CONNECTION ASSESSMENT & APPROVAL PROCESS

ASSESSMENT SUMMARY

Applicant: *Hydro One Networks Inc.*

Project: *Kingston-Gardiner TS: Establish a Second 230kV DESN*

CAA ID No. 2003-EX176

Long Term Forecasts & Assessments Department
Consistent Information Set Department

Date: *10th December 2003*

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ASSESSMENT SUMMARY

HYDRO ONE NETWORKS Inc.

Kingston-Gardiner TS - Establish a 2nd 230/44kV DESN Station

1. GENERAL DESCRIPTION

Kingston-Gardiner TS is connected via a double-circuit tap, approximately 10.3km in length, on to the 230kV circuits X2H & X4H between Lennox GS and Hinchinbrooke TS. The TS is equipped with two 230/44kV 75/125MVA step-down transformers, as shown in Diagram 2.

These transformers have 10-day limited-time-ratings of 156 MVA & 179 MVA, for the summer and winter periods, respectively.

During recent years the peak loads at the TS have exceeded these ratings, and future growth is expected to occur at the rate of approximately 2% per annum for several years.

Hydro One is therefore proposing to establish a second DESN station at Kingston-Gardiner TS to provide relief for the existing facilities.

The new DESN is to consist of two 230/44kV 25/41MVA step-down transformers, with two 44kV feeder positions. The existing feeders, M10 & M11, that presently supply Dupont Canada Inc. are to be reterminated on to the new feeder positions at the second DESN. Feeder positions M10 & M11 at the existing DESN will become idle to be used by Hydro One Distribution and/or Utilities Kingston.

Diagram 1 shows the existing facilities in the Lennox GS to Hinchinbrooke TS corridor and the proposed connection arrangement for the second DESN station.

The scheduled completion date for the second DESN station at Kingston-Gardiner TS is 1st April 2005.

2. PROPOSED FACILITIES

The new facilities that it is proposed to install at Kingston-Gardiner TS are shown in Diagram 3.

Specification for the New Equipment

- *Step-down Transformers*

Transformer ratings	Two 25/41MVA, 230/44kV
Transformer nominal turns ratio	215.5kV : 44kV
Under-load tap-changer	± 40kV in ± 16 steps from 175.5kV to 255.5kV
Transformer connections	HV Y - solidly grounded LV Y - grounded via a 5Ω neutral reactor
Insulation level	900kV BIL on the HV 250kV BIL on the LV and neutral
Impedance	8.5% on 215.5kV - 44kV 25MVA

- *Neutral Reactors*

Neutral reactor type	Air-cored: One per phase
Neutral reactor ratings at 60Hz	5ohm, 4000A for 15 seconds to limit L-G fault current to 19kA
Insulation level	250kV BIL

- *230kV Disconnect Switches*

Type	Motorised
Rated voltage	230kV
Maximum operating voltage	250kV continuous
Continuous current	500A rms
Symmetrical short-circuit rating	17kA for 3 seconds
Asymmetrical short-circuit rating	38.5kA peak
Insulation level (minimum)	900kV BIL line to neutral 1050kV BIL across the open gap

- *44kV Transformer Breakers & Bus-tie Breakers*

Type	SF_6
Rated Voltage	44kV
Maximum operating voltage	48kV continuous
Continuous current	2500A rms (Transformers) 2000A rms (Bus-tie)
Interrupting time	5 cycles
Symmetrical short-circuit rating	7.5kA (500MVA)

- *44kV Feeder Breakers*

Type	SF_6
Rated Voltage	44kV
Maximum operating voltage	48kV continuous
Continuous current	1200A rms
Interrupting time	5 cycles
Symmetrical short-circuit rating	15kA (1000MVA)

- *Feeder Tie Switch*

Rated Voltage	44kV
Maximum operating voltage	48kV continuous
Continuous current	600A rms

- *Surge Arresters*

230kV - Two sets of three (one set for each step-down transformer)

Type	Metal Oxide Gapless - station class
Maximum Continuous Operating Voltage (MCOV)	150kV rms (minimum)
Maximum equivalent front-of-wave impulse level	Not more than 760kV crest
Maximum discharge voltage for 8x20 µs 10kA impulse current	Not more than 690kV crest
Maximum switching surge protection level	Not more than 620kV crest at 1kA
Temporary over-voltage capability	The arrester should be capable of withstanding power frequency over-voltage of not less than 180kV Phase-ground (rms) for a duration of not less than 0.2 second after the rated energy absorption.
Maximum energy dissipation per arrester	As recommended by ANSI/IEEE C62.11-1993 Standard

Pressure relief capability	As recommended by ANSI/IEEE C62.11-1993 Standard: not less than 40kA rms.

44kV - Two sets of three (one set for each step-down transformer)

Type	Metal Oxide Gapless - station class
Maximum Continuous Operating Voltage (MCOV)	29kV rms (minimum)
Maximum equivalent front-of-wave impulse level	Not more than 210kV crest
Maximum discharge voltage for 8x20 µs 10kA impulse current	Not more than 192kV crest
Maximum switching surge protection level	Not more than 172kV crest at 500A
Temporary over-voltage capability	The arrester should be capable of withstanding power frequency over-voltage of not less than 32kV Phase-ground (rms) for a duration of not less than 10 second after the rated energy absorption.
Maximum energy dissipation per arrester	As recommended by ANSI/IEEE C62.11-1993 Standard
Pressure relief capability	As recommended by ANSI/IEEE C62.11-1993 Standard: not less than 40kA rms.

3. CONNECTION ARRANGEMENT

The new DESN station is to be constructed adjacent to the existing facilities at Kingston-Gardiner TS and is to be equipped with two step-down transformers having a lower rating (41MVA) than the existing units (125MVA).

Each transformer is to be connected to the respective 230kV circuit, X2H or X4H, via a motorised disconnect switch. The disconnect switches will be capable of interrupting the full magnetising current of each transformer.

Diagram 3 provides details of the 44kV busbar arrangement at the new DESN station, with a normally-closed bus-coupler breaker interconnecting the two 44kV busbars. The development is to include two 44kV feeder positions and these are to be occupied by the feeders, M10 & M11 to Dupont Canada Inc., relocated from the existing DESN station.

No new station service transformers are to be installed at the new DESN station. The ac load at the new DESN station is to be supplied from the two 200kVA station service transformers at the existing DESN station.

Surge arresters are to be installed on the HV & LV terminals of each step-down transformer.

Protective Relaying

The existing protective relaying on the 230kV circuits is to be modified to accommodate the new facilities.

New protective relaying is to be installed for the new transformers and bus-zone protection is to be installed on the new 44kV busbar.

The existing pilot-wire protection on the M10 & M11 feeders is to relocated to the new DESN station.

The vacated 44kV positions at the existing DESN are to be equipped with standard protective relaying.

No changes are to be made to the existing auto-reclosure schemes on circuits X2H & X4H

4. ASSESSMENT

Rating of the existing 230kV Circuits

Continuous Thermal Rating for Circuits X2H & X4H at 30°C & 4km/hr wind						
Line Section		***Length***	***Conductor***	***Sag Temp.***	***Continuous Rating at 93°C***	
					Amperes	***MVA at 240kV***
Lennox TS to Westbrook Junction		22.9km	1192.5kcmil	150°C	1110A	461MVA
Westbrook Junction to Cataraqui Junction	X2H	10.1km		126°C		
	X4H			143°C		
Cataraqui Junction to Hinchinbrooke TS	X2H	0.6km		150°C		
		26.1km	1277.5kcmil	93/127°C	1140A	474MVA
	X4H	26.7km	1192.5kcmil	150°C	1110A	461MVA
Westbrook Junction to Kingston-Gardiner TS		0.2km		150°C		
		10.2km	795kcmil	150°C	870A	362MVA

The 230kV circuits between Lennox GS and Hinchinbrooke TS are used primarily for accommodating a portion of the output from the four generating units at Lennox GS (2 x 550MW & 2 x 575MW) and they would only be expected to be heavily loaded under contingency conditions involving the 500kV circuits between Lennox GS and Hawthorne TS.

Even under these conditions, with all four units at Lennox GS operating at full output, the flows on the four circuits to Hinchinbrooke TS would be well within their continuous ratings (flows of approximately 250MVA per circuit, compared to a rating of approximately 460MVA)

The additional load at the Kingston-Gardiner TS could therefore be accommodated with no adverse impact.

Conclusion

The proposal to establish a second 230/44kV DESN station at Kingston-Gardiner TS will not materially affect either the reliability or the load meeting capability of the IMO-controlled grid.

5. IMO'S CONNECTION REQUIREMENTS

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.

The two existing 20MVAr 44kV capacitor banks are expected to be sufficient to ensure that the requirement above can be met.

Under-Frequency Load-Shedding

Reference 2 of Appendix 4.3 of the Market Rules requires the new supply point be equipped with an automatic under-frequency load-shedding scheme, and that it have the capability to reject up to 35% of the load supplied from the new facility in response to a declining system frequency. The appropriate settings for the under-frequency load-shedding scheme will be provided by the IMO prior to commissioning of the new facilities.

Voltage Reduction

Reference 4 of Appendix 4.3 of the Market Rules requires facilities to be installed that will allow separate reductions in the supply voltage of 3% and 5% to be initiated remotely, to achieve reductions in load at the TS.

Monitoring

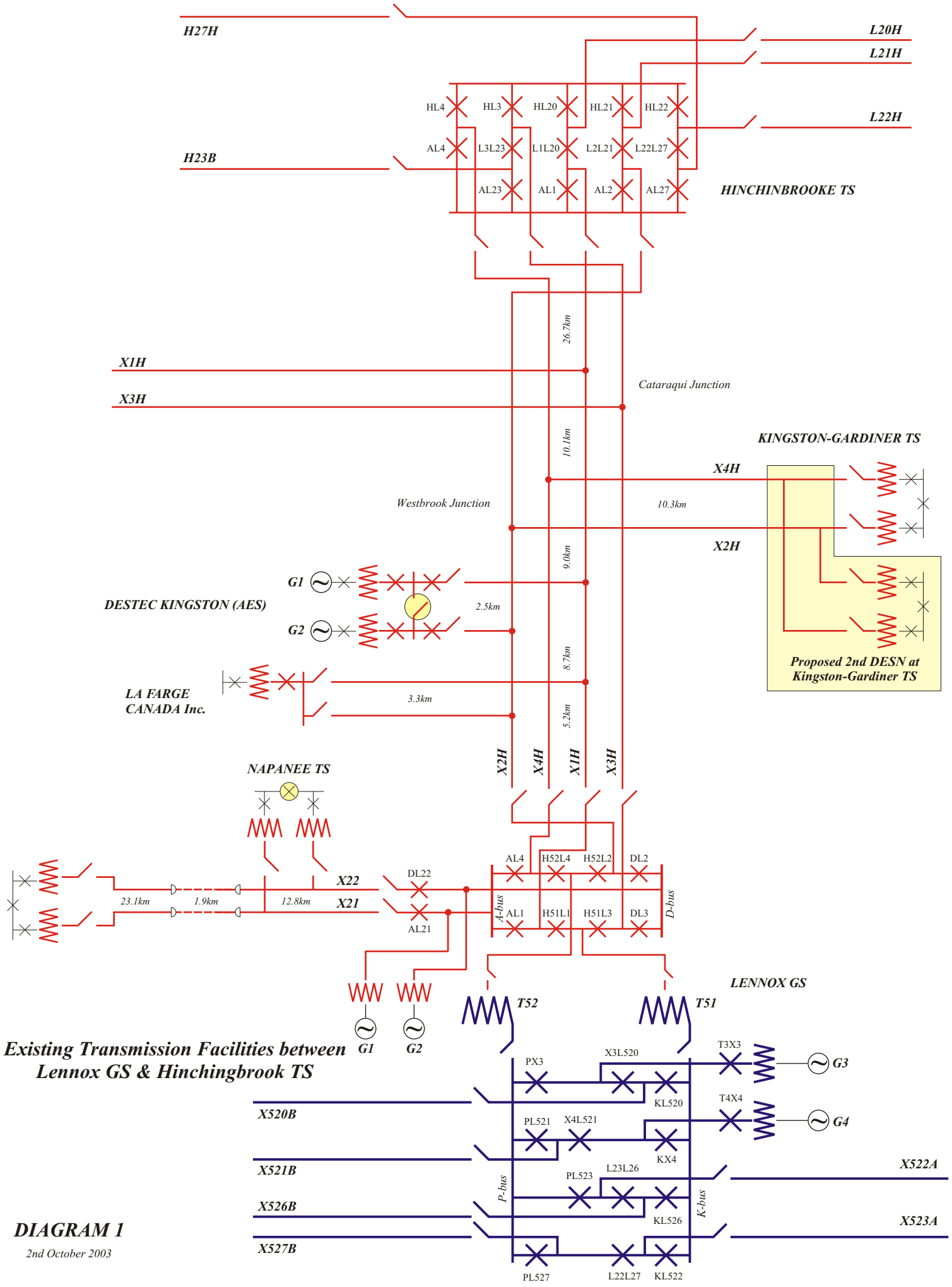
Facilities are to be installed to meet the IMO's monitoring requirements as detailed in Appendices 4.16 & 4.17 of the Market Rules.

7. CUSTOMER IMPACT ASSESSMENT

Since this work will have no impact on local customers or their facilities, Hydro One has notified the IMO that a Customer Impact Assessment will not be required for this Project.

8. NOTIFICATION OF APPROVAL

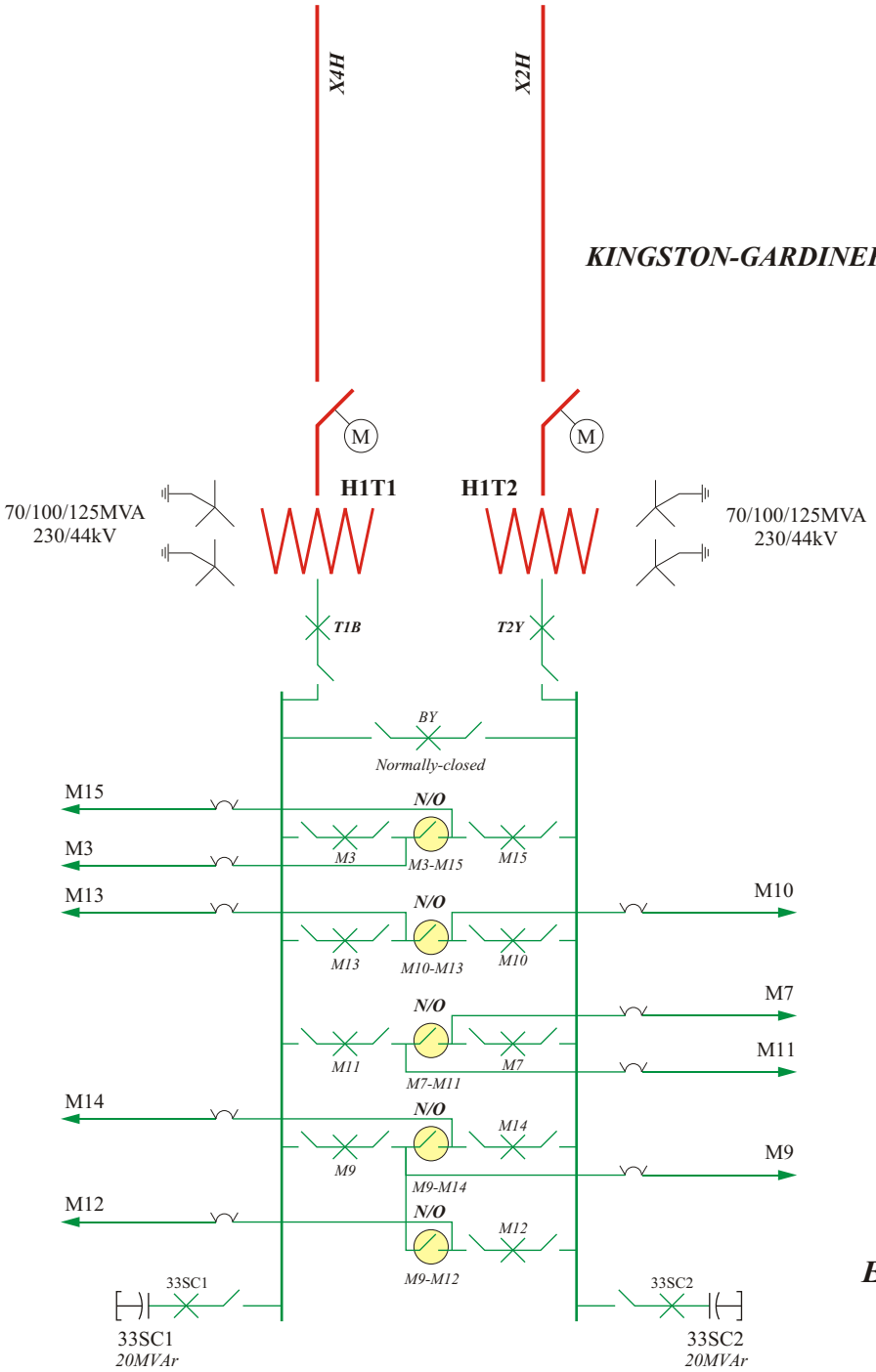
It is therefore recommended that a Notification of Approval of the Connection Proposal be issued.



Existing Transmission Facilities between Lennox GS & Hinchingbrook TS

DIAGRAM 1

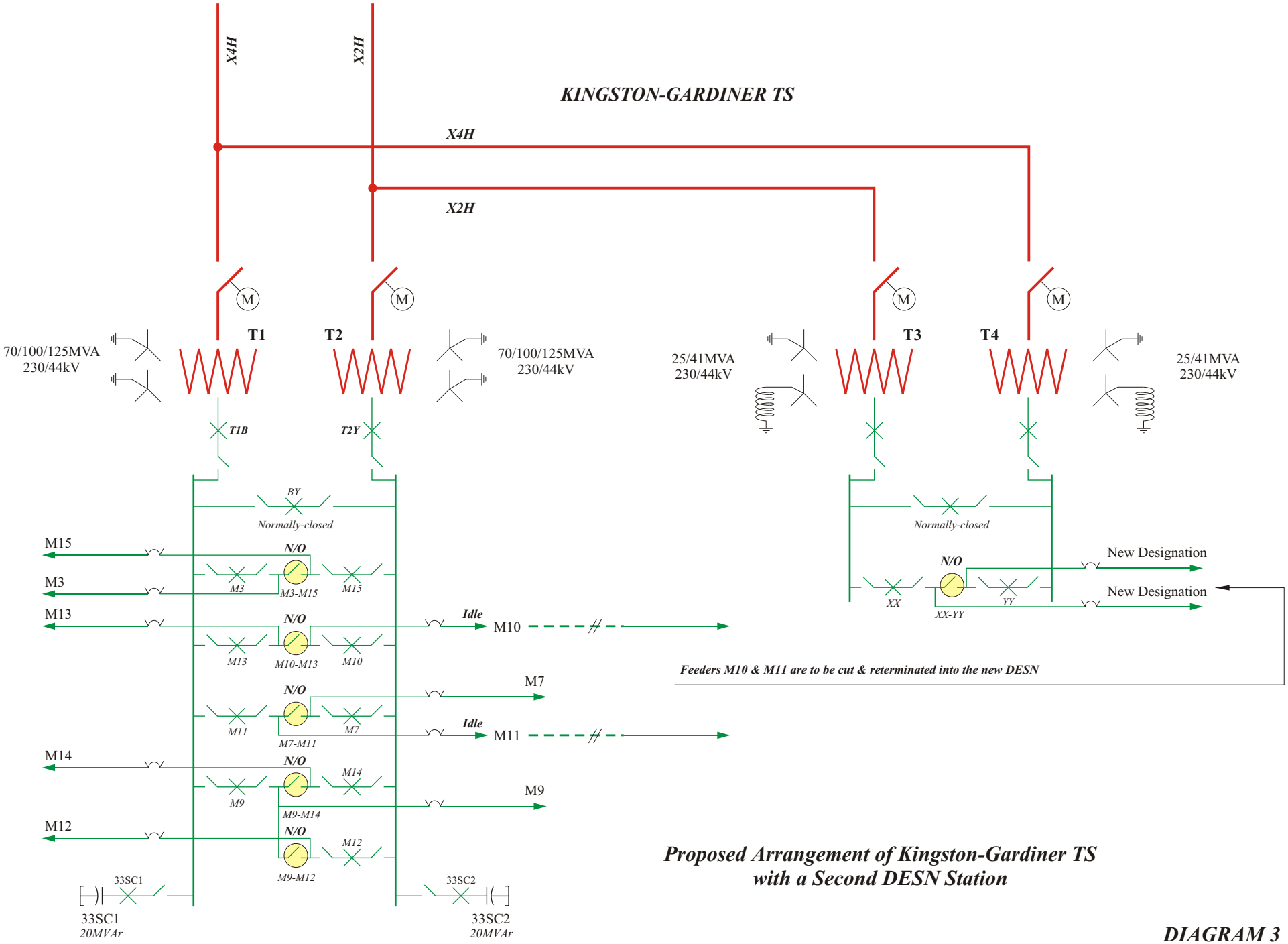
2nd October 2003



Existing Facilities at Kingston-Gardiner TS

DIAGRAM 2

2nd October 2003



Proposed Arrangement of Kingston-Gardiner TS with a Second DESN Station

DIAGRAM 3

9th December 2003