



Newfoundland and Labrador Hydro
Hydro Place, 500 Columbus Drive
P.O. Box 12400, St. John's, NL
Canada A1B 4K7
t. 709.737.1400 | f. 709.737.1800
nlhydro.com

March 10, 2022

Board of Commissioners of Public Utilities
Prince Charles Building
120 Torbay Road, P.O. Box 21040
St. John's, NL A1A 5B2

Attention: Ms. Cheryl Blundon
Director of Corporate Services & Board Secretary

Dear Ms. Blundon:

**Re: Allowance for Unforeseen Items Account – TL219 and TL203 Storm Damage Repairs –
Final Report**

On February 8, 2022, Newfoundland and Labrador Hydro (“Hydro”) notified the Board of Commissioners of Public Utilities of its intent to use the Allowance for Unforeseen Items Account to complete repairs to transmission lines TL219 and TL203 as a result of storm damage. Attached is Hydro’s final report in relation to this work, as required under the Capital Budget Application Guidelines.¹

Should you have any questions, please contact the undersigned.

Yours truly,

NEWFOUNDLAND AND LABRADOR HYDRO

Shirley A. Walsh
Senior Legal Counsel, Regulatory
SAW/kd

Encl.

ecc:

Board of Commissioners of Public Utilities
Jacqui H. Glynn
PUB Official Email

¹ “Capital Budget Application Guidelines (Provisional),” The Board of Commissioners of Public Utilities, January 2022 (originally issued June 2, 2005 and revised October 2007).



TL219 and TL203 Storm Damage Recovery

Final Report

March 10, 2022



A report to the Board of Commissioners of Public Utilities

1 **Executive Summary**

2 Transmission lines TL203 and TL219 were structurally damaged as a result of a severe weather event,
3 with restoration of assets necessary to maintain reliable service to customers. On February 4, 2022, an
4 intense winter storm tracked over the island portion of the province bringing heavy rain and freezing
5 rain to the eastern portion of the Island. Sustained freezing rain lasting several hours resulted in
6 accumulation of ice on transmission lines and structures, resulting in damage to Newfoundland and
7 Labrador Hydro’s (“Hydro”) TL219 and TL203.

8 TL203 is a 230 kV wood pole transmission line interconnecting Hydro’s Sunnyside Terminal Station to
9 the Western Avalon Terminal Station and was originally built in the 1960s. TL219 is a 138 kV wood pole
10 transmission line interconnecting Hydro’s Sunnyside Terminal Station with Newfoundland Power Inc.’s
11 (“Newfoundland Power”) Salt Pond Substation and was originally built in the 1980s.

12 To maintain reliable service to customers, Hydro had to execute required repairs immediately to
13 mitigate the risk of further damage and restore the system. Although there were no customers
14 impacted at the time due to redundant transmission lines in the area, delay in restoration of the
15 transmission lines would have resulted in an unacceptable risk to reliable service. The capital costs
16 associated with the repair effort and restoration of the lines was \$408,848.16. This cost included internal
17 engineering, internal labour, material supply, and contractor costs. The work on TL203 was completed
18 on February 6, 2022 and the work on TL219 was completed on February 9, 2022 by Hydro Operations
19 and local contractor Locke’s Electrical.

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1.0 Introduction

On February 4, 2022, an intense winter storm tracked over the island portion of the province, bringing heavy rain and freezing rain to the eastern portion of the Island and heavy snow to the central and western portions of the Island. The forecasted freezing rain event had the potential to result in substantial ice accumulation on existing power line infrastructure on the Avalon. Refer to Figure 1 below for the forecasted weather event.



Figure 1: Forecasted Weather Event for Avalon Region

In preparation for the forecasted weather event, Hydro initiated severe weather preparedness protocols which included:

- Coordination of on-call support staff including representatives from the Energy Control Center (“ECC”), Hydro Engineering, and Hydro Operations;
- Verification of local contractor availability;
- Strategic preparation and placement of response crews and equipment;
- Setup of post storm field patrols by Operations, including helicopter and ground patrols; and
- Initiation of ice monitoring and data recording protocols.

These readiness initiatives ensured Hydro was prepared in advance of the approaching system and was ready to respond promptly to issues should they arise.

1 On the morning of February 5, 2022, Hydro’s TL203 and TL219 tripped while heavy freezing rain was
2 observed in the region. Freezing rain persisted for several hours, resulting in accumulation of variable
3 amounts of ice on transmission lines and structures (Figure 2) and causing damage to TL219 and TL203
4 conductor and structures. Due to transmission redundancy serving the region, there was no immediate
5 customer impact as a result of the trip; however, to ensure reliable service to customers and ensure
6 damaged structures did not pose a risk to public safety, Hydro had to execute required repairs
7 immediately to mitigate the risk of further damage and restore the system.



Figure 2: Ice Accumulation on TL219 Conductor

8 Hydro mobilized internal and contract resources to investigate and execute repairs of the damaged
9 conductor and structures. The damages experienced on TL219 included the structural failure of four
10 consecutive Tangent H-frame structures and the failure on TL203 involved a crossarm on a Tangent H-
11 frame structure.

12 Repairs on TL203 were completed on February 6, 2022 and repairs to TL219 were completed by
13 February 9, 2022.

2.0 Background

TL203 is a 230 kV wood pole transmission line interconnecting Hydro’s Sunnyside Terminal Station to Western Avalon Terminal Station. This line is a redundant line that was originally constructed in the 1960s and runs parallel to several other lines in the isthmus area of the Avalon Peninsula.

TL219 is a 138 kV wood pole transmission line interconnecting Hydro’s Sunnyside Terminal Station with Newfoundland Power’s Salt Pond Substation, and is one of two transmission lines serving customers on the Burin Peninsula. The line was originally constructed in the 1980s and runs parallel to TL212, another 138 kV line that was constructed in the 1970s. Refer to Figure 3 for location reference of both TL203 and TL219.

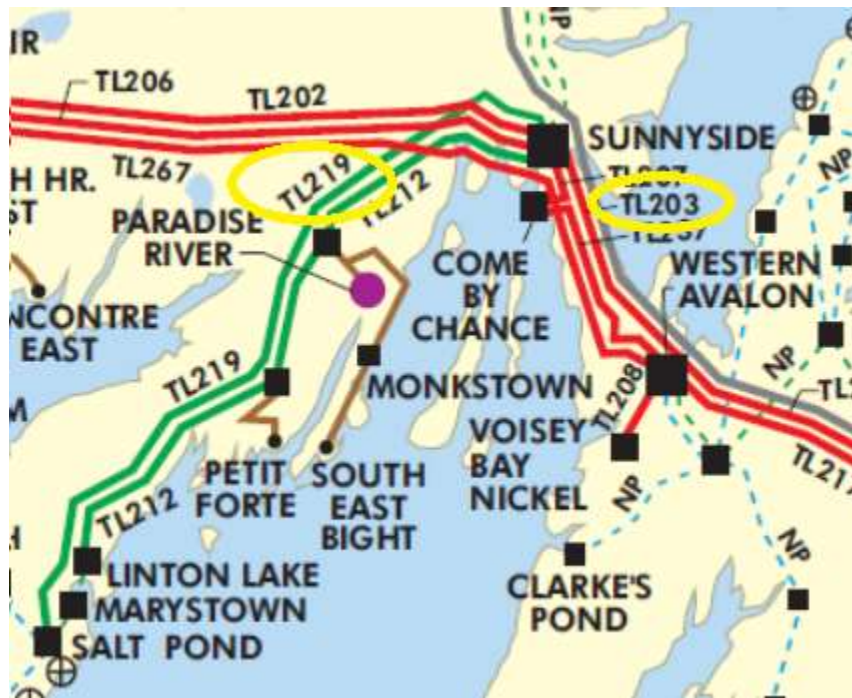


Figure 3: System Map Showing Location of TL203 and TL219

Both of the impacted transmission lines are inspected regularly under the Wood Pole Line Management Program and were deemed to be in good standing at the time of the failure. The specific structures impacted on TL219 were last inspected in 2019 and the damaged structure on TL203 was last inspected in 2017. No issues were identified at the time of inspection on TL203. On TL219, three broken conductor

1 strands were identified during the inspection and repaired accordingly. No other required work was
 2 identified during the inspections.

3 3.0 Event Detail

4 The extended weather event resulted in significant, variable ice accumulation on the transmission lines
 5 in the area. Figure 4 shows examples of ice accumulation in the area of the failures.



Figure 4: Ice Accumulation on TL219 and TL203

6 3.1 Event Timeline

7 Table 1 and Table 2 provide a timeline of activities that were observed during the event.

Table 1: TL203 Event Timeline

Date	Activity
February 5, 2022	TL203 tripped at 1032 hours. The line was reclosed once at 1053 hours but tripped again and remained out of service.
February 5, 2022	Hydro Operations crew performing ground patrol identified damage to Structure 77 at approximately 1200 hours. This damage was discovered quickly due to the proximity of the line to the Trans Canada Highway.
February 5, 2022	Hydro Operations crew mobilized to TL203.
February 5, 2022	Repair commenced on TL203.
February 6, 2022	Repair complete and TL203 returned to service on February 6, 2022 at 1830 hours.

Table 2: TL219 Event Timeline

Date	Activity
February 5, 2022	TL219 tripped at 1039 hours. The line was reclosed once at 1053 hours but tripped again and remained out of service. Limited ground patrol commenced, conditions not suitable for helicopter patrol.
February 6, 2022	Hydro Operations crew performing helicopter patrol identified damage to four consecutive structures on TL219 at approximately 1030 hours. The weather had not presented an opportunity to fly the area prior and, as a result of the remote location, it was not identified through prior ground patrols. Damaged infrastructure was located approximately 3–4 km from Route 210 (Figure 8).
February 6, 2022	Contractor and Hydro Operations crew mobilized to TL219.
February 7, 2022	Repairs commenced on TL219.
February 9, 2022	Repairs complete and TL219 returned to service on February 9, 2022 at 1746 hours.

1 **3.2 TL219 Damage**

2 The damages experienced on TL219 included the structural failure of four consecutive Tangent H-frame
 3 structures (Structures 392–395) in the Terrenceville area as shown in Figure 5. The damage included
 4 broken conductor, poles, crossarms, and cross braces as shown in Figure 6.

5 Based on observations at site, it appears that ice accumulation on the conductor began to shed off as
 6 the temperatures began to increase (refer to Figure 7), resulting in a longitudinal load that caused the
 7 conductor and structure to pull in one direction. Due to the vintage of this line, it was not designed for
 8 such longitudinal loading and resulted in mechanical bending of the crossarms and structures as shown
 9 in Figure 6. The loading experienced had the potential to result in a significant cascade type of failure,
 10 similar to a domino effect. As seen in Figure 8, the failure on TL219 was located on a short section of line
 11 between two dead end structures,¹ which likely prevented the cascade failure of additional structures.

¹ For new designs, Hydro incorporates anti-cascade structures at regular intervals to reduce the potential of a major line failure in accordance with updated guidelines established by utility standards.



Figure 5: TL219 Failure Location



Figure 6: TL219 Structure Failures and Mechanical Bending



Figure 7: Ice Shedding from Conductor

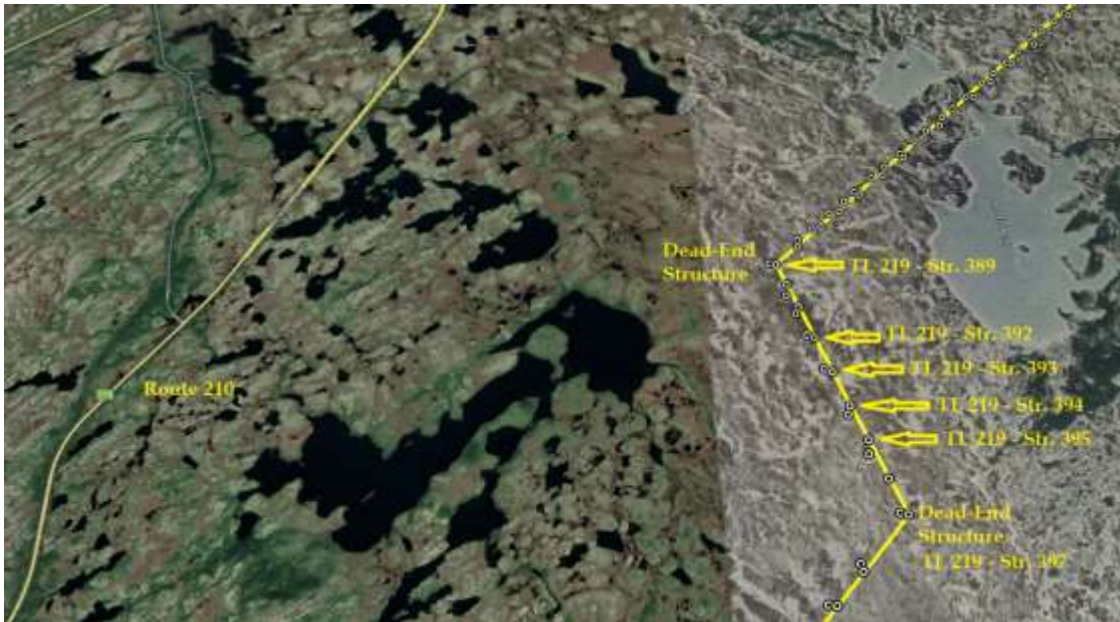


Figure 8: TL219 Failure Location

1 **3.3 TL203 Damage**

- 2 The damage experienced on TL203 included the structural failure of a crossarm on Structure 77 as
3 shown in Figure 9 near the isthmus on the Avalon Peninsula (Figure 10).



Figure 9: Broken Crossarm on TL203 – Structure 77



Figure 10: TL203 Failure Location

1 **4.0 Scope of Work**

2 **4.1 TL219**

3 The scope of work for TL219 included the full replacement of four Tagent H-frame structures. This
4 includes the following work tasks:

- 5 • Remove and dispose existing damaged structures;
- 6 • Splice broken conductor;
- 7 • Install new poles;
- 8 • Install new crossarms and cross bracing; and
- 9 • Install insulators.

10 The existing tangent structures were designed using a single dimensional wood crossarm configuration
11 supported by class 4 poles. As Hydro no longer uses class 4 poles for transmission infrastructure, the
12 existing structures were replaced with class 2 poles, increasing reliability of the structures as per current
13 standards. In addition, a double dimensional wood crossarm was utilized instead of a single crossarm to
14 increase the structures ability to resist future unbalanced loading. Figure 11 illustrates the design
15 difference between the existing structure and the new structure. The more robust material components
16 utilized during the repair effort provide a significant increase in structure capacity. Refer to Figure 12–
17 Figure 14 for photos showing repair work.

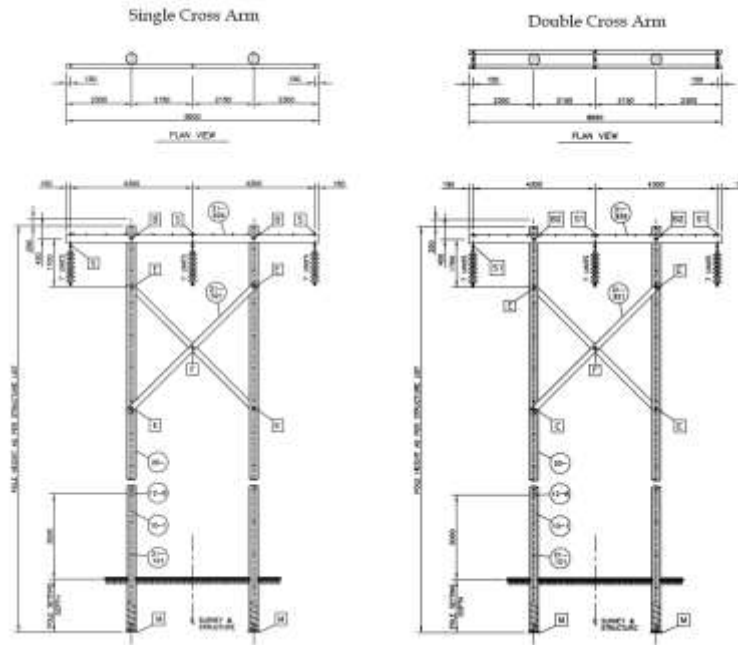


Figure 11: 138 kV H-frame Structure Design



Figure 12: New Tangent Structure (Note TL212 in the Background)



Figure 13: Hydro and Contractor Crews Completing Repairs on TL219



Figure 14: Repairs Complete on TL219

1 **4.2 TL203**

2 The scope of work for TL203 included the replacement of a single wood pole crossarm on Structure 77
3 as shown in Figure 9. This was replaced as per the original design.

4 **5.0 Alternatives**

5 To ensure reliable service was maintained to customers, Hydro had to execute required repairs
6 immediately to mitigate the risk of further damage and restore the system. With the damage occurring
7 during the winter period, the likelihood of additional storm events in the area was high and restoration
8 could not be delayed. In particular, returning TL219 to service as soon as possible was critical, as the
9 redundant transmission system in the power corridor servicing the Burin Peninsula was designed to a
10 lower standard with respect to icing when compared to the current environmental loading standard. In
11 addition to reliability risk, damaged transmission structures on TL219 and TL203 posed a danger to the
12 public and if left unsecured could have put undue strain on nearby structures, causing further damage.
13 Costs associated with securing all safety risks would have been equivalent to repairing the damage.

14 The most effective means of restoring the system was to replace the existing damaged structures and
15 components with readily available materials and existing design standards. Further alternative
16 development through site specific assessment and engineering analysis was not considered and would
17 delay returning the lines to service.

18 As discussed in Section 4.0, Hydro used alternative structure components for the repairs to the TL219
19 structures which increased the structural capacity of the new structures in comparison to the original
20 design. This included the use of class 2 poles as per Hydro’s current standard and the addition of a
21 double crossarm. This resulted in a marginal incremental cost to the project,² but provides a significant
22 increase in structural capacity and protection against longitudinal loading in this remote area in the
23 future.

24 **6.0 Implication to the Utility**

25 As these transmission lines were redundant transmission systems within the Island Interconnected
26 System, there were no customer outages experienced as a result of the failures. However, as a result of

² Approximately \$5,000 total for all structures.

1 the damages and tripped lines, system planning criteria were violated, resulting in elevated risk to
 2 customers. While operations were not disrupted during the event, the elevated risk level required
 3 prompt mitigation to restore system configuration.

4 This work has not impacted Hydro’s ability to execute its capital program for 2022.

5 **7.0 Project Costs**

6 Table 3 identifies preliminary capital costs associated with the failure and repairs. The cost may change
 7 marginally as Hydro receives final invoicing from all contractors. Actual final costs will be reported in
 8 Hydro’s Allowance for Unforeseen monthly reporting.³

Table 3: Costs (\$000)

Activity	Cost
Internal Labour	159,851.00
Contract Cost	195,673.00
Material	53,324.16
Total	408,848.16

9 **8.0 Conclusion**

10 On February 4, 2022, an extreme weather event resulted in variable ice accumulation on sections of
 11 TL219 and TL203. This ice accumulation, in conjunction with the age of the assets, was significant
 12 enough to overload the capacity of the structure components resulting in a system failure. For TL219
 13 specifically, it is suspected that ice shedding from the conductor resulted in unbalanced loading of the
 14 structures⁴ causing the structures to bend longitudinally and eventually fail.

15 In anticipation of the event, Hydro implemented severe weather preparedness protocols to ensure a
 16 coordinated and efficient response to any trouble on the system. As a result of this readiness and
 17 unrestricted access due to a lack of snow accumulation on the Avalon, repairs were completed within
 18 one day on TL203 and four days on TL219.

³ Filed with the Board of Commissioners of Public Utilities on the tenth business day of each month.

⁴ This was not included in the original design criteria.

- 1 As the repairs to the transmission lines were the result of a winter storm event, not planned and
- 2 anticipated in the annual capital budget, and as restoration of damaged infrastructure was required
- 3 immediately to mitigate the risk to service reliability and public safety, Hydro proceeded with the work
- 4 under the Allowance for Unforeseen Account.