionalised to reduce the amount of load that would be exposed to a possible supply interruption in the event of a double-circuit conditions and thereby meet the IMO's reliability criterion.

Parkway Junction would appear to be a suitable location for these additional switching facilities since not only would it allow circuits C11R & C12R to be sectionalised at a suitable point to provide an acceptable degree of distribution between the loads that are supplied from these circuits, but it would also allow the circuits to Buttonville TS to be terminated separately.

On the assumption that Parkway Junction SS is developed, then the new Markham MTS could be connected to the section of circuits C11R & C12R between Parkway Junction and Cherrywood TS, as shown in Diagram 3. While this would expose three of the Markham MTSs to a possible supply interruption in the event of a double-circuit contingency, this risk could be reduced by introducing normally-open points into this section once additional transmission reinforcement has been provided into the new switching station at Parkway Junction.

Alternatively, if a new single-circuit line were to be constructed from Cherrywood TS, part of the load at the new Markham MTS No. 4 could be supplied from this line. Furthermore, if this new line were to be extended towards Parkway Junction, the loads at the three existing Markham MTSs could be distributed between the three circuits. Not only would this reduce the loading on each circuit but it would also reduce the exposure to supply interruptions due to double-circuit contingencies.

While a new line would address some of the reliability concerns that have been identified with the existing supply arrangement, the new line would need to be extended through to Claireville TS to address those concerns that are associated with the radial sections of circuits V71R & V75R.

Should a new switching station be developed at Parkway Junction, then the IMO's preferred connection point would therefore be on the section of circuits C11R & C12R between the new switching station and Cherrywood TS, as shown in Diagram 4.

8. Conclusions & Recommendations

This Assessment has concluded that the proposed connection of the new Markham MTS No. 4 to circuits C11R & C12R will not materially reduce the level of reliability or the load-meeting capability of the existing facilities. However, concerns have been identified regarding the ability of the existing transmission facilities in the immediate area to meet the IMO's criterion for supply availability.

Since these concerns are considered to relate to existing system deficiencies, the IMO expects that Hydro One will respond with a suitable proposal that would adequately address them.

Markham Hydro is encouraged to consult with Hydro One on the possible form that their proposal will take for addressing the IMO's concerns since this could influence the connection arrangement for the new MTS. However, should Hydro One's proposal involve the development of a new 230kV switching station at Parkway Junction, then the preferred location for the connection of the new MTS would be on the section of circuits C11R & C12R between Parkway Junction & Cherrywood TS as shown in Diagram 4.

9. Need for a System Impact Assessment

Based on the results of this assessment it has been concluded that all the necessary analysis to determine the impact that the proposed Markham MTS No. 4 would have on the IMO-controlled grid has been undertaken.

A separate System Impact Assessment is therefore not considered to be necessary for this Project.

10. Customer Impact Assessment

Hydro One Networks Inc., in consultation with the IMO, has concluded that this Project will have no adverse impact on any other customers in the area and that a detailed Customer Impact Assessment will not be required.

11. Notification of Approval of the Connection Proposal

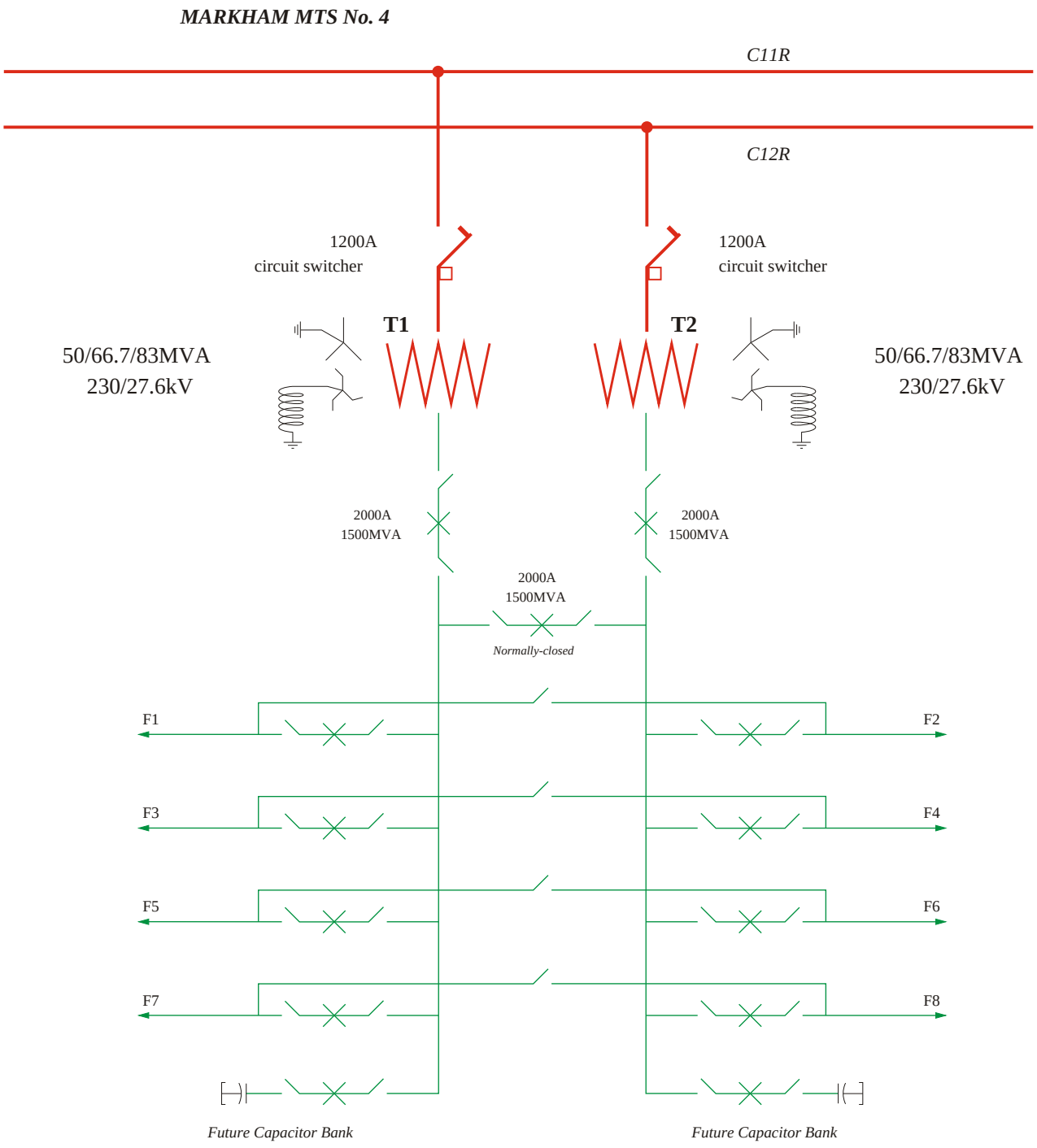
Based on the results of this Assessment it is recommended that a *Notification of Approval for Connection* be issued for this Project.

TABLE 1

Circuit-Pairs	***Transformer Stations***	***Forecast Load***			***Total Exposure****		
		2001	***2004***	***2008***	***2001***	***2004***	***2008***
V71R & V75R	Vaughan MTS No. 1	160MW	165MW	172MW	514MW	574MW	595MW
	Vaughan MTS No. 2	179MW	184MW	192MW			
	Richmond Hill TS No. 1	175MW	133MW	137MW			
	Richmond Hill TS No. 2	-	92MW	94MW			
C11R & C12R	Markham TS No. 1	116MW	361MW	406MW	516MW	526MW	577MW
	Markham TS No. 2	109MW					
	Markham TS No. 3	106MW					
	Markham TS No. 4	N/A					
	Buttonville TS	176MW	150MW	155MW			
	IBM	9MW	15MW	17MW			

*Note: * Total Exposure is intended to represent the load that would be at risk to an interruption in the event of a double circuit contingency involving the particular circuit-pair*

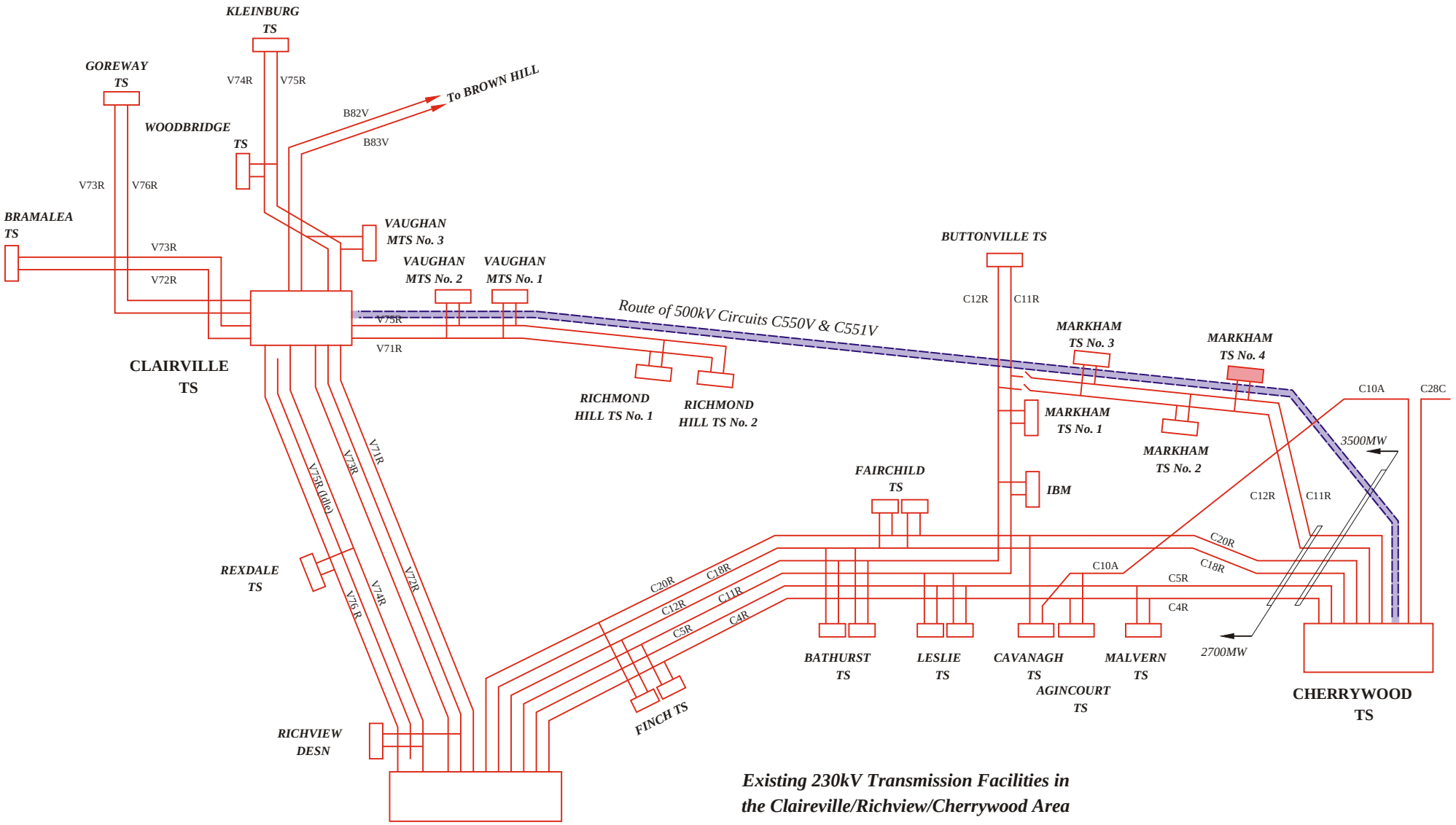
Shaded cells indicate exposures that exceed IMO criterion



Proposed facilities at Markham MTS No. 4

DIAGRAM 1

26th May 2002

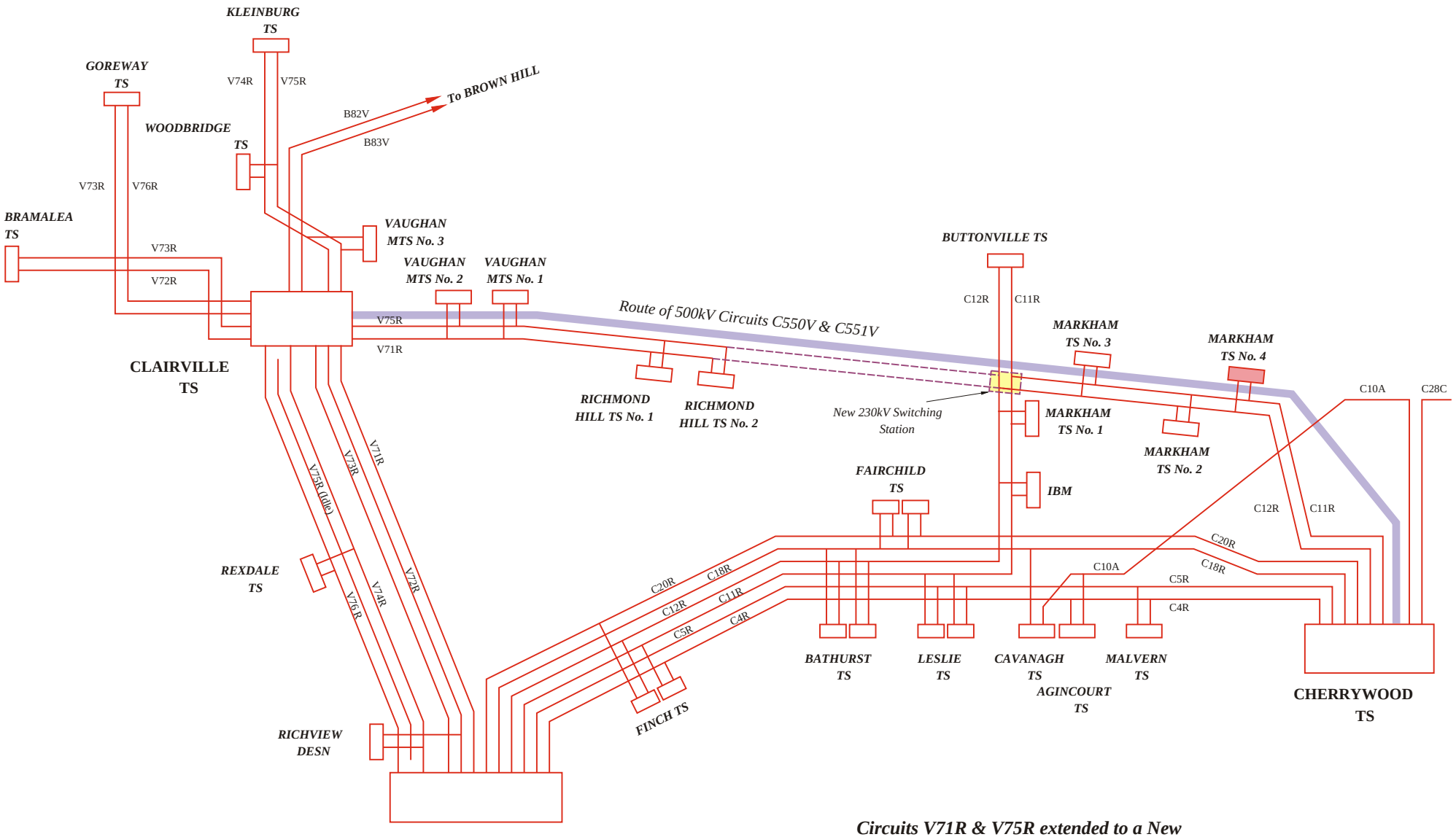


Existing 230kV Transmission Facilities in the Claireville/Richview/Cherrywood Area

Proposed Location of Markham MTS No. 4 added

DIAGRAM 2

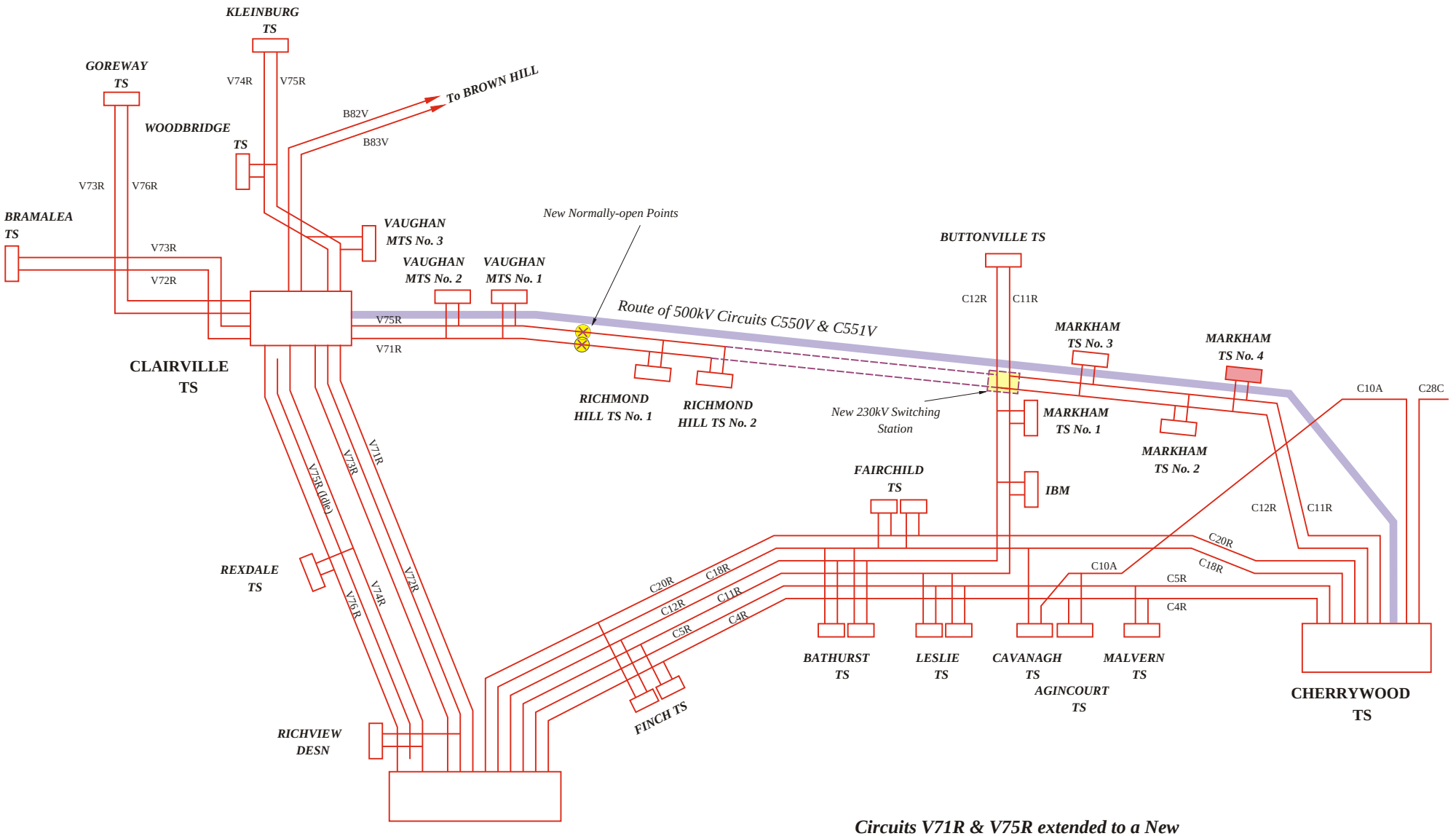
10th June 2002



Circuits V71R & V75R extended to a New Switching Station at Parkway Junction

DIAGRAM 3

10th June 2002

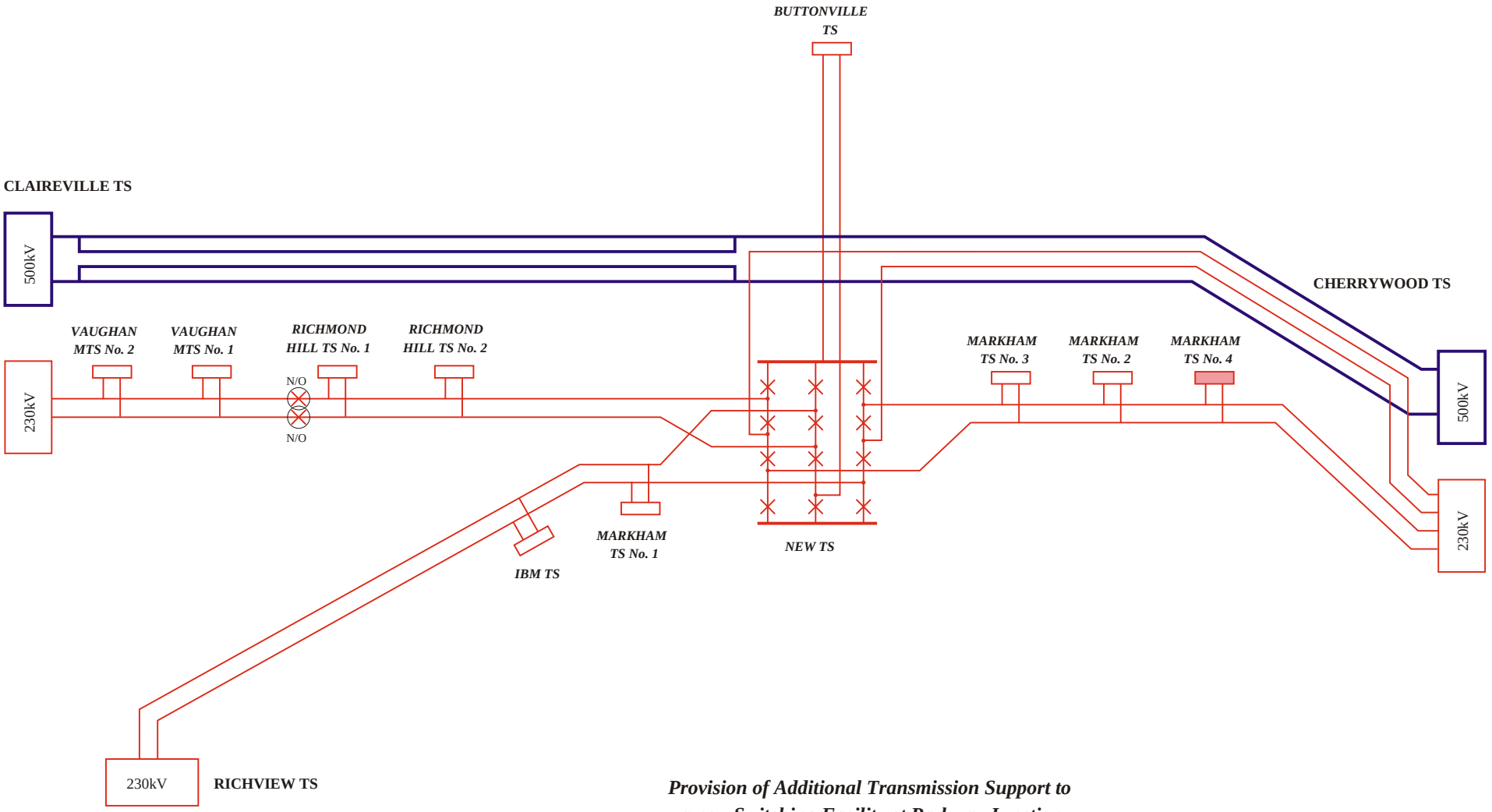


Circuits V71R & V75R extended to a New Switching Station at Parkway Junction

With new normally-open points in circuits V71R & V75R

DIAGRAM 4

10th June 2002

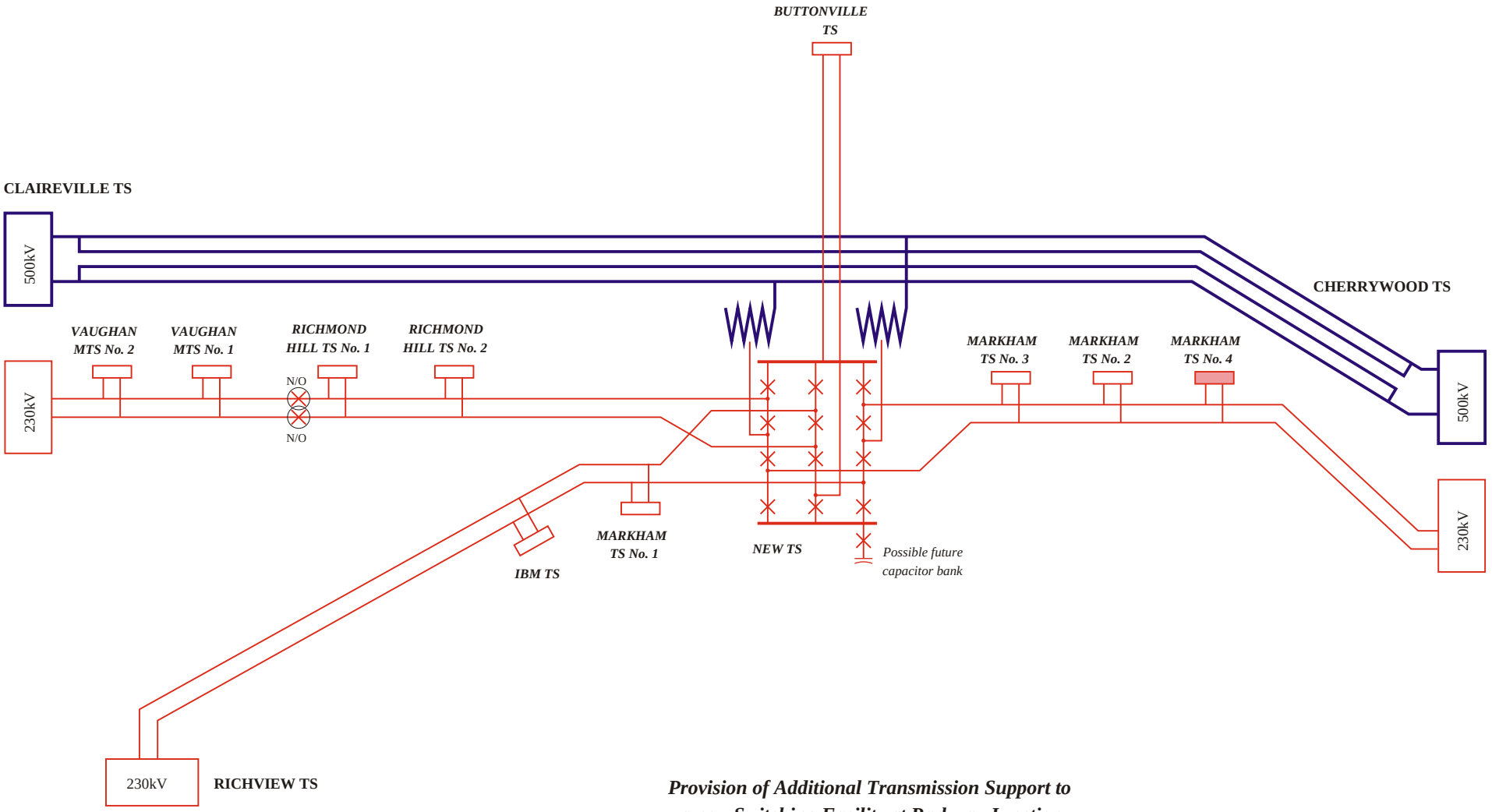


Provision of Additional Transmission Support to a new Switching Facility at Parkway Junction

(230kV Option)

DIAGRAM 5

10th June 2002



Provision of Additional Transmission Support to a new Switching Facility at Parkway Junction

(500kV Option)

DIAGRAM 6

10th June 2002