TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ONTARIO ENERGY BOARD STAFF

UNDERTAKING NO. JT3.1:

Reference(s): N/A

To provide any third-party reports assessing the effectiveness of distribution capital and maintenance planning and execution processes that Toronto Hydro relies upon, in whole or in part, to plan and deliver its plan.

RESPONSE:

Please see Table 1 below for a list of third-party reports produced to inform effectiveness of processes related to the planning or delivery of Toronto Hydro's distribution capital and maintenance programs.

Please note, Toronto Hydro has already produced a number of third-party benchmarking studies in its response to interrogatory 1B-SEC-5. In addition, within Toronto Hydro's response to interrogatory 2B-AMPCO-33, it provided descriptions of asset studies which may inform its planning processes. Relevant studies are produced as appendices to this response, or to another undertaking as indicated in Table 1.

Table 1: Third-Party Reports Related to Planning or Delivery of Distribution Capital and Maintenance

Third Party Study	Description	Location
Preventative Maintenance Optimization Overhead Switches	Conducted by METSCO Energy Solutions Inc. in 2022 to review Toronto Hydro's existing preventative maintenance practices for overhead three-phase gang-operated and SCADA-mate switches to identify opportunities for improvement.	Appendix A
ISO55001 Gap Assessments	Studies conducted by AMCL in 2020 and 2023 to review Toronto Hydro's Asset Management System to assess against maturity towards ISO55001 certification.	Latest 2023 report was filed as Appendix A to 2B-SEC-34. The 2020 Gap Assessment is produced as Appendix B.
Third Party Auditor Reports Supporting Toronto Hydro's Project Management	Example of a daily activity report (also known as a daily site log) by NBM Engineering, where auditor visits the project execution site and captures and documents observations.	Appendix C
	Example of a final audit report (also known as Green Construction Folder, "GCF" finalization report) by NBM Engineering. Auditor performs final checks upon project completion, which includes various aspects such as project summary, auditor site observations, deficiencies, billing validation, as-constructed verification, etc.	Appendix D
	Another example of a final audit report by WSP.	Appendix E
	Another example of a final audit report by AtkinsRealis	Appendix F
PMO Best Practices Assessment	Study conducted by Comtech in 2022 to inform best practices for processes pertaining to program and project management.	Appendix B to Toronto Hydro's response to undertaking JT4.12
Project Variance Analysis ("PVA") Process Review	Study conducted by Validation Estimating LLC in 2022 to review Toronto Hydro's Project Variance Analysis (PVA) process to identify recommendations for practice improvement.	Appendix C to Toronto Hydro's response to undertaking JT4.12.

METSCO
MAKING IT POSSIBLE

PREVENTATIVE MAINTENANCE OPTIMIZATION
OVERHEAD SWITCHES

Prepared by

METSCO Report no. 21-181-001-R1

June 2022

Disclaimer

This 2022 report has been prepared by METSCO Energy Solutions Inc. ("METSCO") for Toronto Hydro-Electric System Limited ("THESL"). Neither THESL, nor METSCO, nor any other person acting on their behalf makes any warranty, expressed or implied, or assumes any legal responsibility for the accuracy of any information or for the completeness or usefulness of any process disclosed or results presented, or accepts liability for the use, or damages resulting from the use, thereof. Any reference in this report to any specific process or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement or recommendation by THESL or METSCO.

Table of Contents

1 Qualitative Analysis

1.1 Introduction

Toronto Hydro-Electric System Limited ("THESL") engaged METSCO Energy Solutions Inc. ("METSCO") to review of THESL's existing preventative maintenance practices for overhead three-phase gang-operated and SCADA-mate switches to identify opportunities for improvement. One component of this initiative is the completion of a qualitative review that aims to compare THESL's existing practices against the practices used by select peer group utilities, manufacturers' recommendations, and the ANSI/NETA *Maintenance Testing Specifications* ("MTS") 2019 standard. The objectives of these benchmarking exercises and the qualitative review are listed below:

1. Determine if relevant peer group utilities complete time-based condition-based maintenance (or some other approach).
    - If time-based maintenance is completed, the analysis aims to determine the cycle lengths used by peer group utilities.
    - If condition-based maintenance was completed, the analysis aimed to determine the specific condition required to trigger maintenance.
2. Compare the activities completed as part of THESL's switch inspection and maintenance practice to those completed by its peer group utilities.
3. Compare the activities completed as part of THESL's switch inspection and maintenance practice to those recommended by manufacturers.
4. Compare the activities completed as part of THESL's switch inspection and maintenance practice to those recommended by the ANSI/NETA MTS 2019 standard.
5. Based on the above steps, provide recommendations on additional activities that THESL should complete, if applicable.

1.2 Current-State Practices

The benchmarking exercise requires the establishment of THESL's current-state practices. These current-state practices are documented in THESL's maintenance manuals, which METSCO has summarized below for the two switch sub-classes.

1.2.1 Overhead Three-Phase Gang-Operated Switches

THESL currently has approximately 950 overhead three-phase gang-operated switches in its system. The expected typical useful life of these devices is 50 years. These units are subject to the maintenance and inspection procedures provided in Table 1-1 below on a four-year cycle. In addition, THESEL completes IR scans of overhead line components on an annual basis and performs a line patrol (i.e., including visual inspection) every three years. THESL is currently experiencing a backlog of units that require maintenance.

Table 1-1: Summary of THESL's Overhead Three Phase Gang-Operated Switch Maintenance Practices

No.	Activity
1	Inspect physical and mechanical condition
2	Clean the unit
3	Verify correct blade alignment, blade penetration, travel stops, arc interrupter operation, and mechanical operation - make minor repair or parts replacement to ensure switch is in good working order
4	Redress the switch contacts by first cleaning off any old grease. Next, remove the oxidization layer with a light grit sandpaper and wipe clean. Next, apply a light coating of Shell Darina lubricant to the contact surfaces
5	Do not apply any grease or lubricant on the interrupter part of the switch
6	Verify correct operation
7	Inspect Pigtail connectors for corrosion and/or damage and report it under connection deficiency question in the inspection form. Mention the color of the phase that has the issue under comments section when the deficiency is flagged in the inspection form.
8	Exercise caution if corrosion is noticed around the pigtail connectors, just conduct a visual inspection if it is a "normally open" switch and do not operate the switch until the connectors are fixed.
9	If any follow-up repair is required, please indicate the deficiency on inspection form corresponding to the item that needs attention and provide description of the issue in comments section. If an emergency condition (equipment / public / crew safety hazard) exists, please inform your supervisor immediately and follow the instructions
10	Report any non-standard installation in the "Other/Unusual conditions" field on the inspection form

1.2.2 SCADA-Mate Switches

THESL currently has approximately 900 SCADA-Mate in its system with an expected typical useful life of 45 years. These units are subject to the maintenance and inspection procedures provided in Table 1-2 below on a four-year cycle. In addition, THESEL completes IR scans of overhead line components on an annual basis and performs a line patrol (i.e., including visual inspection) every three years. THESL is currently experiencing a backlog of units that require maintenance.

Table 1-2: Summary of THESL's SCADA Mate Switch Maintenance Practices

No.	Activity
1	Perform open and close operation from Control Room
2	Report any warning signal or malfunction of switch, RTU, Battery, etc. for follow-up repair
3	Perform local open/close operation of both SF6 interrupter and manual disconnect switch
4	Lubricate manual switch contacts and hinges. Do not apply grease or any lubricant on the Interrupter part
5	Inspect for signs of corrosion on the handle and switch base
6	Inspect insulators for tracking and cracks
7	Inspect interphase operating link for damage/joints worn out
8	Inspect for loose/damaged connections
9	Inspect Pigtail connectors for corrosion and/or damage and report it under connection deficiency question in the inspection form. Mention the color of the phase that has the issue under comments section when the deficiency is flagged in the inspection form.
10	Exercise caution if corrosion is noticed around the pigtail connectors, just conduct a visual inspection if it is a "normally open" switch and do not operate the switch until the connectors are fixed.
11	Inspect for ground deficiencies
12	Inspect for surge arrester deficiencies
13	Record counter reading
14	If any follow-up repair is required, please indicate the deficiency on inspection form corresponding to the item that needs attention and provide description of the issue in comments section. If an emergency condition (equipment / public / crew safety hazard) exists, please inform your supervisor immediately and follow the instructions
15	Report any non-standard installation in the "Other/Unusual conditions" field on the inspection form

1.3 Peer Group Utilities Benchmarking

1.3.1 Peer Group Utilities Selection

A list of peer group utilities was established to benchmark THESL's current-state practices against comparable utilities. The selection of peer group utilities was completed through an analysis of key variables found in the publicly available *OEB 2020 Yearbook of Electricity Distributors*. The criteria listed below were used to select the peer group utilities.

- Total customers;
- Proportion of rural/urban service area;
- Total km of line;
- Average peak load; and
- Customer density.

If a utility was determined to be comparable to THESL in terms of multiple criteria, it was selected as a peer group utility. The final list of peer group utilities is provided below:

- Alectra Utilities;
- Elexicon Energy;
- Burlington Hydro;
- Hydro Ottawa;
- London Hydro; and
- Oakville Hydro.

1.3.2 Utility-Specific Analysis

As outlined in Section 1.1, the objectives of the peer group utilities benchmarking component of the qualitative review are as follows:

1. Determine if relevant peer group utilities complete time-based maintenance or condition-based maintenance.
    - If time-based maintenance is completed, the analysis aims to determine the cycle lengths used by peer group utilities.
    - If condition-based maintenance was completed, the analysis aimed to determine the specific condition required to trigger maintenance.
2. Compare the activities completed as part of THESL's switch inspection and maintenance practice to those completed by its peer group utilities and provide recommendations on additional activities that THESL should complete, if applicable.

The information used to complete this exercise was compiled from publicly available documentation for each of the peer group utilities, namely from their latest available Distribution System Plans and supporting documentation filed with the OEB. The following subsections compare THESL's maintenance program to the peer group utilities' programs with the intention of addressing the objectives listed above.

1.3.2.1 Alectra Utilities Benchmarking

The activities completed as part of Alectra Utilities' switch maintenance program are summarized in Table 1-3 below. Alectra completes routine activities such as visual inspections and infrared ("IR") scanning on a three-year cycle and Load-Interrupting Switch ("LIS") maintenance on a six-year cycle. In comparison,

THESL completes visual inspections during line patrols on a three-year cycle, IR scanning on an annual basis, and all other maintenance activities on a four-year cycle. Based on the available information, THESL's inspection practices appear to be more comprehensive than Alectra's. THESL's maintenance manuals contain more detail than Alectra's latest DSP and specify additional activities beyond visual and mechanical inspections. However, there is one activity that Alectra performs that THESL does not: electrical testing.

Table 1-3: Summary of Alectra Utilities Switch Maintenance Practices

Activity	Cycle	Description
Visual Inspection	3 years	• Visual inspection only
IR Scanning	3 years	• IR scanning only
LIS Maintenance	6 years	• Detailed inspection including electrical testing and mechanical adjustments in accordance with manufacturer specifications • Observations are recorded in standardized checklist

Key Takeaways

- Alectra does not complete condition-based maintenance.
- Alectra completes visual inspections at the same frequency as THESL (i.e., three-year cycle), IR scanning less frequently than THESL (i.e., three-year cycle vs. THESL's annual program), and additional maintenance activities are less frequently than THESL (i.e., six-year cycle vs. THESL's four-year cycle).
- THESL's maintenance program is generally more comprehensive than Alectra's, but Alectra does complete one activity that THESL does not: electrical testing.

1.3.2.2 Elexicon Energy Benchmarking

The activities completed as part of Elexicon Energy's switch maintenance program are summarized in Table 1-4 below. Elexicon completes all maintenance activities on a three-year cycle – in comparison, Toronto Hydro's maintenance activity cycles range from one to four years. Based on the available information, THESL's inspection practices appear to be more comprehensive than Elexicon's. THESL's maintenance manuals contain more detail than Elexicon's latest DSP and specify additional activities beyond visual inspections, mechanical inspections, and reactive repairs.

Table 1-4: Summary of Elexicon Energy Switch Maintenance Practices

Activity	Cycle	Description
Visual Inspection	3 years	• Visual inspection only
IR Scanning	3 years	• IR scanning only
Mechanical Check	3 years	• Mechanical check only
In Field Repairs	N/A	• In Field Repairs as required

Key Takeaways

- Elexicon does not complete condition-based maintenance.

- Elexicon completes visual inspections at the same frequency as THESL (i.e., three-year cycle), IR scanning less frequently than THESL (i.e., three-year cycle vs. THESL's annual program), and all other maintenance activities more frequently than THESL (i.e., three-year cycle vs. THESL's four-year cycle).THESL's maintenance program is generally more comprehensive than Elexicon's in terms of the scope of maintenance activities.

1.3.2.3 Burlington Hydro Benchmarking

The activities completed as part of Burlington Hydro's switch maintenance program are summarized in Table 1-5 below. Burlington Hydro generally completes all maintenance activities more frequently than THESL as comparable activities are completed on the same cycle as THESL or on a shorter cycle (i.e., all activities are performed on a one or three-year cycle).. Based on the available information, THESL's inspection practices appear to be more comprehensive than Burlington Hydro's as they include additional activities beyond visual inspections and operational/mechanical checks.

Table 1-5: Summary of Burlington Hydro Switch Maintenance Activities

Activity	Cycle	Description
Visual Inspection	1 year	• Visual inspection only
IR Scanning	1 year	• IR Scanning only
LIS Maintenance	3 years	• Switches are isolated and crews open/close switches to make repairs • Includes operational checks and the addition of lubricant if necessary

Key Takeaways

- Burlington Hydro does not complete condition-based maintenance.
- Burlington Hydro completes visual inspections more frequently than THESL (i.e., annual vs. THESL's three-year line patrol cycle), IR scanning at the same frequency as THESL (i.e., annually) and all other maintenance activities more frequently than THESL (i.e., three-year cycle vs. THESL's four-year cycle).
- THESL's maintenance program is generally more comprehensive than Burlington Hydro's in terms of the scope of maintenance activities

1.3.2.4 Hydro Ottawa Benchmarking

The activities completed as part of Hydro Ottawa's switch maintenance program are summarized in Table 1-6 below. Hydro Ottawa completes visual inspections at the same frequency as THESL and IR scanning less frequently than THESL (three-year cycle vs. THESL's annual program). However, its switch-specific maintenance is only completed on critical switches (i.e., switches with a high reliability consequence) and is completed less frequently (eight-year cycle) than comparable activities in THESL's maintenance program. Overall, THESL's switch maintenance program is more comprehensive than Hydro Ottawa's as its maintenance manuals include activities beyond visual inspections and preventative switch maintenance on critical switches only.

Table 1-6: Summary of Hydro Ottawa Switch Maintenance Practices

Activity	Cycle	Description
Visual Inspection	3 years	• Visual inspection only
IR Scanning	3 years	• IR Scanning only
Critical Switch Maintenance	8 years	• Targets gang operated switches with a higher reliability consequence • Includes visual inspection and additional preventative maintenance

Key Takeaways

- Hydro Ottawa does not complete condition-based maintenance but considers criticality during maintenance planning.
- Hydro Ottawa performs visual inspections at the same frequency as THESL (i.e., three-year cycle) but performs IR scanning less frequently than THESL (i.e., three-year cycle vs. Toronto Hydro's annual program).
- Hydro Ottawa performs switch-specific maintenance less frequently than THESL (eight-year cycle vs. THESL's four-year cycle).
- Hydro Ottawa's switch-specific maintenance activities target critical switches only, as defined by their reliability consequence.
- THESL's maintenance program is generally more comprehensive than Hydro Ottawa's in terms of the scope of maintenance activities.

1.3.2.5 London Hydro Benchmarking

The activities completed as part of London Hydro's switch maintenance program are summarized in Table 1-7 below. London Hydro performs routine maintenance activities on the same cycle as Toronto Hydro – specifically, it completes visual inspections on a three-year cycle and IR scanning annually. However, its switch-specific maintenance is performed less frequently than THESL's as it is completed on a five-year cycle. In addition, this targeted switch maintenance only addresses gang-operated switches whereas THESL completes targeted activities on both gang-operated and SCADA-mate switches. THESL's switch maintenance program is more thorough than London Hydro's as it specifies detailed activities beyond the scope of London Hydro's program in addition to addressing both gang-operated and SCADA mate switches.

Table 1-7: Summary of London Hydro Switch Maintenance Activities

Activity	Cycle	Description
Visual Inspection	3 years	• Visual inspection only
IR Scanning	1 year	• IR Scanning only
Gang-Operated Switch Maintenance	5 years	• Assessed based on operability, frequency of use, and hot spots

Key Takeaways

- London Hydro does not complete condition-based maintenance.
- London Hydro completes visual inspections and IR scanning on the same cycle as THESL (i.e., three years and one year, respectively).
- London Hydro performs switch-specific maintenance less frequently than THESL (five-year cycle vs. THESL's four-year cycle).
- London Hydro's switch-specific maintenance activities target gang-operated switches only.
- THESL's maintenance program is generally more comprehensive than London Hydro's in terms of the scope of maintenance activities.

1.3.2.6 Oakville Hydro Benchmarking

The activities completed as part of Oakville Hydro's switch maintenance program are summarized in Table 1-8 below. Oakville Hydro maintenance program consists of visual inspections and IR scanning on a three-year cycle, meaning that it performs visual inspections at the same frequency as THESL but performs IR scanning less frequently than THESL. However, it is important to note that THESL's switch maintenance program is significantly more comprehensive than Oakville Hydro's as it includes switch-specific maintenance activities. Oakville Hydro is the only peer group utility that does not perform any switch specific maintenance.

Table 1-8: Summary of Oakville Hydro Switch Maintenance Activities

Activity	Cycle	Description
Visual Inspection	3 years	• Visual inspection only
IR Scanning	3 years	• IR Scanning only

Key Takeaways

- Oakville Hydro does not complete condition-based maintenance.
- Oakville Hydro performs visual inspections at the same frequency as Toronto Hydro (i.e., three-year cycle) and IR scanning less frequently than Toronto Hydro (i.e., three-year cycle vs. annual program).
- THESL's maintenance program is significantly more complete than Oakville Hydro's as the latter does not perform any switch-specific maintenance.

1.3.2.7 Key Conclusions

Through an analysis of available documentation published by the peer group utilities, it was determined that no peer group utilities complete condition-based maintenance. All peer group utilities complete time-based maintenance and apply varying cycle lengths to their maintenance programs. The peer group utilities and Toronto Hydro complete routine activities – specifically visual inspection and IR scanning – and switch-specific maintenance activities on different cycles. The cycle lengths for routine maintenance activities range from one to three years for both Toronto Hydro and its peer group utilities. The cycle lengths for switch-specific maintenance activities completed by peer group utilities range from three to eight years, meaning that most peer group utilities complete these activities less frequently than THESL.

It was also discovered that THESL generally has a more comprehensive maintenance program than all its peer group utilities. In comparing the switch maintenance program descriptions provided in the peer group utilities' Distribution System Plans and THESL's switch maintenance manuals, it is evident that THESL completes all maintenance activities that its peer group utilities complete. In addition, THESL completes several activities that are not included in the peer group utilities switch maintenance program descriptions. The only exception is electrical testing, which is only completed by Alectra. In addition, Hydro Ottawa and London Hydro's strategies vary from other peer group utilities as they only complete targeted maintenance on critical switches (as defined by reliability consequence) and gang-operated switches, respectively.

Overall, THESL's switch maintenance program has been determined to be more effective than its peer group utilities based on this qualitative review. This claim is supported by the fact that THESL completes switch-specific maintenance more frequently than most peer group utilities and that the activities included in THESL's program are more comprehensive than its peer group utilities' programs. While some peer group utilities complete some activities that THESL does not, such as electrical testing, these activities were not deemed to be critical or cost efficient by METSCO subject matter experts. However, the review of the peer group utilities' programs revealed some potential areas of improvement – these suggestions are not critical but have been listed below in case THESL chooses to explore further enhancements in the future.

- THESL should explore the inclusion of electrical testing in its maintenance program if:
  - Additional budget is available; and
  - Reliability performance is significantly poor and requires improvement.
- THESL should explore completing routine activities (such as visual inspections and basic mechanical checks) and comprehensive maintenance activities (such as cleaning or lubrication) more frequently if:
  - the utility wishes to pursue the implementation of a best in class maintenance program
  - Work crews have sufficient availability or budget is available to expand resources; and
  - A focus on operational efficiency becomes higher priority.

1.4 Manufacturer Recommendations Benchmarking

As outlined in Section 1.1, the objective of the manufacturer recommendations benchmarking component of the qualitative review is to compare the activities completed as part of THESL's switch inspection and maintenance practice to those recommended by manufacturers and provide recommendations on additional activities that THESL should complete, if applicable.

The asset registry data used for this initiative did not have sufficient detail to identify the manufacturer and model of all gang-operated and SCADA-mate switches in deployment. Therefore, a set of manufacturer recommendations published by S&C Electric for similar switch types was leveraged to complete this analysis.

1.4.1 Overhead Gang-Operated Three-Phase Switches

1.4.1.1 Comparison of THESL and Manufacturer-Recommended Maintenance Practices

The manufacturer recommendations for overhead gang operated three phase switches are provided in the tables below – Table 1-9 provides an overview of the manufacturer recommendations for inspection practices and Table 1-10 provides an overview of the manufacturer alignment recommendations. In Table 1-1 above, all of THESL's current practices are enumerated and the tables below contain references to THESL's current practice using this numeric identifier. Using this information, the reader can understand which manufacturer recommended practices are included in THESL's current maintenance program. Any items requiring additional clarification or action are highlighted and discussed in Section 1.4.1.2.

Table 1-9: Manufacturer Recommendations – Inspection Practices

Activity Description	THESL Activity Reference (Table 1-1)
General	
Make sure the switch and operating mechanism have been installed per the appropriate installation and operation instruction sheets provided with each switch.	1, 3, 9, 10
Make sure all clamping bolts are tight and the piercing set screws are installed properly. Check the through-bolts, pole-band (if furnished), and J-bolts (if furnished) securing the switch to the pole or mounting structure. Tighten the hardware, if necessary.	1, 3, 7, 8, 9
Examine insulators, live parts, and the switch base for signs of tracking, contamination, arc damage, and soot. Clean the insulators, if necessary, with a clean cloth and a mild soap and water solution. Follow by rinsing with clean water.	1, 2, 3
Check that the switch is free from wildlife nests, tree limbs, and debris. Remove any impediments if present.	1, 9
Interrupter	
Do not rework the interrupters. Replace the entire interrupter if any of the conditions below are not met.	N/A
Check that all interrupter end caps are in place and secure.	1
Make sure all interrupters operate smoothly and the shunt arm automatically resets to its **Closed** position after opening.	3, 6
Check all interrupters for damage or soot.	1, 9
Live Parts	
Check the condition of the shunt contact. If any shunt contacts exhibit signs of damage or excessive wear, replace the associated blade and operating cam assembly.	1, 9
Clean and grease the contacts (for switches without catalog number suffix "-C"), if required. Wipe dirt and grease from both the blade and jaw contacts with a clean dry cloth. Remove any oxidation by lightly polishing the contacts with steel wool or fine-grit sandpaper and wiping excess grit off with a dry cloth. Apply a light coating of Shell Gadus S2 U1000 (available from S&C) to the contact surface.	4
The graphite-impregnated contacts (catalog number suffix "-C") do not require grease. Grease may be applied, but once used on graphite-impregnated contacts,	N/A

Activity Description	THESL Activity Reference (Table 1-1)
the contacts must be maintained in the same manner as non-graphite-impregnated contacts.	
Operating Mechanism	
For rotating-type operating mechanisms, make sure the operating handle is adjusted to create an "overtoggle" in the operating-mechanism linkage when the switch is in the **Closed** position. To adjust the overtoggle, move the handle stops as necessary. (When power-operated, the overtoggle should not be present.)	6
For reciprocating-type operating mechanisms, make sure the operating handle is adjusted so all slack in the operating linkage is taken up when the handle is fully closed (and over center). When operated to the fully **Closed** position, a definite resistance should be felt at the end of the stroke.	
For hookstick-type operating mechanisms, make sure that the stop pin on the operating mechanism engages with the detent spring when the switch is in the **Open** position and an "overtoggle" is present in the operating-mechanism linkage when the switch is in the **Closed** position.	
Options	
If furnished, examine ice shields (catalog number suffix "-B") for signs of tracking, contamination, arc damage, and soot.	1, 9
If furnished, examine wildlife protection (catalog number suffix "-U" or "-W") for signs of tracking, contamination, arc damage, and soot.	

Table 1-10: Manufacturer Recommendations – Alignment Recommendations

Activity Description	THESL Activity Reference (Table 1-1)
Move the Operating handle slowly to the fully open position (The interrupter and interrupter shunt arm must be parallel to the sweep of the blade.)	N/A
The operating cam shunt contact should engage the interrupter shunt arm on the copper-bronze surface of the shunt contact.	1, 3, 6
When the blade reaches its full travel, the interrupter shunt arm will be released and will quickly snap back to its **Closed** position, reset for the next operation.	
With the operating handle as far as it will go in the opening direction, the switch blades should be 90 degrees from the **Closed** position.	
Move the operating handle slowly to the fully closed position The interrupter shunt arm should be guided into position by the curved back of the shunt contact.	N/A
With the operating handle as far as it will go in the closing direction:	
All switch blades move into the jaw contact guide fingers on center and are fully seated in the jaw contacts.	1, 3, 6
The interrupter shunt arms are no more than **1/8**-inch (3 mm) from the auxiliary return arm of the multipurpose operating cam, and the shunt arm and return arm do not touch each other.	

1.4.1.2 Key Conclusions

The maintenance practices currently used by THESL for overhead gang-operated three-phase switches generally satisfy the manufacturer recommendations. For each specific activity outlined by the manufacturer, THESL has a comparable activity in its maintenance/inspection practice. It should be noted that the manufacturer's recommendations are provided at a greater level of detail than the practices outlined in THESL's maintenance manuals. However, this does not imply that THESL's switch maintenance practices are insufficient, particularly since the utility's practices are more comprehensive than all its peer group utilities (as outlined in Section 1.3.2.7). METSCO subject matter experts have determined that THESL does not need to make significant changes to the activities completed as part of its switch maintenance program based on these manufacturer recommendations. If the utility wishes to enhance its practices in the future, it can review these manufacturer recommendations to identify areas of improvement. However, it is recommended that THESL considers other benchmarking exercises to identify these future enhancements as its current practices generally satisfy the recommendations above.

1.4.2 SCADA-Mate Switches

1.4.2.1 Comparison of THESL and Manufacturer-Recommended Maintenance Practices

The manufacturer recommendations for SCADA-mate switches are provided in the tables below – Table 1-11 provides an overview of the manufacturer recommendations for inspection practices and Table 1-12 provides an overview of the manufacturer cleaning and lubrication recommendations. In Table 1-2 above, all THESL's current practices are enumerated and the tables below contain references to THESL's current practice using this numeric identifier. Using this information, the reader can understand which manufacturer recommended practices are included in THESL's current maintenance program. Any items requiring additional clarification or action are highlighted and discussed in Section 1.4.2.2.

Table 1-11: Manufacturer Recommendations – Inspection Practices

Activity Description	THESL Activity Reference (Table 1-2)
General	
Check with your local S&C Sales Office to verify whether there are any outstanding field notifications for inspection, maintenance, or retrofit of your model switch.	None
Check the switch for overall cleanliness of the insulators, live parts, and control cabinet. The switch should be free from wildlife nests, tree limbs, or other debris that could affect dielectric clearances.	5 to 12, 14
Check the through bolts, pole-band and J-bolts, and cross-arms (if furnished) securing the switch to the pole or mounting structure. Tighten the mounting hardware, if necessary.	7, 14
Insulation and Sensors	
Check for evidence of arc damage, tracking, or soot.	6, 14
Check that the insulation is free from contamination or debris from wildlife or the environment. Clean the insulators if necessary.	
Disconnect Live Parts	
Check that the disconnect current carrying contact enters the jaw contact on-center.	3, 14
Check that the disconnect operates smoothly and freely through its full travel, without binding. Clean and lubricate the contacts, if necessary.	3, 4, 14
Control Cabinet (CCU) and Control Cable	
Check for evidence of water ingress, damage, excessive corrosion, or wear.	2, 8, 9 10, 14
Check electrical operation using local control trip and close buttons.	3
Check for loose wiring inside enclosure and proper functioning of all LED indicating lights, operation counter, 6801 Automatic Switch Control, remote terminal unit (RTU), etc.	2, 8, 14
Check the key interlocks, if furnished, mechanically and electrically.	14
Inspect the control cable and connectors for evidence of damage or moisture ingress.	8, 14
Inspect the ground wires to ensure the switch and communication and control unit (CCU) are properly grounded.	11, 14
Perform the Battery Charger Recalibration Procedure detailed in RD-3808.	None
Options	
Check that the lightening arresters are in good condition and properly grounded.	11, 12
Check the condition of the wildlife covers, if furnished, to make sure they are in place and secure.	14
Operation	
Manually operate the switch	3
Operate the 6801 Automatic Switch Control or the Communication and Control Unit open and closed 3 times to ensure that the controls, control cable, and switch are working properly.	1, 3

Table 1-12: Manufacturer Recommendations – Cleaning and Lubrication Recommendations

Activity Description	THESL Activity Reference (Table 1-2)
General	
Remove any wildlife nests or debris if present	14
Trim trees around switch to the distance specified by standard utility practices.	14
When connector/jumper connections are adjusted, wire-brush the surface of the Scada-Mate terminal pads and re-apply a suitable aluminum connector compound before replacing connectors/jumpers.	None
Insulators	
Check for evidence of arc damage, tracking, or soot. Check that the insulation is free from contamination or debris from wildlife or the environment. Clean the insulators if necessary.	6, 14
Wipe dirt and grease from both hinge and jaw contact with a clean cloth. Dirt or contamination can be cleaned off of the blade and hinge with a mild soap and water solution and a clean cloth. Follow by rinsing with clean water. Manual cleaning of the live parts must be performed with the switch de-energized.	None
Apply a light coating of Shell Aeroshell #7 or an equivalent non-sulfur containing contact lubricant. (Shell Aeroshell #7 is available from S&C Electric Company.)	4
Power Washing	
DO NOT power wash with water or other liquid solvent. A ventilator hole is located at the base of the switch operating mechanism. Power washing with water or another liquid solution can force liquid inside the operating mechanism causing damage.	N/A
S&C recommends hand washing the de-energized switch with a mild soap and water solution and a clean, lint-free cloth.	None

1.4.2.2 Key Conclusions

In comparison to the benchmarking between the manufacturer recommendations and THESL's current practice for overhead gang-operated three-phase switches, this benchmarking exercise for SCADA-mate switches revealed several potential areas for improvement. There are several manufacturer-recommended practices that are either not completed or only partially completed by THESL. These items are highlighted in Table 1-11 and Table 1-12 above and are discussed in further detail below. It is important to note that while this benchmarking exercise reveals several potential improvements, these conclusions should be interpreted as recommendations and not explicit requirements. Although THESL's maintenance program may not satisfy all manufacturer recommendations, its program is more comprehensive than its peer group utilities (see Section 1.3.2.7). METSCO subject matter experts recommend that the utility should explore these enhancements if reliability performance is poor and the additional cost can be justified.

- (Table 1-11) Check with your local S&C Sales Office to verify whether there are any outstanding field notifications for inspection, maintenance, or retrofit of your model switch.

  - THESL current maintenance program does not include any activities related to this manufacturer recommendation. Although THESL may not exclusively use S&C products, it is recommended that the utility routinely check for updated notices regarding switch maintenance from relevant manufacturers.
- (Table 1-11) Check the through bolts, pole-band and J-bolts, and cross-arms (if furnished) securing the switch to the pole or mounting structure. Tighten the mounting hardware, if necessary.
  - THESL currently has several activities (items 7 and 14 in Table 1-2) that would entail completing certain tasks outlined in this manufacturer recommendation. However, it is not clear if all these tasks are completed based on the available information from THESL's maintenance manual. THESL should explore the addition of a new checklist item for the inspection of mounting hardware.
- (Table 1-11) Control Cabinet (CCU) and Control Cable
  - There are several maintenance tasks recommended by the manufacturer within this inspection category. While THESL's inspection and maintenance checklist would likely include inspections for the majority of the manufacturer's recommendations, it is recommended that the utility explore the addition of a new checklist item for the inspection of the control cabinet and related accessories.
- (Table 1-11) Check that the lightening arresters are in good condition and properly grounded.
  - THESL's current inspection practice includes a checklist item for the inspection of ground deficiencies. However, there are no inspection checklist items for lightning arresters – the utility should explore the addition of a new inspection checklist item for these assets.
- (Table 1-11) Check the condition of the wildlife covers, if furnished, to make sure they are in place and secure.
  - THESL's current practices do not include any specific activities intended to inspect switches for wildlife damage. If this activity is not completed as part of a separate program, THESL should explore the addition of a new checklist item for the inspection of switches for wildlife damage.
- (Table 1-12) Remove any wildlife nests or debris, if present.
  - THESL's current practices do not include any specific activities intended to inspect switches for wildlife impact. If this activity is not completed as part of a separate program, THESL should explore the addition of a new checklist item for the inspection of switches for wildlife impact.
- (Table 1-12) Trim trees around switch to the distance specified by standard utility practices.
  - THESL's current practices do not include any specific activities intended to address vegetation interference. If this activity is not completed as part of a separate program, THESL should explore the addition of a new checklist item for the inspection of switches for vegetation interference.
- (Table 1-12) When connector/jumper connections are adjusted, wire-brush the surface of the Scada-Mate terminal pads and re-apply a suitable aluminum connector compound before replacing connectors/jumpers.
  - THESL should explore the inclusion of this activity in its maintenance practices as the current inspection checklist may not contain any similar activities.

- (Table 1-12) Apply a light coating of Shell Aeroshell #7 or an equivalent non-sulfur containing contact lubricant. (Shell Aeroshell #7 is available from S&C Electric Company.)
    - While THESL's current inspection practices include the lubrication of switch components, the utility should consider if the type of lubricant used differs significantly from the manufacturer recommendation as this information is not currently captured in its switch maintenance manuals.
- (Table 1-12) S&C recommends hand washing the de-energized switch with a mild soap and water solution and a clean, lint-free cloth.
    - THESL's current practices do not include any switch cleaning practices for SCADA mate switches. The utility should explore the inclusion of this activity as part of its standard procedures.

1.5 ANSI/NETA Maintenance Testing Specifications 2019 Standard Benchmarking

As outlined in Section 1.1, the objective of the ANSI/NETA MTS 2019 standard recommendations benchmarking component of the qualitative review is to compare the activities completed as part of THESL's switch inspection and maintenance practice to those recommended by the ANSI/NETA MTS 2019 standard and provide recommendations on additional activities that THESL should complete, if applicable

The ANSI/NETA MTS 2019 standard contains a set of recommendations for visual and mechanical inspections and a set of recommendations for electrical testing. These two sets of recommendations are discussed below with references to specific maintenance activities for gang-operated and SCADA-mate switches (see Table 1-1 and Table 1-2 for activity numbers, respectively).

1.5.1 Visual and Mechanical Inspections

The ANSI/NETA MTS 2019 standard contains a list of recommended maintenance practices for visual/mechanical inspections as well as electrical testing – this subsection pertains to the former. All recommended visual/mechanical inspection practices are summarized in Table 1-13 below. If THESL's current maintenance practices (as defined in the switch maintenance manuals) contain a similar activity, its numeric identifier is provided in the "Gang-Operated Reference" or "SCADA-Mate Reference" column (see Table 1-1 and Table 1-2, respectively). Some of the recommended practices are only applicable to certain switch sub types, as identified in the "Switch Type" column. This benchmarking exercise reveals that there are several practices recommended by the ANSI/NETA MTS 2019 standard that THESL does not complete in its program. These practices are highlighted in the table below and further discussed in Section 1.5.3 Key Conclusions.

Table 1-13: Summary of ANSI/NETA MTS 2019 Visual/Mechanical Inspection Recommendations

Activity	Switch Type	Gang-Operated Activity Reference (Table 1-1)	SCADA-Mate Activity Reference (Table 1-2)
Inspect physical and mechanical condition.	All	1	5 to 12, 14
Inspect anchorage, alignment, grounding, and required clearances.	All	3, 9	14
Prior to cleaning insulators/unit, perform as-found tests, if required.	All	None	None
Clean the insulators/unit.	All	2	None
Verify correct blade alignment, blade penetration, travel stops, arc interrupter operation, and mechanical operation.	Air	3	None
Verify that fuse sizes and types are in accordance with drawings, short-circuit studies, and coordination study.	All	None	None
Verify that each fuseholder has adequate mechanical support and contact integrity.	All	None	None
Inspect bolted electrical connections for high resistance using one or more of the following methods:	All	None	None
Use of a low-resistance ohmmeter in accordance with Section 7.5.1.3.B.1.	All	None	None
Verify tightness of accessible bolted electrical connections by calibrated torque wrench method in accordance with manufacturer's published data or Table 100.12.	All	None	None
Perform a thermographic survey in accordance with Section 9.	All	None	None
Verify operation and sequencing of interlocking systems.	All	6	1, 3
Perform mechanical operator tests in accordance with manufacturer's published data.	All	6	1, 3
Verify correct operation and adjustment of motor operator limit switches and mechanical interlocks.	Air, Vacuum	6	1, 3
Use appropriate lubrication on moving current-carrying parts and on moving and sliding surfaces.	All	None	4
Perform as-left tests.	All	None	None
Record as-found and as-left operation counter readings.	Air, SF6	None	13
Verify correct operation of SF6 gas pressure alarms and limit switches as recommended by the manufacturer.	SF6	None	None
Measure critical distances as recommended by the manufacturer.	SF6, Vacuum	None	None
Test for SF6 gas leaks in accordance with manufacturer's published data.	SF6	None	None

Activity	Switch Type	Gang-Operated Activity Reference (Table 1-1)	SCADA-Mate Activity Reference (Table 1-2)
Inspect insulating assemblies for evidence of physical damage or contaminated surfaces.	Vacuum	9	14
Verify that insulating oil level is correct.	Vacuum	None	None

1.5.2 Electrical Testing

The ANSI/NETA MTS 2019 standard contains a list of recommended maintenance practices for visual/mechanical inspections as well as electrical testing – this subsection pertains to the latter. All recommended electrical testing practices are summarized in Table 1-14 below. THESL does not perform any type of electrical testing on its overhead gang operated three phase switches or SCADA mate switches. Although this presents a potential area of improvement, METSCO subject matter experts have determined that the addition of electrical testing may not provide sufficient incremental value to justify expenditures. The utility should only explore completing these activities if it wishes to further enhance performance metrics such as reliability and the additional cost of testing can be justified.

Table 1-14: Summary of ANSI/NETA MTS 2019 Electrical Testing Recommendations

Activity	Type
Perform resistance measurements through bolted connections with a low-resistance ohmmeter in accordance with Section 7.5.1.3.A.8.1.	All
Perform a contact-resistance test.	All
Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase to ground with switch closed and across each open pole. Apply voltage in accordance with manufacturer's published data. In the absence of manufacturer's published data, use Table 100.1.	All
Perform insulation-resistance tests on all control wiring with respect to ground. The applied potential shall be 500 volts dc for 300-volt rated cable and 1000 volts dc for 600-volt rated cable. Test duration shall be one minute. For units with solid-state components or control devices that cannot tolerate the applied voltage, follow manufacturer's recommendation.	All
Perform a dielectric withstand voltage test on each pole with switch closed. Test each pole to ground with all other poles grounded. Test voltage shall be in accordance with manufacturer's published data or Table 100.19.	Air
Perform a dielectric withstand voltage test across each gas bottle with the switch in the open position in accordance with manufacturer's published data.	SF6
Perform a vacuum bottle integrity (dielectric withstand voltage) test across each vacuum bottle with the switch in the open position in strict accordance with manufacturer's published data.	Vacuum
Measure fuse resistance.	All
Remove a sample of SF6 gas and test in accordance with Table 100.13.	SF6

Activity	Type
Perform a dielectric withstand voltage test in accordance with manufacturer's published data.	SF6, Vacuum
Verify open and close operation from control devices.	SF6, Vacuum
Perform magnetron atmospheric condition (MAC) test on each vacuum interrupter.	Vacuum
Remove a sample of insulating liquid in accordance with ASTM D923. The sample shall be tested in accordance with the referenced standard.	Vacuum
Dielectric breakdown voltage: ASTM D877	Vacuum
Color: ASTM D1500	Vacuum
Visual condition: ASTM D1524	Vacuum

1.5.3 Key Conclusions

As outlined above, the ANSI/NETA MTS 2019 standard provides a set of recommendations for visual and mechanical inspections and another set of recommendations for electrical testing. THESL's switch maintenance program includes the completion of some visual/mechanical inspection recommendations but does not include any electrical tests. Generally, these activities are more technical than the utility's current procedures and represent a more comprehensive maintenance plan. While there is value in completing these additional visual/mechanical inspection activities and electrical tests, METSCO subject matter experts determined that they may not provide sufficient incremental value to justify the additional expenditures. This is further supported by the fact that the peer group utilities benchmarking exercise revealed that THESL's current switch maintenance program is already more comprehensive than comparable utilities (see Section 1.3.2.7). The utility should only consider completing these activities if switch reliability performance requires significant improvement and the required expenditures can be justified.

1.6 Conclusions

The peer group utilities benchmarking exercise revealed that all comparable utilities complete time-based maintenance with varying cycle lengths. The peer group utilities typically complete routine maintenance activities such as visual inspections and IR scanning on the same inspection cycle as Toronto Hydro (i.e., on a one to three-year cycle). However, they complete specialized switch-specific maintenance activities less frequently than THESL's four-year inspection cycle (i.e., on a three to eight-year inspection cycle). THESL's maintenance program is generally more comprehensive than its peer group utilities as it generally completes all activities that its peer complete and more. The only exception is electrical testing, which is completed by Alectra only. This implies that THESL's practices are in alignment with its peers in terms of the maintenance type (i.e., time-based) and the cycle lengths and they generally exceed the peers' practices in terms of the scope of activities that are completed. The final conclusions and recommendations of the peer group benchmarking are listed below (please refer to Section 1.3.2.7 Key Conclusions for additional information).

- THESL and its peer group utilities both complete time-based maintenance on similar cycles, but the peer group utilities cycle lengths vary depending on the maintenance type (i.e., routine maintenance such as visual inspection vs. switch-specific maintenance such as mechanical/operational checks).

    - THESL may wish to explore completing routine activities (such as visual inspections and basic mechanical checks) and comprehensive maintenance activities (such as cleaning or lubrication) more frequently if it wishes to further enhance its maintenance program, work crews have sufficient availability, budget is available, and/or additional operational efficiency is required.
- THESL's maintenance practices are generally more comprehensive than its peer group utilities – the only activity that THESL does not complete is electrical testing.
    - METSCO subject matter experts determined that electrical testing would not provide significant incremental value, but the utility can explore the addition of such activities if additional budget is available and switch reliability performance (or other KPI performance) is sufficiently poor to justify additional expenditures.

The manufacturer recommendations benchmarking exercise revealed that THESL's switch maintenance program generally satisfies the manufacturer maintenance recommendations around overhead three phase gang-operated switches. These recommendations are provided at a greater level of detail than the information captured in THESL's maintenance manuals. METSCO subject matter experts determined that THESL does not need to make significant changes to its maintenance program based on these recommendations, but the utility can explore them in further detail if it wishes to enhance its program in the future. In comparison, the manufacturer recommendations benchmarking exercise for SCADA-mate switches revealed that there are several manufacturer-recommended activities that the utility does not complete. However, this does not necessarily imply that the utility must improve its current practices as the peer group benchmarking exercise indicated that THESL's switch maintenance program is more comprehensive than comparable utilities. METSCO subject matter experts recommend that the utility explores these enhancements (as outlined in Section 1.4.2.2) if switch reliability performance (or other KPI performance) indicates the need for additional maintenance and the incremental cost can be justified.

The ANSI/NETA MTS 2019 standards provide a set of visual/mechanical inspection recommendations and electrical testing recommendations. The benchmarking exercise revealed that THESL's current switch maintenance program satisfies some of the visual/mechanical inspection recommendations but does not satisfy any of the electrical testing recommendations. The visual/mechanical inspection recommendations that THESL does not complete are provided in Section 1.5.1. While there is value in completing these additional activities, METSCO subject matter experts determined that the incremental value provided may not be justifiable as THESL's activities are already comprehensive in comparison to other comparable utilities. The same verdict was given to the electrical testing recommendations – while THESL does not complete any type of electrical test, the inclusion of such activities would not provide material value such that the cost can be justified. However, it is recommended that THESL explore these activities in the future if additional enhancements are required due to poor reliability performance (or other KPIs) such that the additional cost can be justified.

2 Quantitative Analysis

2.1 Introduction

The purpose of the quantitative analysis is to derive key insights by investigating the following questions:

- What is the optimal maintenance frequency?
- What is the ideal start age for maintenance?
- Should the utility replace overhead switches proactively or employ a run-to-failure strategy?

This analysis is undertaken based on the risk mitigated by the maintenance activities relative to the cost of the maintenance. The characteristics defining the risk of a given switch in THESL's distribution system can vary. For example, factors such as the condition, age, number of connected customers, and other risk factors such as location can differ significantly from switch to switch. This study aims to standardize part of this variability by creating a set of predetermined risk profiles that will guide the analyses. In absentia of a comprehensive quantitative risk assessment for all the overhead switches on THESL's system, Table 2-1 shows a simple risk matrix that THESL can immediately apply to estimate the risk of switches based on the effective age (i.e., condition-adjusted age) and the number of connected customers. These two dimensions of the matrix are intended to broadly represent the probability and consequence of failure, respectively. The numbers within the matrix cells are identifiers for a given risk profile and the colours indicate the meaning of the risk profile, as outlined in **Error! Reference source not found.** below. The interpretations presented in **Error! Reference source not found.** are based on a total risk calculation that is detailed in subsequent sections of this report.

Table 2-1: Risk Matrix for Switches based on Effective Age and Customer Count

	Number of Connected Customers		
Effective Age	≤ 100	101-1000	>1000
Age <60% of TUL	1	2	3
Age >= 60% of TUL and <TUL	4	5	6
Age >= TUL	7	8	9

Legend
Low
Medium
High

2.2 Optimal Maintenance Frequency

2.2.1 Overview

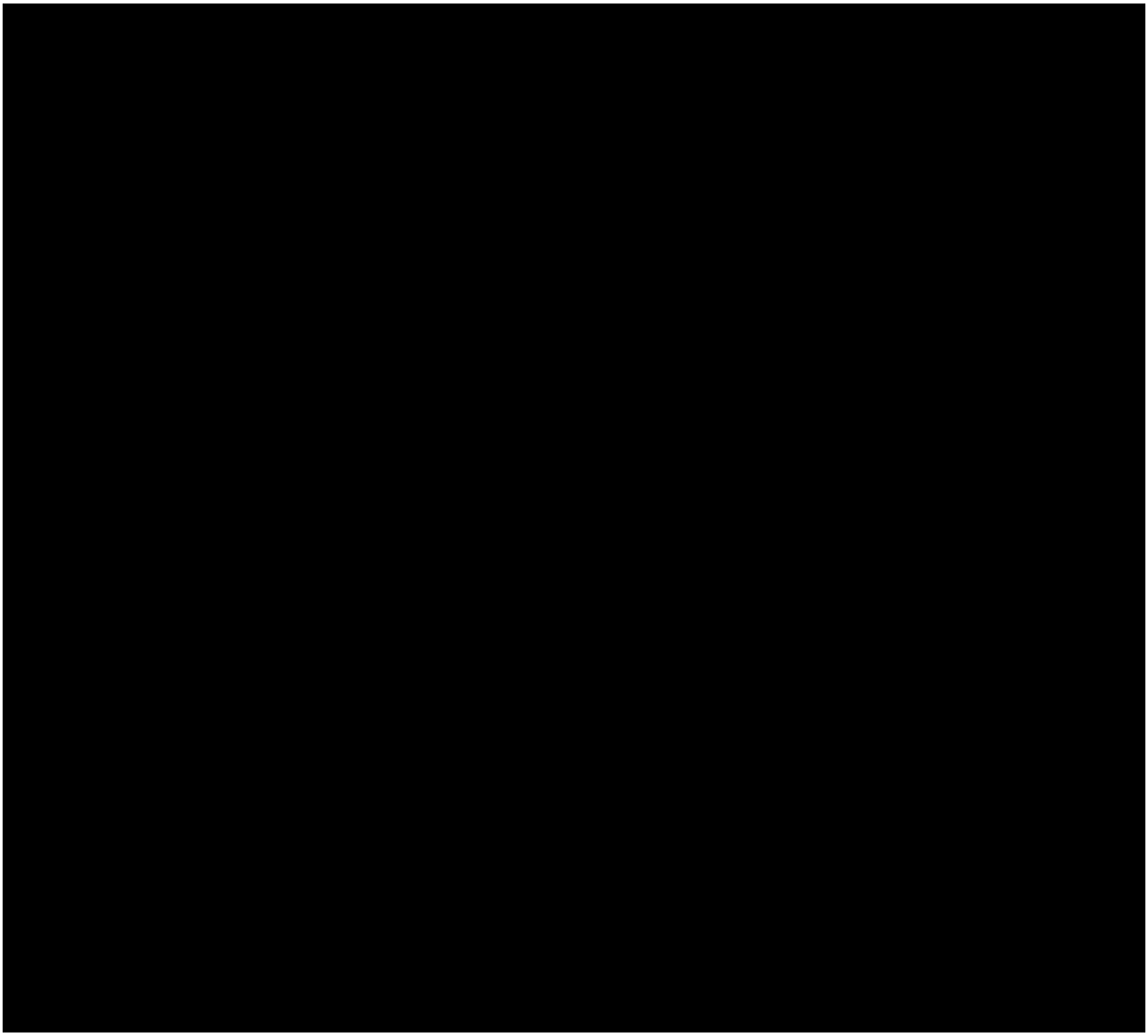
THESL's current maintenance cycle length is four years for comprehensive maintenance activities (as outlined in 1.2 Current-State Practices). This analysis entailed the comparison of several maintenance frequencies using a Benefit-Cost ratio. In the context of this analysis, benefit is defined as the risk reduction from one maintenance cycle length to another. If maintenance is completed more frequently, it becomes more likely that issues that would otherwise cause in-service failure are identified and addressed before the failure occurs. In this manner, the outage impact can be minimized. Risk is presented as a monetary value and is calculated as the product of failure probability and impact – the complete risk calculation methodology is detailed in Section 2.2.2 below.

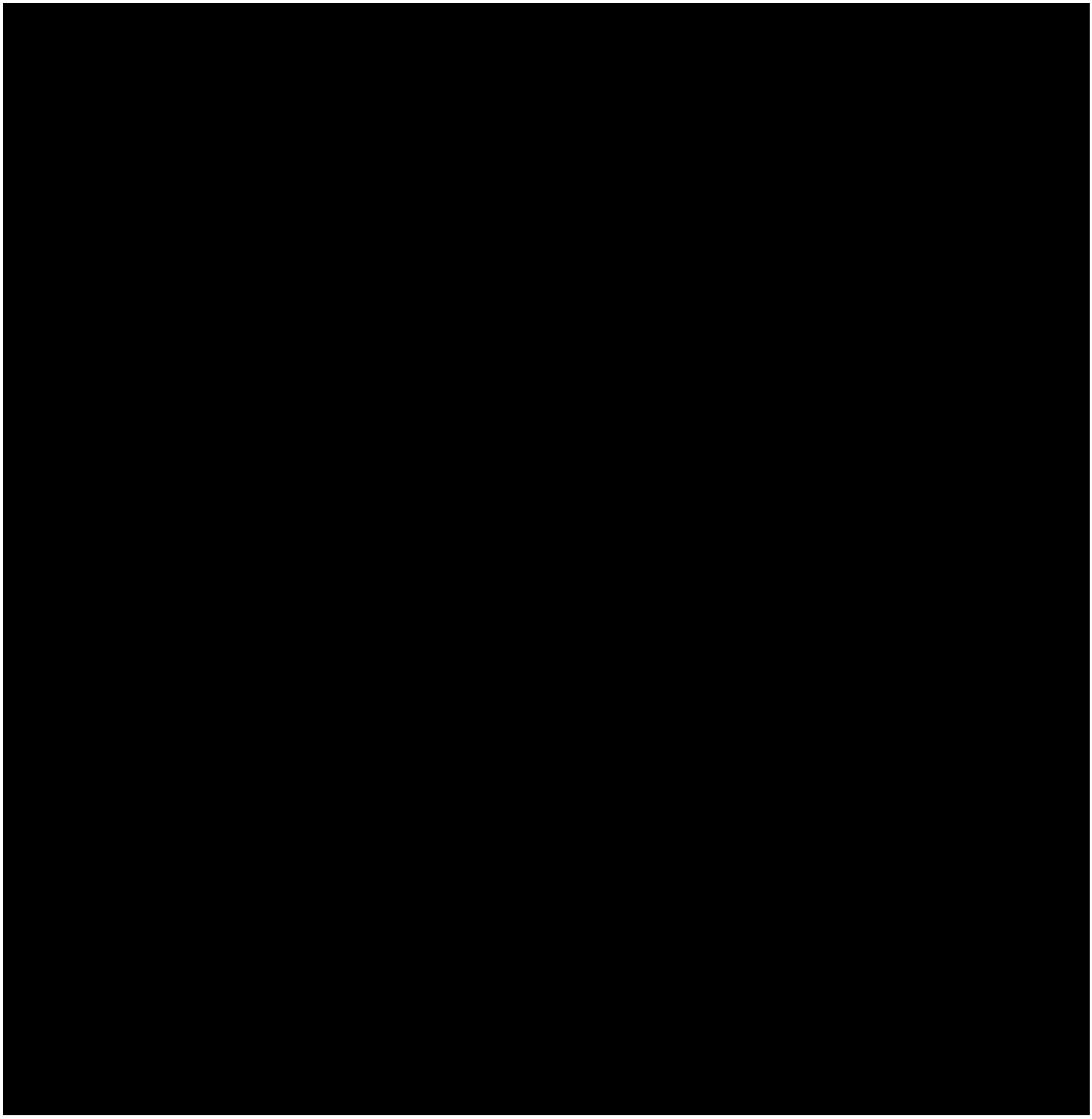
The cost component of the Benefit-Cost ratio is defined as the incremental cost from one maintenance cycle to another. For example, if a given maintenance activity has an average unit cost of $3600 on a four-

year maintenance cycle, increasing the maintenance frequency would result in the maintenance expense being incurred more frequently.

This analysis considers the trade off between the reduction in risk and the increase in cost due to increased maintenance frequency. Given that there are multiple risk profiles for various switches (as outlined in Section 0), this analysis was completed separately for each profile to identify optimal practices depending on the switch risk level. For example, given that a switch within risk category 1 (as defined in Table 2-1 above) has a lower initial risk value, the risk reduction benefit will not be as significant as it would be for a switch within risk category 9 – this difference significantly affects the benefit-cost ratio calculation. This process is further detailed in the subsequent sections which detail the methodology and results of this analysis.

2.2.2 Methodology





2.2.3 Results

As outlined above, the complete analysis involved comparing all maintenance plans to identify the optimal maintenance frequency depending on the switch risk profile. Each maintenance plan was compared to subsequent maintenance plans only – for example, the four-year maintenance plan was compared to the three-year and five-year plans. This strategy allowed the analyst to identify if increasing or decreasing the

maintenance frequency resulted in more optimized and cost-efficient practices. The analysis revealed that increasing the maintenance frequency was a worthwhile decision for high-risk switches and decreasing the maintenance frequency was a worthwhile decision for low-risk switches. The analysis results presented below provide the details of this analysis. The example presented in Section 2.2.2.5 suggests that a benefit-cost ratio greater than one would indicate that the increased maintenance frequency is cost-efficient. However, a benefit-cost ratio threshold of 2.5 was used for the analysis to add an additional safety factor and ensure that the results of the analysis will still be valid if inputs change (i.e., ratio must be greater than or equal to 2.5).

Table 2-6 presented an overview of the benefit-cost ratio calculation for a three-year maintenance cycle compared to a four-year maintenance cycle. A similar calculation was completed for all consecutive plans. The benefit-cost ratios resulting from this analysis are presented in Table 2-7. As outlined above, a benefit-cost ratio of 2.5 would indicate that there is sufficient benefit in increasing the maintenance frequency. In analyzing the results presented below, it is evident that there are similarities between switches in the same risk category.

Table 2-7: Summary of Final Benefit-Cost Ratio Results for Optimal Maintenance Frequency Analysis

Risk Identifier	Risk Category	1 year vs. 2 years	2 years vs. 3 years	3 years vs. 4 years	Current Plan – 4-year Cycle	4 years vs. 5 years	5 years vs. 6 years
1	Low	0.01	0.02	0.05		0.08	0.11
2	Low	0.07	0.21	0.43		0.71	0.98
3	Medium	0.41	1.22	2.45		4.08	5.62
4	Low	0.05	0.15	0.30		0.50	0.69
5	Medium	0.44	1.31	2.62		4.36	6.02
6	High	2.50	7.49	14.97		24.95	34.44
7	Medium	0.20	0.60	1.20		2.00	2.77
8	High	1.74	5.23	10.47		17.45	24.08
9	High	9.98	29.95	59.89		99.82	137.75

In addition to the comparison of subsequent plans provided in Table 2-7 above, an additional analysis was completed to compare all potential maintenance plans (i.e., 1-year cycle to 6-year cycle) to the current 4-year maintenance cycle. The results of this analysis are presented in Table 2-8 below and demonstrate alignment with the results of the overall benefit-cost ratio calculation presented in Table 2-7 above. The final conclusions and recommendations of these analysis are provided below. In general, however, THESL should be mindful of the fact that any significant changes to input values (such as maintenance costs) may impact the accuracy of this recommendation.

Table 2-8: Summary of Final Benefit-Cost Ratio Results in Comparison to 4-Year Maintenance Cycle

Risk Identifier	Risk Category	1 year vs. 4 years	2 years vs. 4 years	3 years vs. 4 years	4 years vs. 5 years	4 years vs. 6 years
1	Low	0.02	0.03	0.05	0.08	0.09
2	Low	0.14	0.28	0.43	0.71	0.82
3	Medium	0.82	1.63	2.45	4.08	4.70
4	Low	0.10	0.20	0.30	0.50	0.58
5	Medium	0.87	1.74	2.62	4.36	5.03
6	High	4.99	9.98	14.97	24.95	28.75
7	Medium	0.40	0.80	1.20	2.00	2.31
8	High	3.49	6.98	10.47	17.45	20.10
9	High	19.96	39.93	59.89	99.82	114.99

Low-Risk Switches

Low-risk switches are represented by risk identifiers 1, 2, and 4 – these switches are characterized as low risk since they represent units that have yet to reach the TUL and do not serve a large number of customers. As shown in Table 2-7 above, none of the plan comparisons yield a benefit-cost ratio greater than 2.5 (and are in fact all less than 1). This indicates that the risk reduction benefit provided by increasing the maintenance frequency is not sufficient to justify the incremental maintenance cost. In addition, the comparison between the current four-year cycle and a five-year cycle indicates that there is insufficient benefit in completing maintenance on the current cycle vs. a five-year cycle. This implies that the current maintenance cycle is too frequent and the utility should decrease the maintenance frequency for switches in this risk category. The comparison between the five-year cycle and the six-year cycle yields the same conclusion – there not enough benefit in completing maintenance on a five-year cycle versus a six-year cycle. The scope of this analysis was limited to a maximum maintenance frequency of six years as anything greater would not be practical due to potential deterioration of switch sub-components. Therefore, it is recommended that THESL switch to a six-year maintenance cycle for switches in the low-risk category.

Medium-Risk Switches

Medium-risk switches are represented by risk identifiers 3, 5, and 7 – these switches are categorized as medium risk since they represent units that are well below the TUL but serve a large number of customers, are approaching the TUL and serve a moderate number of customers, or are past the TUL but serve a low number of customers. The results of the benefit-cost ratio analysis are slightly different for each of these risk identifiers. Based on the benefit-cost ratio threshold of 2.5, the recommended maintenance frequency is between three and five years. It is recommended that THESL maintains its current four-year plan for medium-risk switches.

High Risk Switches

High-risk switches are represented by risk identifiers 6, 8, and 9 – these switches are categorized as high risk because they represent units that are approaching or past the TUL threshold and serve a moderate or high number of customers. The comparison of the two-year plan and the three-year plan indicates that

there is sufficient value in completing maintenance on a two-year cycle for all three risk identifiers in this category as they all meet the 2.5 benefit-cost ratio threshold. The comparison between the one-year plan and the two-year plan for risk identifiers 6 and 9 indicates that there is significant value in completing maintenance on a one-year cycle for these switches. It is recommended that THESL adopts a one-year maintenance cycle for all high-risk switches. Although risk identifier 8 switches do not meet the 2.5 benefit cost threshold under a one-year plan, the benefit cost ratio is still greater than 1.

This analysis suggests that THESL should vary the maintenance frequency based on the switch's risk profile. Based on the analysis results, the final recommendations for each switch risk profile have been compiled and are summarized in Table 2-9 below.

Table 2-9: Summary of Final Recommendations for Optimal Maintenance Frequency Analysis

Risk Category	Optimal Frequency
Low	6 years
Medium	4 years
High	1 year

2.3 Maintenance Start Age

2.3.1 Overview

THESL's current maintenance program is completed on a four-year cycle. This means that all switches within the scope of this analysis are included in the maintenance cycle starting at age four. The purpose of this analysis is to determine the optimal start age for THESL's maintenance program. Similar to the Optimal Maintenance Frequency analysis described in Section 2.2, this analysis is also completed through the calculation of a benefit-cost ratio. Given that asset maintenance reduces the risk of failure, the benefit is defined as the difference in asset risk when the THESL's maintenance program is applied and when it is not applied. The cost is defined as the annual maintenance cost. This analysis is based on the optimal maintenance frequencies recommended by the Optimal Maintenance Frequency analysis (see Section 2.2.3). The analysis methodology is detailed in the following subsection.

2.3.2 Methodology

As outlined above, this analysis is completed using a benefit-cost ratio where the benefit is defined as the reduction in risk due to the implementation of a maintenance plan and the cost is defined as the annual maintenance cost. The risk and maintenance cost calculations are the same as the calculations described in Section 2.2.2. However, the overall methodology does differ – please see the following subsections for a complete explanation of the Maintenance Start Age analysis methodology.

2.3.2.1 Risk Calculation (Benefit)

The first component of this analysis is the calculation of risk under two scenarios: with a maintenance program and without a maintenance program. Similar to the Optimal Maintenance Frequency Analysis, the risk is comprised of the financial risk and customer risk. The methodologies for calculating these two variables will not be repeated in this section as they are essentially the same as described in Section 2.2.2.2 and Section 2.2.2.3. One key difference is that risk is calculated for each year over the asset's lifecycle as opposed to a current risk estimation based on the general categories outlined in Table 2-1. This means

that annual failure probabilities derived from failure curves are used in place of the average failure probabilities described in Table 2-2.

There are also some differences between the calculation of year-over-year risk for the with maintenance and without maintenance scenario. The calculation for the with maintenance scenario is the same as the calculation described in Section 2.2.2 above. However, the without maintenance scenario assumes that there is a zero percent chance of inspection defined as the likelihood of discovering significant deficiencies is minimal in the absence of a detailed maintenance program.

Given that this analysis entails the calculation of year-over-year risk values, the risk matrix can be simplified to three categories that align to customer counts. The asset's effective age is not a risk factor in this analysis as risk values are calculated for every year over the asset's expected lifespan. The analysis was completed for three types of switches based on their criticality:

- Criticality 1 – Number of customers on circuit is less than or equal to 100
- Criticality 2 – Number of customers on the circuit is between 101 and 1000
- Criticality 3 – Number of customers on the circuit is more than 1000

The risk methodology presented in Section 2.2.2 is used to calculate the year-over-year asset risk. Example results are provided in Table 2-10 below. The benefit is calculated as the risk reduction through the implementation of a maintenance program.

2.3.2.2 Cost Calculation (Cost)

The cost calculation consists of calculating the annual maintenance cost using the formula below.

$$Annual\ Maintenance\ Cost = \frac{Maintenance\ Cycle\ Unit\ Cost}{Maintenance\ Cycle\ Frequency}$$

2.3.2.3 Benefit-Cost Ratio

After the risk reduction benefit and annual costs have been calculated for every year over the asset's expected lifecycle, the benefit-cost ratio is also computed. The point at which the benefit-cost ratio exceeds a value of one can be considered the optimal maintenance start age. Example results are provided in Table 2-10 – these results are truncated at the point where the benefit-cost ratio exceeds one.

2.3.3 Results

Example results are provided in Table 2-10 below – these results are for a criticality 3 switch (i.e., more than 1000 customers). Although this analysis was completed for criticality 1 and criticality 2 switches as well, the recommendations provided are based on the example results for a criticality 3 switch below. The reasoning behind this decision is that customer count may not be adequate indicator of switch criticality as single customers can serve vital functions (e.g., hospitals). Therefore, if the recommendations are provided based on the most critical switch category, they can provide insights based on the most stringent scenario.

Table 2-10: Example Maintenance Start Age Benefit-Cost Ratio Results

Effective Age	Risk (with Maintenance)	Risk (without Maintenance)	Benefit	Annual Cost	B/C Ratio
1	$7.02	$14.54	$7.52	$900.00	0.008355
2	$31.96	$66.16	$34.21	$900.00	0.038008
3	$77.52	$160.50	$82.98	$900.00	0.092199
4	$145.36	$300.97	$155.60	$900.00	0.172894
5	$236.73	$490.14	$253.41	$900.00	0.281566
6	$352.62	$730.08	$377.46	$900.00	0.419403
7	$493.88	$1,022.55	$528.67	$900.00	0.587416
8	$661.24	$1,369.08	$707.83	$900.00	0.786481
9	$855.37	$1,771.02	$915.64	$900.00	1.01738
10	$1,076.86	$2,229.60	$1,152.74	$900.00	1.280817

As Table 2-10 indicates, the optimal maintenance start age for the most critical switch (i.e., customer count) is approximately ten years old based on this analysis. However, it is important to consider that certain sub-components of the switch, such as the lubricant that ensures smooth operation, may require servicing sooner than this ten-year period. Therefore, it is recommended that the maintenance start age aligns with the optimal maintenance frequency recommendations, as outlined in Table 2-11 below.

Table 2-11: Final Recommendations for Maintenance Start Age Analysis

Customer Count	Risk Category (for a new switch – i.e., below TUL)	Maintenance Start Age
Less than or equal to 100	Low	6 years
101 to 1000	Low	6 years
More than 1000	Medium	4 years

2.4 Proactive vs. Run to Failure

2.4.1 Overview

The purpose of this analysis is to determine whether THESL should continue completing proactive asset maintenance and replacements or switch to a run to failure strategy. This analysis involved calculating the total cost of ownership for a given switch over its lifecycle under two scenarios: with a proactive maintenance plan and without any maintenance plan. Similar to the Maintenance Start Age analysis, the risk profiles described in the risk matrix in Table 2-1 were not used as year-over-over calculations were performed. Instead, the analyst completed the total cost of ownership calculation for the three switch criticality profiles described in Section 2.3.2.1:

- Criticality 1 – Number of customers on circuit is less than or equal to 100
- Criticality 2 – Number of customers on the circuit is between 101 and 1000
- Criticality 3 – Number of customers on the circuit is more than 1000

The reasoning behind this strategy is that the effective age component of the risk matrix becomes irrelevant in a year-over-year analysis. As outlined above, the total cost of ownership is the basis of comparison for this analysis. The procedure for calculating the total cost of ownership is presented in the following subsection.

2.4.2 Total Cost of Ownership

The total cost of ownership consists of three sub-components: the asset replacement cost, the lifecycle maintenance cost, and the lifecycle risk cost. It is calculated using the equations presented below:

$$Total\ Cost\ of\ Ownership = Capital\ Cost + Lifecycle\ Maintenance\ Cost + Lifecycle\ Risk\ Cost$$

For the total cost of ownership under the with proactive maintenance plan, the capital cost consists of the cost of planned replacement. Likewise, the capital cost under the run to failure maintenance plan consists of the cost of reactive replacement. These replacement cost assumptions are listed below.

- Capital Cost (Proactive) = $18,500
- Capital Cost (Reactive) = $30,000

The lifecycle maintenance cost is calculated as the sum of the annual maintenance cost of the asset, based on the optimal maintenance frequency recommendations in Section 2.2.3. Each switch is assumed to have a lifespan of 50 years. This cost is only applicable to the total cost of ownership calculation in the with proactive maintenance scenario as it is assumed that no maintenance is completed in the run-to-failure scenarios. The lifecycle maintenance cost is calculated as follows:

$$Lifecycle\ Mainteannce\ Cost = \sum_{0}^{50} Annual\ Maintenance\ Cost$$

The lifecycle risk cost is calculated using the same methodology described in Section 2.2.2 and the results are in the same format as Table 2-10. The lifecycle risk is calculated as the sum of all yearly risk values over a 50-year lifespan, as indicated by the equation below.

$$Lifecycle\ Risk\ Cost = \sum_{0}^{50} Annual\ Risk\ Cost$$

2.4.3 Results

The total cost of ownership calculation results for the proactive maintenance and run-to-failure scenarios for the three switch criticality profiles are presented in Table 2-12 below. As expected, the results indicate that completing proactive maintenance on the cycles recommended in Section 2.2.3 results in a lower total cost of ownership than a run-to-failure strategy, regardless of the switch criticality. METSCO's final recommendation is that THESL should continue to complete proactive maintenance on the recommended cycle lengths specified in Section 2.2.3.

Table 2-12: Final Results for Proactive vs. RTF Analysis

Criticality Identifier	Total Cost of Ownership (Proactive)	Total Cost of Ownership (Run-to-Failure)
1	$84,224.47	$102,785.02
2	$216,827.42	$288,243.69
3	$651,368.69	$1,292,356.63

2.5 Key Conclusions

To establish the optimal maintenance frequency a benefit-cost ratio analysis was completed to compare several potential maintenance cycle lengths. The benefit was defined as the risk reduction between two maintenance plans and the cost was defined as the incremental maintenance cost between two maintenance plans. A benefit-cost ratio of three was used as the recommendation threshold to account for potential variability in the analysis input parameters. A recommendation was provided for each switch risk category (as defined in Table 2-1). The final results of this analysis and the optimal maintenance frequency recommendations are provided in Table 2-13 below.

Table 2-13: Summary of Final Recommendations for Optimal Maintenance Frequency Analysis

Risk Category	Optimal Frequency
Low	6 years
Medium	4 years
High	1 year

The maintenance start age analysis involved completing a benefit-cost ratio calculation for a switch over every year of its expected lifespan. The risk was calculated under two different assumptions: (1) a maintenance program exists and (2) no maintenance is completed. The benefit was calculated as the difference in risk between these two strategies and the cost was defined as the annual maintenance. The recommendations were based on the most critical switch profile to ensure that the most stringent requirements are satisfied. The age at which the benefit-cost ratio exceeded a value of one was used to provide the recommendation – for this analysis this age was ten years. However, some switch sub-components require more frequent servicing (e.g., lubricant). Therefore, it is recommended that the maintenance start age should align to the optimal maintenance frequency recommendations in Table 2-13 (e.g., the recommended maintenance start age for a Low-Risk switch is six years old).

The proactive vs. run-to-failure strategies analysis entailed the calculation of an asset's total cost of ownership over its lifespan under each of these scenarios. In other words, the total cost of ownership was calculated for a switch under the assumption that proactive maintenance is completed and under the assumption that a run-to-failure strategy is employed. This analysis was completed for three switch criticality levels, as defined by the customer counts in risk matrix (see Table 2-1). The result of this analysis indicate that a proactive maintenance strategy is the most cost-efficient option for all levels of switch criticality.

AMCL+
LEADING ASSET MANAGEMENT

TORONTO HYDRO ELECTRIC SYSTEM LIMITED (THESL)

ISO 55001 Gap Analysis & Roadmap

ISO 55001 Gap Analysis

Final Report

Date: 4th February 2021

KEY CONTACTS

Australasia +61 (0) 2 9252 7623

Americas +1 212 370 7319

Europe +44 (0) 207 688 2828

Asia +852 2834 6122

Original held by Asset Management Consulting Limited at:

2 St. Clair Avenue West, Floor 12, Toronto, Ontario, M4V 1L5, Canada

Tel: +1 (416) 660-7620

Email: sarah.vine@amcl.com

Company Website: www.amcl.com

DOCUMENT CONTROL

APPROVAL

FILE REF: CAN/21086

Version	Date	Compiled by	Reviewed by	Authorised by
Final Report	4th February 2021	Imad Khan Keegan Varella	Andrew Sharp	Sarah Vine

EXECUTIVE SUMMARY

Toronto Hydro-Electric System Limited (THESL) owns and operates an electricity distribution system that delivers electricity to approximately 779,000 customers located in the city of Toronto, Ontario, Canada.

This report contains the results of an ISO 55001[1] gap analysis undertaken in July 2020. AMCL undertook the assessment in accordance with its Asset Management Assessment & Certification process, which is accredited under the Institute of Asset Management's (IAM's) Endorsed Assessor Scheme. The results of this gap analysis provide THESL with the actions required to ensure conformance with ISO 55001 which will then be developed into a Roadmap (high-level plan) for achieving compliance.

This report also contains an assessment of the maturity of THESL's Asset Management practices against the ISO 55001 clauses – possible because of the nature of the AMCL Asset Management Excellence Model™ (AMEM) assessment methodology used (see Section 3).

The main conclusion of this gap analysis is that THESL has already achieved good state of maturity and in some cases improved on the score assessed by the previous assessor. Whilst many areas of good practice exist, there are still some specific areas for improvement and some significant shortfalls that need to be addressed before many of the other improvements would become effective.

The gap analysis has concluded that there are eight (8) clauses where THESL appears to be currently compliant, fourteen (14) where compliance is potentially 'at risk' and three (3) where it appears to be non-compliant. These are summarized in Table 2.

It is our opinion that all the conformance issues identified in this gap analysis can be rectified by the end of 2023.

AMCL has recommended activities for THESL to undertake, in order of priority, to fill the gaps and conform to the ISO 55001 standard (see Section 5.2).

AMCL would like to thank all THESL staff who contributed to the successful completion of this gap analysis. The level of organization and commitment was appreciated by the AMCL team and demonstrated a clear commitment to best practices in Asset Management.

[1] *ISO 55001: 2014, Asset Management – Management System Requirements, Version 2014-07, Edition 1, Published 2014-01,*

TABLE OF CONTENTS

1. INTRODUCTION

Toronto Hydro-Electric System Limited (THESL) owns and operates an electricity distribution system that delivers electricity to approximately 779,000 customers including 42 large users i.e., hospitals, universities and essential services located in the city of Toronto, Ontario Canada.

THESL delivered 24,476 GWh of electricity as of December 31, 2019. The peak load is 4,312 MW with one control centre and four operation centres. THESL has 1,360 employees and covers around 180,000 poles, 15,480km of overhead wires and 13,407km of underground wires. Other assets include primary switches and distribution transformers.

This report contains the results of an ISO 55001 gap analysis undertaken in July 2020. AMCL undertook this in accordance with its Asset Management Assessment & Certification process, which is accredited under the Institute of Asset Management's (IAM's) Endorsed Assessor Scheme. The results of this gap analysis provide THESL with the required actions to ensure conformance with ISO 55001 which will then be converted into a Roadmap (high-level plan) for achieving compliance.

This report also contains an assessment of the maturity of THESL's Asset Management practices against the ISO 55001 clauses.

2. ACTIVITIES & SCOPE

The scope of this maturity assessment covers all distribution assets described in Section 1, including operational buildings and SCADA/Data systems. During the assessment process, it was agreed that other non-operational facilities, fleet, streetlights, and IT (e.g., Laptops/Software) would be outside of the current scope of the AM System. These assets may be incorporated into the AM System later.

The activities completed to draft this report were:

- Reviewing key Asset Management documentation in advance of and during the interview sessions.
- Interviewing the staff listed in the sessions in Appendix B.
- Assessing THESL's conformance to each of the ISO 55001 clauses (see below), through a strict interpretation of the 71 'shall' statements in Appendix C.

Preparing this report using the findings and drawing conclusions against the level of THESL's alignment with the requirements of ISO 55001.

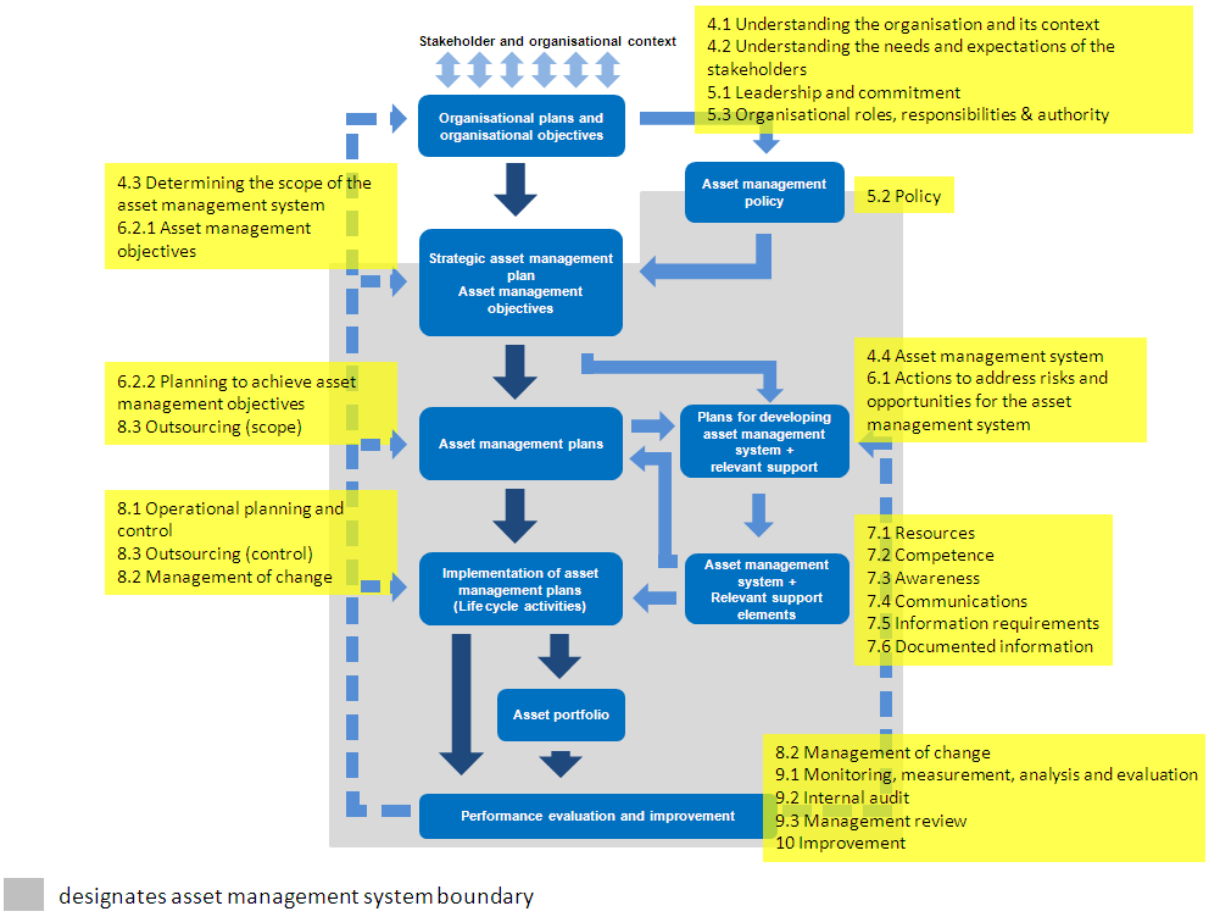


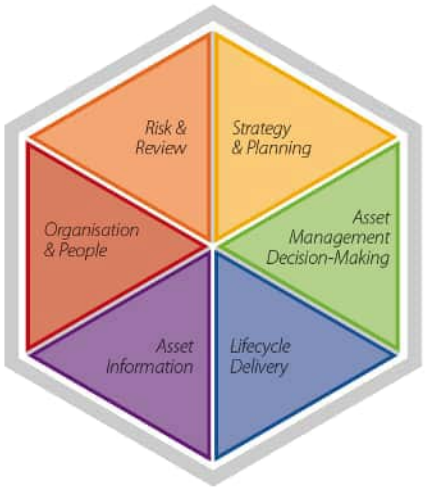
Figure 1 The ISO 55001 Clauses ©

AMCL undertook the assessment in accordance with its Asset Management Assessment & Certification process, which is accredited under the Institute of Asset Management's (IAM's) Endorsed Assessor Scheme. The assessment was based on interviews and other evidence (including documentation) and the findings, conclusions and recommendations in this report reflect AMCL's objective interpretation of the information provided against the requirements of ISO 55001.

3. THE AMCL ASSET MANAGEMENT EXCELLENCE MODEL™

3.1 OVERVIEW

The AMEM, which is shown in Figure 2, enables organizations to assess their Asset Management capability maturity and benchmark it against world best practice. It is built around the '39 Subjects' which span the range of technical, organisational and human capabilities needed to achieve world-class Asset Management. These subjects are aligned with the second edition of the 'Asset Management Landscape' agreed by the Global Forum for Maintenance & Asset Management (GFMAM). The AMEM tests the *existence*, *completeness*, *effectiveness,* and *integration* of these subjects and is applicable to any asset intensive organisation, including those in highly regulated environments.



Strategy & Planning
01 Asset Management Policy
02 Asset Management Strategy & Objectives
03 Demand Analysis
04 Strategic Planning
05 Asset Management Planning

Asset Information
22 Asset Information Strategy
23 Asset Information Standards
24 Asset Information Systems
25 Data & Information Management

Asset Management Decision-Making
06 Capital Investment Decision-Making
07 Operations & Maintenance Decision-Making
08 Lifecycle Value Realisation
09 Resourcing Strategy
10 Shutdown & Outage Strategy

Organisation & People
26 Procurement & Supply Chain Management
27 Asset Management Leadership
28 Organisational Structure
29 Organisational Culture
30 Competence Management

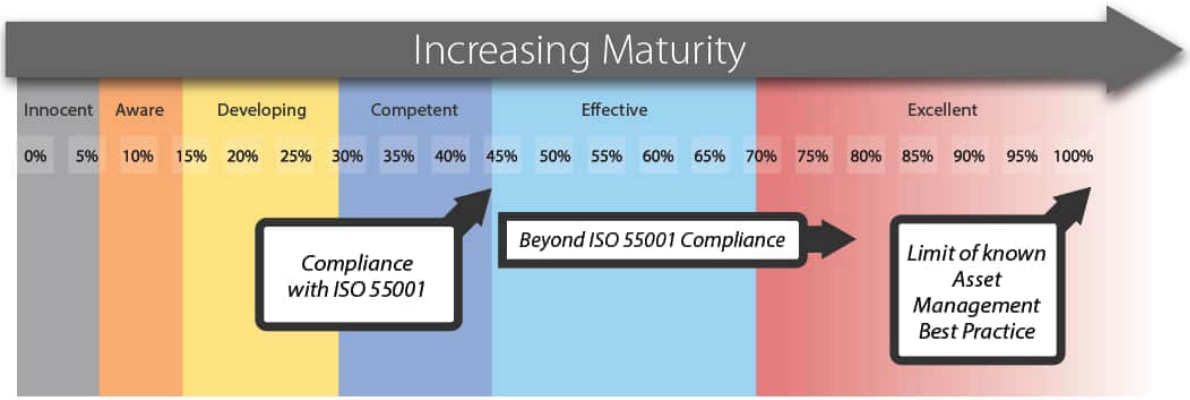
Lifecycle Delivery
11 Technical Standards & Legislation
12 Asset Creation & Acquisition
13 Systems Engineering
14 Configuration Management
15 Maintenance Delivery
16 Reliability Engineering
17 Asset Operations
18 Resource Management
19 Shutdown & Outage Management
20 Fault & Incident Response
21 Asset Decommissioning & Disposal

Risk & Review
31 Risk Assessment & Management
32 Contingency Planning & Resilience Analysis
33 Sustainable Development
34 Management of Change
35 Asset Performance & Health Monitoring
36 Asset Management System Monitoring
37 Management Review, Audit & Assurance
38 Asset Costing & Valuation
39 Stakeholder Engagement

Figure 2 The AMCL Asset Management Excellence Model™ (AMEM)

Organizations are scored against each of the 39 Subjects using a range of assessment criteria and questions. The scores are presented using the maturity scale shown in Figure 3, which in turn is aligned to the Asset Management maturity scale defined by the IAM. Improvement actions are identified based on the criticality of each subject to the organisation, the current scores for the assessment criteria that make up each subject, and the targets an organization and its stakeholders wish to set themselves for each subject.

AMEM results are used to identify and prioritize improvements based on where an organization sits relative to globally recognized best practice standards, including ISO 55001.



The maturity scale has six maturity states as follows:	
0 *Innocent*	The organisation is starting to ***learn*** about the importance of Asset Management activities
1 *Aware*	The organisation is aware of the importance of the Asset Management Activities and has started to ***apply*** this knowledge
2 *Developing*	The organisation is developing its Asset Management Activities and ***embedding*** them
3 *Competent*	The organisation's Asset Management Activities are developed, ***embedded*** and are becoming effective
4 *Effective*	The organisation's Asset Management Activities are fully effective and are being ***integrated*** throughout the business
5 *Excellent*	The organisation's Asset Management Activities are fully ***integrated*** and are being continuously improved to deliver ***optimal*** whole life value

Figure 3 The AMEM Asset Management Maturity Scale

The AMEM can be used in several assessment modes. For ISO 55001 gap analysis assessments and Certification Audits the output is presented by ISO 55001 clause. The concepts of the

existence, completeness, effectiveness, and integration of processes ensure the maturity assessment effectively identifies ISO 55001 conformance on the maturity scale already introduced. To be in the 'competent' band or above, an organization must have demonstrated that processes exist and are complete. This is broadly the equivalent of ISO 55001 compliance. If the organization can demonstrate its processes are effective and integrated, it will begin to demonstrate 'effective' or 'excellent' maturity.

3.2 INTERPRETING ISO 55001 GAP ANALYSIS ASSESSMENT RESULTS

When using the AMEM to assess ISO 55001 compliance during a Gap Analysis assessment, maturity scores below the 'competent' band would tend to indicate areas of systematic nonconformity against an ISO 55001 Clause, which could result in a major nonconformity during a Certification Audit. Conversely, scores above the 'competent' band would provide a high degree of confidence that ISO 55001 requirements were met, and scores within the 'competent' band would indicate some uncertainty.

In general, the following guidelines are followed to categorize findings:

1) **Current Compliance with ISO 55001**: Based on the evidence presented and assessed during the gap analysis assessment it is likely that the client would achieve compliance assuming this could be successfully demonstrated in a fully evidenced Certification Audit. This means that there is evidence that processes exist and are broadly complete which meet the requirements of the ISO 55001 Clause being assessed. Maturity scores for these Clauses are usually above 45%. It should be noted that there may be cases where the maturity score is above 45% where an organization is relatively mature against a particular clause of ISO 55001 but there is a specific nonconformity with one aspect of that clause.
2) **Compliance with ISO 55001 at Risk**: Based on the evidence presented and assessed during the gap analysis assessment it is likely that the client would not achieve compliance without instigating further work, completing existing improvement projects, or undertaking some other straightforward re-alignments of existing processes or projects. This means that there is evidence that the processes to satisfy the Clause exist but are not yet complete and there are no plans in place to complete them. Maturity scores for these Clauses are usually between 30% and 45%.

3) **Non-Compliance with ISO 55001**: Based on the evidence presented and assessed during the gap analysis assessment it is likely that the client would not achieve conformance without introducing further processes or systems. This means that there is no evidence that the processes to satisfy the Clause exist and there are no plans to put them in place. Maturity scores for these Clauses are usually below 30%.

4. ISO 55001 GAP ANALYSIS FINDINGS

4.1 OVERVIEW

Figure 4 below shows THESL's Asset Management maturity against each of the requirements of ISO 55001 as evidenced through this gap analysis assessment.

The top of the 'competent' maturity band (45% on the scale) represents the level where THESL is broadly compliant with ISO 55001. As discussed in Section 3.2, this does not mean compliance is guaranteed for these clauses as consideration needs to be given to the level of conformity with each individual requirement within the clause, but this chart provides an overview of the relative strengths and weaknesses within THESL's AM System.

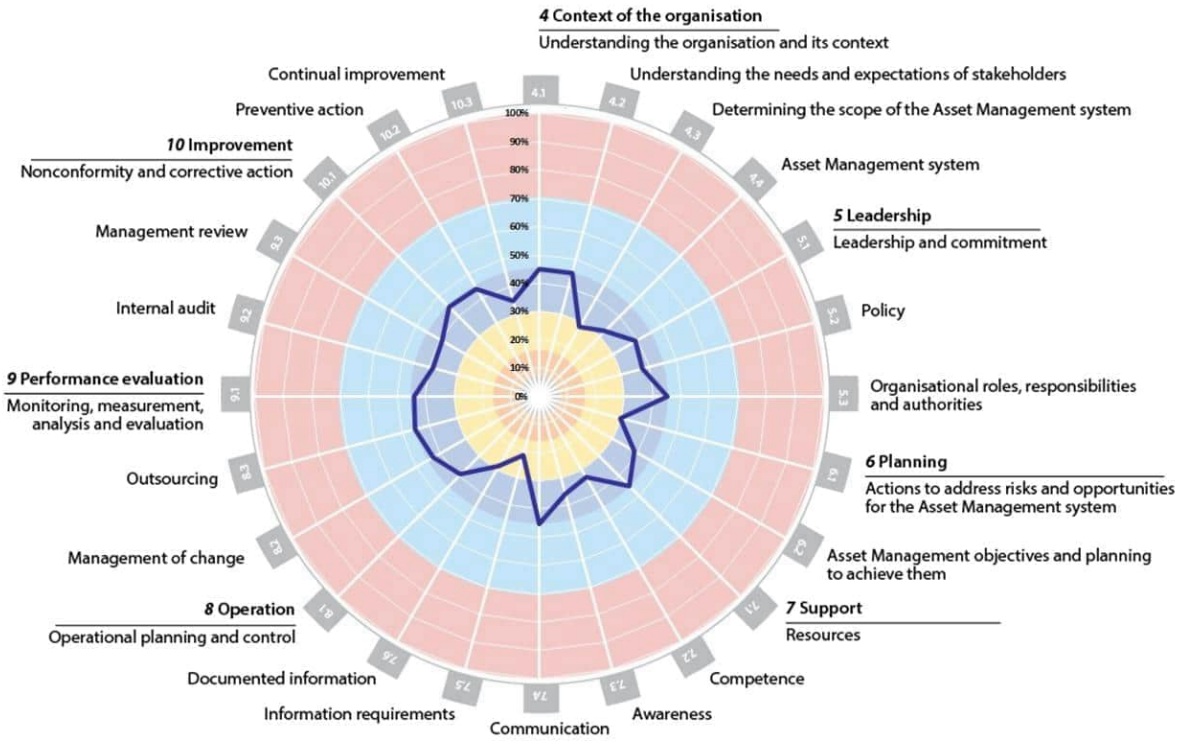


Figure 4 THESL Maturity Scores by ISO 55001 clause

Table 1 on the following page summarizes the level of conformance against each of the ISO 55001 clauses based on the findings from this gap analysis. The actions required to address the identified nonconformities are summarised in Table 2 and detailed in Table 1 of this report.

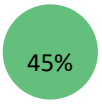
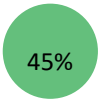
Table 1 : Overall Conformance

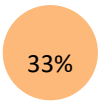
ISO 55001 Clause	Percentage	Current Compliance	Compliance at Risk	Non-Compliance
4.1 - Understanding the organization and its context	45%	X		
4.2 - Understanding the needs and expectations of stakeholders	45%	X		
4.3 - Determining the scope of the AM System	29%			X
4.4 - AM System	33%		X	
5.1 - Leadership and commitment	39%		X	
5.2 - Policy	38%		X	
5.3 - Organizational roles, responsibilities, and authorities	45%	X		
6.1 - Actions to address risks and opportunities for the AM System	30%		X	
6.2 - AM Objectives and planning to achieve them	39%		X	
7.1 - Resources	45%	X		
7.2 - Competence	33%		X	
7.3 - Awareness	36%		X	
7.4 - Communication	45%	X		
7.5 - Information requirements	22%			X
7.6 - Documented Information	29%			X
8.1 - Operational planning and control	41%		X	
8.2 - Management of change	43%		X	
8.3 - Outsourcing	45%	X		
9.1 - Monitoring, measurement, analysis, and evaluation	44%		X	
9.2 - Internal audit	39%		X	
9.3 - Management review	39%		X	
10.1 - Nonconformity and corrective action	45%	X		
10.2 - Preventive action	45%	X		
10.3 - Continual improvement	35%		X	
Average	38%		X	

4.2 SUMMARY OF FINDINGS & REQUIRED ACTIONS FOR CONFORMANCE

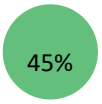
Table 2 shows a summary of the main findings from this gap analysis by ISO 55001 Clause and summarizes the minimum actions required to achieve conformance. Table 2 is used as the starting point for the ISO 55001 Compliance Roadmap which is separate to this gap analysis report. Where findings relate to observations for improvement, but do not constitute a conformance risk, these are excluded from Table 2. These improvement opportunities will be further explored and refined as part of the enhancement programme to move THESL 'beyond ISO 55001 conformance'. Details of all findings can be found in Appendix C of this report.

Table 2 Summary of Findings and Required Actions by ISO 55001 Clause

ISO 55001 Clause	Summary of Findings	Required Actions for Conformance
4.1 - Understanding the organization and its context 	The organization has an organizational business plan in place which implements effective Asset Management. The alignment of AM objectives with organizational objectives is also evident. THESL's corporate strategy and associated business planning processes, including the AM Process, are guided by a set of principles that align with the utility's four corporate pillars in a balanced way that promotes customer value and a sustainable business. THESL's AM objectives are driven by relevant legislative and regulatory obligations and guidance such as the OEB's Distribution System Code ("DSC") and the Electricity Act, 1998. The corporate strategy and outcome objectives determine the overall direction for decision-making throughout the AM Process.	No further action is required for this clause, however, to enhance capability above conformance, an organizational plan must acknowledge full support for the implementation, embedding and continual improvement of the AM System.
4.2 - Understanding the needs and expectations of stakeholders 	THESL has leveraged its Customer Engagement results to develop an enhanced Outcomes Framework for the 2020-2024 planning horizon. This translates Toronto Hydro's expenditure plan objectives into outcome categories that matter to the utility's customers. The framework is also aligned with Toronto Hydro's four corporate pillars and the OEB's Renewed Regulatory Framework ("RRF") Outcomes. All strategic stakeholders are effectively engaged throughout the planning process to understanding their requirements and have an opportunity to provide inputs and feedback. However, these existing processes require integrating with the newly defined AM System and decision-making criteria need defining.	Undertake a systematic stakeholder analysis with respect to the newly defined AM System to define an integrated set of stakeholder requirements across the asset lifecycles. Include clear criteria for THESL's corporate Asset Management decision-making to support stakeholder needs and requirements.

ISO 55001 Clause	Summary of Findings	Required Actions for Conformance
4.3 - Determining the scope of the AM System 	THESL has not formally defined or documented the scope and boundaries of its AM System with respect to the implementation of the ISO 55001 Asset Management standard. The boundaries also need to consider how AM System will interact with other existing management systems. The detail of the scope needs to reflect the external and internal issues identified in 4.1, the requirements identified in 4.2, alignment with newly developed Strategic Asset Management Plan (SAMP, see 4.4) and interfaces with other existing management systems.	Define the AM System scope with respect to THESL's: ▪ organization and its relationships to its stakeholders. ▪ approaches, frameworks, and processes. ▪ Scope of distribution Asset Management areas: 1) Distribution System Assets[2] 2) Operational Buildings 3) SCADA/DATA Systems Ensure the detail of the scope reflects the external and internal issues identified in 4.1, the requirements identified in 4.2, alignment with SAMP and interfaces with other management systems.
4.4 – AM System 	An AM System is not yet formally established and documented. A clear interface with AM System needs to be defined with respect to functions, assets, and processes. The AM System will enable THESL to deliver, review, and continually improve its activities to achieve its organizational objectives and maximize value from its assets. THESL has not defined its Strategic Asset Management Plan (SAMP) yet as required by Clause 4.4, which includes documentation of the role of the AM System in supporting achievement of AM Objectives.	Establish the AM System in accordance with Clause 4.4. It consists of a set of interacting processes, people, and information. Describe the AM System in an AM System Manual (or descriptor document). Ensure this is achieved using existing frameworks, approaches, processes, and procedures where possible, and across all elements of THESL's organization that are within the defined AM System scope. THESL is planning to define this in the Strategic Asset Management Plan (SAMP) in 2021-2023.
5.1 - Leadership and commitment 	Top management pro-actively manage organizational culture to support good practice Asset Management, however there is no clear framework for delineating the key Asset Management roles. Likewise, top management have established AM policy and AM objectives that are compatible with the organizational objectives, however, they have not effectively communicated the importance of Asset Management and the requirement for conformance to the AM System consistently across the company. The specific requirements for Clause 5.1 are not yet fulfilled, however these will be fulfilled once THESL's AM System is effectively defined and communicated.	Appoint a member of THESL's top management to take ownership of the AM System. Implement a cross-functional Asset Management Governance Committee (AMGC), chaired by the owner of the AM System, which will provide a focus for Asset Management governance leading up to and after certification to ISO 55001. Link Top Management competences from Clause 5.3 into this clause.

[2] *Ref: 2B_D1 – Asset Management Process Overview*

ISO 55001 Clause	Summary of Findings	Required Actions for Conformance
5.2 - Policy 	Asset Management Policy is in place and owned by the Executive Vice President and Chief Engineering and Construction Officer. This policy is approved by the Policy Administration Steering Committee (PASC) who is responsible for considering the impact of the proposed policy to corporate risks. The AM Policy has not been widely distributed or understood and a review of the AM Policy will be required following the rescoping of the AM System.	Communicate and implement the existing AM Policy to ensure its awareness within THESL is raised. Plan for the AMGC (see Clause 5.1) to review, update and re-communicate the policy at least once prior to an ISO Certification Audit.
5.3 - Organizational roles, responsibilities, and authorities 	General roles and responsibilities for the asset related activities are defined, however for the governance of the AM System there are significant differences in opinion and lack of awareness across the organization. THESL does not have a RACI chart, however, it has alternative processes and policies in place which specify Asset Management responsibilities with expected outcomes.	Compare existing THESL departmental roles and responsibilities against the AM System defined in 4.4. Reconcile in detail existing team and personal roles and responsibilities against the requirements of the newly defined AM System and fill any gaps. Define this in a RACI which is approved by the AMGC (see Clause 5.1). Define a framework that works for THESL that delineates the key Asset Management roles i.e., seven capabilities defined by the IAM Competency Framework. Incorporate this framework into the AM System definition document and ensure the roles and responsibilities defined in that document also cover all the specific requirements of 5.1.
6.1 - Actions to address risks and opportunities for the AM System 	THESL has systems in place to provide assurance that capital project delivery includes actions to address the risks and opportunities facing the AM System. THESL has internal metrics to track and ensure its safety and reliability outcomes required by its external stakeholders. As part of defining the scope of AM System (as discussed in 4.3 and 4.4), THESL need to complete the risk assessment of this AM System. THESL's Enterprise Risk Management (ERM) framework has been formally approved and is aligned with the ISO 31000[3] and ISO Guide 73[4], industry best practices and the direction of its regulating agencies; however, the Asset Risk Management Framework is still not formally approved. This framework is more focused toward strategic and operational risks of the distribution assets. Risk assessment sophistication varies by business unit and individual, and they are not necessarily consistent with the draft framework. Asset related risks are assessed in order of priority *(i.e., high, medium, and low*). Risks related to litigation are also assessed.	Create an Asset Risk & Opportunity Management Framework which is consistent with the existing THESL's Corporate Risk Management Framework (and ISO 31000) and approved by the AMGC (see Clause 5.1). This framework also needs to be consistent with the requirements identified in 4.2 and 4.3. Implement the new Asset Risk & Opportunity Management Framework, ensuring full support through training, briefings and the review of all documents and processes that involve the assessment of risk. Define risk assessment and management competences within role profiles where required. Development of a 'Value Framework' is in progress. This must be consistent with the Corporate Risk Management Framework and the new Asset Risk Management Framework. Both frameworks should be used to define the business rules for consistent asset decision making.

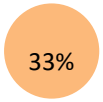
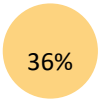
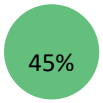
[3] *ISO 31000 is a family of standards relating to risk management codified by the International Organization for Standardization. ISO 31000:2018 provides principles and generic guidelines on managing risks faced by organizations.*

[4] *ISO Guide 73: 2009, Risk Management Vocabulary, ICS: 01.120 Standardization.*

ISO 55001 Clause	Summary of Findings	Required Actions for Conformance
6.2 - AM Objectives and planning to achieve them. 6.2.1 AM Objectives	THESL's Outcomes Framework translates expenditure plan objectives into outcome categories: *Customer Service, Reliability, Safety, Environment, Public Policy, and Financial* The alignment of AM Objectives with organizational objectives is evident. However, the AM Objectives are not consistently SMART (*Specific, Measurable, Achievable, Realistic and Time-bound*). AM Objectives should be part of the SAMP and as already discussed in 4.4 this has not yet been defined. Strategic Asset Management Plan (SAMP) is a critical requirement for this clause to enable the development of a top-down long-term work volumes and costs.	Define a set of SMART AM Objectives that are aligned to other organizational objectives and will deliver stakeholder requirements. Ensure these meet the specific requirements of 6.2.1. and are approved by the AMGC (see Clause 5.1). Incorporate the AM Objectives into the SAMP and ensure that the SAMP defines the required frameworks, approaches and processes to develop AMPs which will deliver them. Ensure that the AM Objectives and the SAMP are fully integrated into other aspects of THESL's organization and approach.
6.2 - AM Objectives and planning to achieve them. 6.2.2 – Planning to achieve AM Objectives 39%	Capital Plan: Capital investment planning (e.g., "IPPR"[5]) is defined, embedded, and followed within THESL and there are various KPIs in place to manage deliverables. Decision-making criteria have not been explicitly defined as required by Clause 4.2. Existing and emergent investment needs are reprioritized together, ensuring some consistency in decision-making and project selection is top-down constrained by budget. THESL exceeded the conformance score in one of the sub-criteria of this clause, covering budget planning and approval processes required to deliver the AMP, however this plan does not cover the entire asset lifecycle stages. AMPs should also be focused on AM Objectives and newly developed SAMP soon. Maintenance Plan: Maintenance requirements analysis (MRA) process is in place and well documented, THESL use reliability engineering tools i.e., FMECA, RCA, RCM etc. to optimize their inspection, maintenance and intervention regimes, however, THESL does not appear to have fully defined the quality requirements for these processes. This is one of the AM System requirements. Some asset plans are based on unit cost models, however it's not consistent across the asset base. Existing unit cost models need to be updated on an ongoing basis using actual cost data to ensure that up-to-date models can be developed. These plans also need to cover the entire lifecycle stages and associated risks and unit costs.	Develop AM plans which will achieve the AM objectives, in a way that is consistent with the approach set out in the SAMP. Ensure these plans detail planned activities to the assets across their lifecycles, and activities to develop the capability of the AM System. The plans should meet the requirements of Clause 6.2.2 and include work volumes, costs, resources, timescales and milestones, and the financial and non-financial implications of these activities. It is recommended to have asset class strategies for key asset types such as transformers, overhead poles, operational buildings etc. A 'Value Framework' is currently being developed which will drive improvements in organization-wide decision making. THESL's Outcomes Framework must be consistent with the 'Value Framework'. Existing Process for Data Production and Quality Assurance need to be consistent and traceable. Apply the same rigour for their data for their internal decision making.

[5] *Investment Planning and Portfolio Reporting (IPPR)*

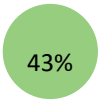
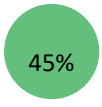
ISO 55001 Clause	Summary of Findings	Required Actions for Conformance
6.2 - AM Objectives and planning to achieve them. 6.2.2 – Planning to achieve AM Objectives 39%	There is very limited alignment between the existing AM strategies (which are not formalized as SAMP) and lifecycle value approaches. Technology Plan: A technology plan is in development e.g., smart metering, grid modernization etc. This will enable them to leverage trends and changes in technology to improve its AM capability. Resilience Plan: There is no defined framework for the analysis of Asset Resilience. Resilience cover four 'R's. i.e., Redundancy (*e.g., system design that allows for operational flexibility*), Resistance (*e.g. the ability of the system to withstand external demands without degradation or loss of functionality*), Responsiveness (*e.g., the ability to mobilize and sustain services in emergencies*) and Recovery (*e.g., the speed with which disruption can be resolved and the site returned to normal operation*). Sustainability Plan: THESL considers the impact of Climate Change on its system as well as reducing environmental risk by eliminating PCB's by 2025.	
7.1 - Resources 45%	There is top management commitment to providing the resources required to deliver plans and a resourcing strategy is in place to defines the approach to resourcing activities. A Resource Balancing Tool is used to develop all resource plans enabling THESL to maximize utilization of its resources and to use internal staff for most of the work. Resources are planned and sufficient for the current technical delivery requirements; however, they may not be sufficient to support future AM System requirements. THESL need to identify the resources for the establishment, implementation, maintenance and continual improvement of Asset Management activities i.e., meeting the AM Objectives and implementing the AM Plan. Fixed resources are defined on an annual basis using 10+ years of historical data based on outages. Financial planning supports operational planning to balance workforce continuity with the resourcing strategy and includes an assessment of risk associated with deferring work due to resourcing constraints. Inventory and spares are managed reactively. Consumption patterns are reviewed quarterly for consumption, vendor performance on time delivery, shortage issues along with cost of holding inventory.	Include resourcing of the AM System in the scope of the Resourcing Strategy and identify resources required to establish, implement, maintain, and continually improve the AM System (including delivery of AMPs / AM Objectives). Ensure any gaps are addressed prior to the Certification Audit by the AMGC (see Clause 5.1). Define the resources required to deliver the AM Objectives as defined in the AMP, utilizing the AM competence requirements defined in 5.1, 5.3, 7.1 and 7.2 next and reconcile existing resourcing levels against this.

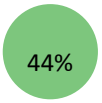
ISO 55001 Clause	Summary of Findings	Required Actions for Conformance
7.2 - Competence 	THESL have good process in place to assess technical competence. There are adequate programmes available to enable staff to develop their technical competence. THESL's talent management strategy is tied-up to the headcount data managed from HR, contract management and procurement plan. Contractors manage their own training compliance processes. THESL has technical competency Management System inhouse such as Professional Engineer (P.Eng) License, however there are no specific AM Competencies defined to meet current and future Asset Management needs. For example, competency required to develop the whole life cost models or an Information Management System.	Build on the existing approaches to develop a Competence Management System for core and functional competences, ensuring that AM Competences required to deliver the AM Objectives are included and fully integrated for the development of THESL Asset Management capabilities. Develop a list of the AM Competence required to deliver the activities within the AM System (use a good practice framework like the IAM's if needed). Align these to the RACI developed in 5.3 and define the competences for each job role. Update job descriptions to reflect the new AM competency requirements and incorporate these into the existing CMS. Build approaches to developing AM Competences (training, IAMcert, DipIAM, Expert Coaching, Mentoring, RAMP[6] etc.)
7.3 - Awareness 	Asset Management awareness is limited outside the core team. There is a perception that Asset Management is something that the Asset Management department does rather than an enterprise-wide management system. All staff are not aware of their specific roles in Asset Management hence there is an impact on their contribution to the effectiveness of the Asset Management activity.	Ensure that the Asset Management improvement plan is clearly communicated to all those within the scope of the AM System. Develop a training programme to increase understanding across the business of how different departments contribute to achieving the AM Objectives.
7.4 - Communication 	External communication channels are good and engagement with customers and regulators is well controlled. THESL internal communication relevant to Asset Management activity is limited outside the core team, impacting the awareness score as described earlier in 7.3. AM Policy is in place, but not communicated consistently outside the core team.	Develop and implement a plan for communicating relevant Asset Management information to all internal stakeholders. Communication plans are needed to increase awareness outside of the Asset Management team once the relevant documents and AM System has been developed. Ensure the AMGC takes ownership of these communication plans with respect to approval and monitoring.

[6] *Registered Asset Management Professional*

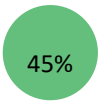
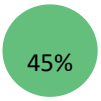
ISO 55001 Clause	Summary of Findings	Required Actions for Conformance
7.5 - Information requirements 22%	Asset Management information requirements have not been defined across all Business Units within THESL. For example, the requirements for aligning the information in the financial Fixed Asset Register and Physical Asset Register have not been defined. Asset lifecycle Information requirements and criteria are not mapped to the decision-making process e.g., renewal, maintenance strategies, disposal planning, etc. Asset Information Standards are not well defined. No logical data model exists which can be aligned with asset information needs. THESL specifies information it requires contractors to collect and audits them, however when the requirements are not specified (for example 'As-Built' data), contractors collect information based on their understanding and judgement. Inconsistent reports were noted during the assessment on the quality of the data being collected. This suggests that the information THESL specifies may be inconsistent.	Ensure the requirements for data collection and quality are defined for all assets and for all activities within the AM System in accordance with the requirements of Clause 7.5. Asset information requirements should extend to the requirements for the alignment of financial and non-financial information (specifically the financial and non-financial asset registers). Define and implement plans to rectify any gaps in these requirements. Consider using the requirements analysis and plan as the basis for an Asset Information Strategy that also consider broader asset information management needs, including requirements sufficient to guide all existing and future asset information development activities including technology and systems investments.

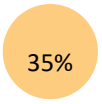
ISO 55001 Clause	Summary of Findings	Required Actions for Conformance
7.6 - Documented Information 29%	There are good data governance processes covering regulatory reportable data with defined owners and verification. However, non-regulatory data captured during the capital and maintenance delivery process is not as well controlled or defined. For example, for unit cost data, newly installed asset attributes and geolocations there is no defined data governance, owners, verification, and subsequent data standards. Also, no information requirements are defined (see 7.5), hence quality, consistency, and validity of data varies. A Data Population Plan does not appear to exist, so data collection and analysis is ad-hoc and not according to a consistent integrated approach. Data and information are maintained in several locations including off-line spreadsheets. It is important to understand that the relevant data should be available in timely manner should you required it to make informed decisions. Each individual area of the business has a particular asset register. Technical standards are managed in a systematic manner. However, the dependence on delivery contractors defining information for input into the Maintenance Management Systems means THESL may or may not get the information it requires. Another challenge is related to the control of asset documentation. This has a significant impact on the asset lifecycle stages handover process and risk of missing data and/or delays in updating asset and operational records. When new assets go into service, data is collected using paper-based equipment changeout forms. A pilot project has been on-going to digitize this form to capture asset and operational data and minimize errors, inconsistencies, and missing information.	Review in detail the documented information required by the following, and ensure all documented information is relevant and controlled: • ISO 55001 • THESL's legal and regulatory requirements • The AM System (*other than those identified above*) Review the specific requirements of 7.6 against THESL's current documentation control systems. These specific requirements cover general requirements, when creating and updating documented information and control of these documented information. Implement the plan to rectify any deficiencies in THESL's asset information requirements, or the full Asset Information Strategy defined in 7.5. A consolidated asset register should be established and configured to collect/manage data and information in accordance with the asset information strategy and standards.

ISO 55001 Clause	Summary of Findings	Required Actions for Conformance
8.1 - Operational planning and control 	Overall, THESL has developed its capital programs to maintain and improve reliability and safety, meet service and compliance obligations, address load capacity and growth needs, improve contingency constraints, or make necessary day-to-day operational investments. The choices made by the utility reflects a balance between customer preferences, affordability, and prioritized outcomes with the overriding objective of delivering value for money. An effective methodology for the management of capital program is in place including regular reports on the performance of the program. Operational planning and control of capital delivery is an example of good practice and is well embedded. Standards and procedures containing the maintenance and inspection regimes (including defect codes) for all assets are in place. Similarly, shutdown & outage planning processes are in place which enable the strategic optimization of access plans. The systems engineering approach does not enable effective alignment of business case benefits into project requirements and therefore benefits realization is not robust. Baseline configuration is established in the basic asset register; but not through a systematic commissioning and change management processes.	No actions are required for the delivery of capital plans. THESL will need to be able to demonstrate that capital delivery processes are adhered to during a certification audit. For other areas of operational planning and control (including operations, maintenance and shutdown management) it is recommended that THESL verify that for each area processes are defined and followed reliably prior to the certification audit. THESL needs to clearly identify the criteria, information and processes required to control operations, and provide sufficient assurance that they are operating the assets in accordance with these. It is suggested this be included in the asset class strategies for key asset types such as transformers, overhead poles, operational buildings etc. Design and implement annual planning requirements in accordance with the SAMP and clause 6.2; monthly reporting requirements in accordance with clause 9.1; transparent risk assessment and management in accordance with clause 6.2.2; and regular review of the achievement of AM Objectives.
8.2 - Management of change 	An overall organisational 'Change Management Framework' on organizational change or system change has not been defined, however, clear 'approval for modification' and project change control processes exist which could be utilised once the AM System is defined. Project requirements and benefits are not validated against original business case requirements.	Define an overall risk-based change management framework based on existing approaches and external good practice. Ensure this approach includes the identification and management of all changes within THESL in the most appropriate way, for example: • Managing day-to-day change (such as asset or project changes) through embedded processes. • Managing medium-scale changes (such as minor organizational or system implementation changes) through specific projects and good practice guidelines. • Managing major changes (such major organizational redesign) through specific programmes under the authority of the AMGC.
8.3 - Outsourcing 	A sourcing strategy is in place that defines THESL's approach to outsourcing its activities. Existing procurement and supply chain processes deliver products and services that effectively support delivery of the organization's AM Objectives including the ability to adapt to a changing workload. THESL validate the capabilities of their suppliers prior to any kind of engagement. Reliability growth plans are not documented where a large majority of work is outsourced.	No actions are required for the management of general outsourcing arrangements (for example contracts and suppliers), however outsourcing agreements would benefit from a review against the information requirements from the supply chain (see clauses 7.5 & 7.6).

ISO 55001 Clause	Summary of Findings	Required Actions for Conformance
9.1 - Monitoring, measurement, analysis, and evaluation 	In developing its approach to performance measurement, THESL considered the OEB's guidance, including the Renewed Regulatory Framework for Electricity Distributors ("RRF"). THESL is proposing 15 custom measures for the 2020-2024 plan period. These measures are incremental to the measures contained in the Electricity Distributor Scorecard ("EDS") and the Electricity Service Quality Requirements ("ESQR"), for a total of 44 measures reported to the OEB annually[7]. THESL monitor and manage the overall maintenance plan against output (lagging) KPIs but have not considered the systematic monitoring, measurement, analysis, and evaluation of leading indicators to assure achievement of KPIs. Financial outcomes are monitored and reviewed on a regular basis by analysing underlying trends. An Asset Condition Assessment model is used to derive an asset health index. The maturity of the AM system is not periodically assessed/reviewed against agreed good practice targets.	Build on the proposed measures with a focus onleading indicators (which appear to be deficient). Build capability to periodically monitor the AM System capability. Ensure monitoring, measurement, analysis, and evaluation is effectively targeted across the AM System scope and balanced to meet the requirements of the AM System and the achievement of THESL's AM objectives (see clause 7.5). Ensure the AMGC has an overview of all key performance indicators. Consider (it is not a requirement) implementation of a Performance Management Framework and stringent overview by the AMGC. Ensure these are aligned to the requirements detailed under 8.1 and 8.3.
9.2 - Internal audit 	Internal audit of the specific scope of the AM System is not in place. THESL's internal audit process uses known risks and ensures the use of competent auditors. Audit findings are monitored and reviewed by the internal audit team. A risk-based process for defining an audit plan is in place. The ERP group provide input to the 3-year audit plans.	Establish an overall audit plan for the scope of the AM System. Build on existing plans and resources where possible, drawing on the existing internal audit team to support this. Ensure the audit plan is reviewed and approved by the AMGC and that the outputs of audit activity are reported and actioned as required by the AMGC. Ensure that however is managing the compliance audit be it internal audit or third-party external auditors that they are trained as per best industry standards.
9.3 - Management review 	Formal management review and performance management framework is in place, although this is not focused on the scope of the AM System. Systematic review of performance indicators and other information is undertaken periodically; however due to the issues identified under clause 7.5 and 7.6, information inconsistencies may affect these management reviews.	Establish an overall AM System management review framework for periodic review of the overall AM System. Build on the existing review and performance management framework where possible and focus this on the scope of the AM System defined in Clause 4.3 and 4.4. Ensure the AMGC has full accountability for management review activities including input from risk assessments, audits and performance indicators and reports. Consider adopting a 'management review' calendar which defines the review and approval cycles for all key AM System artefacts (such as AM Policy, Objectives, SAMP and AMPs).

[7] *Ref: 2B_C_Performance Measurement*

ISO 55001 Clause	Summary of Findings	Required Actions for Conformance
10.1 - Nonconformity and corrective action 	THESL effectively identify and prioritize reactive work. There is a process in place to identify root causes of non-conformances, faults, failures, and defects and to identify appropriate mitigations measures. Nonconformity and corrective / preventive action with respect to the AM System does not yet exist, but it is anticipated that the existing QMS capabilities and scope will provide a solid foundation for this. THESL's fault response resources are in place with defined responsibilities and effective communication. THESL review and report the lessons learned from faults and incidents. A prioritized list of preventive and corrective actions is tracked, analysed, and reported to all relevant Management Review meetings. Risks and opportunities inherent in field activities are pro-actively identified and managed.	Establish a process for recording, prioritizing, and managing nonconformities and corrective actions resulting from implementing and monitoring the AM System. Collate good practices together and put in into the AM system manual while ensuring the process is outlined in detail and systematically. Define further written processes, if required. Develop an overall framework for description in the AM Manual (see Clause 4.4)
10.2 - Preventive action 	Operators identify potential failures in asset performance at the monthly meetings and preventive actions are agreed there. There is evidence of a proactive risk identification culture within field/operational staff. Preventive and corrective actions are tracked in a single, accessible system for periodic reporting. Owners are allocated and regular reports from the system enable tracking of the actions to closure.	Establish a process for recording, prioritizing, and managing preventive actions resulting from implementing and monitoring the AM System. Collate good practices together and put in into the AM system manual while ensuring the process is outlined in detail and systematically. Define further written processes, if required.

ISO 55001 Clause	Summary of Findings	Required Actions for Conformance
10.3 - Continual improvement 	Top management encourage a culture of collaborative continual improvement and provide a clear focus on achievement of the Asset Management Strategy and Objectives. A culture of continual improvement is evident from existing and upcoming programs i.e., Enhanced Outcomes Framework for the 2020-2024 planning horizon. THESL has transitioned from the Asset Condition Assessment (ACA) methodology originally adopted in 2008 to a model that provides more accurate and comprehensive condition-based analytics, and better supports longer-term expenditure planning. THESL is currently developing a data warehouse to streamline data access and perform “big data” calculations that can support planning and system investment strategies, alongside deploying new data blending and analytics software. The existing enterprise systems are to be consolidated into one system (ERP System) so that data integrity can be improved. This will provide teams across THESL access to one system with accurate and up-to-date information. Tactical contingency plans are created, implemented, tested, and continually improved in accordance with the agreed processes and AMPs are modified accordingly. The resilience Analysis process is incomplete. It is evident from the current ISO 55000 gap analysis, development of roadmap exercise and aspiration for the certification that THESL intend to enhance their existing capabilities and mature their practices.	Establish continual improvement of the AM System and make it an integral activity defined in the AM System definition document. Implement and maintain a CI Register for the AMGC for CI opportunities identified through management review. Ensure each section of the AM System Manual include a short sentience on how the clause is continually improved and who is accountable. Ensure that a Plan-Do-Check-Act cycle is always followed and formulating an AM system manual. THESL should have the ability to demonstrate that they are doing improvements continually and in a timely manner.

5. CONCLUSIONS & RECOMMENDATIONS

5.1 OVERALL CONCLUSIONS (DISTRIBUTION ASSETS)

The overall conclusion of this gap analysis is that the fundamental requirement of ISO 55001 to 'establish, implement, maintain and continually improve an Asset Management System, including the processes needed and the asset information requirements' is not met.

There is currently no overall Asset Management governance structure within THESL to own, deliver and be accountable for the Asset Management System. To meet the overall requirement THESL top management will need to take a strong position on governance along with accountability for putting a clear AM structure in place and clearly defining roles and responsibilities to people managing the process. The lack of a defined AM System along with undefined roles and responsibilities with respect to Asset Management, result in significant risks to compliance with the ISO 55001, and will require some changes to THESL's existing approach for Asset Management. This will be specified in more detail in the ISO 55001 compliance Roadmap.

The gap analysis assessment has concluded that there are eight (8) clauses where THESL appears to be currently compliant, fourteen (14) where compliance is potentially 'at risk', and three (3) where it appears to be non-compliant. These are summarised in Table 2.

The three (3) non-compliant clauses reflect the lack of a clearly defined AM System and its core AM documentation (e.g., Strategic Asset Management Plan (SAMP), SMART Objectives and Plans) along with explicitly defined information and documentation requirements.

The fourteen (14) clauses where compliance is potentially 'at risk' reflect the lack of a clear communication about the Asset Management requirements, no clear framework for delineating the key AM roles, no specific AM Competency Framework, and the analysis of asset resilience. THESL do not appear to validate project requirements and benefits against the original business case requirements. An overall change management approach has not been defined with respect to the AM System.

It is our opinion that all the compliance issues identified in this gap analysis can be rectified at the end of 2023 providing the required actions summarized in Section 4.3 and detailed in Appendix C are put into effect. Some of the existing and upcoming planned business improvement projects will develop many of the key building blocks towards compliance but THESL will need to implement these and demonstrate that the AM System is embedded before it can demonstrate compliance with the requirements of ISO 55001.

Summary of non-distribution assets is discussed in the Appendix under Additional Findings

5.2 RECOMMENDATIONS

It is recommended that THESL undertakes the following activities:

1. Implement a cross-functional Asset Management Governance Committee (AMGC) which will be chaired by an Executive Vice President accountable for the AM System and take responsibility to 'establish, implement, maintain and continually improve an AM System as required by ISO 55001.
2. Develop a clear scope and definition of its AM System that is independent of the elements of the system itself. This should define the overall framework for the AM System, and act as a 'signpost' document to existing or newly developed elements.
3. Develop a Strategic Asset Management Plan (SAMP) which includes THESL's AM Objectives and the strategic plan to deliver these over an appropriate timescale. This core documentation should demonstrate clear alignment between THESL's organizational goals from above) and the AM Plans (below).
4. Develop and establish the information requirements necessary to support the AM System and delivery of the AM Objectives.
5. Implement all other required actions summarised in Table 2 and detailed in Appendix C of this report, ensuring a focus on the newly defined AM System when implementing all recommended activities.
6. There are eight (8) clauses where THESL appears to be currently compliant. Although no further action should be required with respect to ISO 55001 compliance, it is still recommended that THESL validates this and ensures it will be able to demonstrate compliance during an ISO 55001 certification audit.

APPENDICES

Appendix A ADDITIONAL FINDINGS (NON-DISTRIBUTION ASSETS)

This section summarises high-level shortfalls related to non-core assets of distribution system:

- THESL's Asset Management policy states that it does not apply to fleet, tools, facilities, or IT assets. Develop, approve, communicate, implement, and review a revised Asset Management policy to cover all assets.
- For non-core assets, they should develop Asset Class Strategies as supplementary sections or appendices to the overall Strategic Asset Management Plan (SAMP) once it is completed.
- THESL has currently not defined or documented the scope and boundaries of AM System. They have not defined the non-core asset portfolio covered by the scope of AM System. They need to consider the external and internal issues related to these assets including their existing management systems.
- When planning for the non-distribution AM system, THESL need to determine the risks, assess their impacts, mitigation treatment approaches and opportunities that need to be addressed to give assurance that the updated AM system (for all assets) can achieve its intended outcomes to prevent, or reduce undesired effects and achieve continual improvement.
- THESL need to integrate planning activities with non-core assets and ensure consistent evaluation and prioritization of investment and funding needs.
- THESL need to consider non-core asset related risks in the organization's risk management approach.
- THESL need to determine the required current and future resources necessary to manage non-core assets performance.
- The lack of clarity around asset information requirements covers all assets. THESL need to ensure that the asset information strategy contains the requirements for all assets.

- The extent of the documented information for non-core assets can differ as compared to core assets, however THESL AM system shall include documented information required by international standard, applicable legal and regulatory requirements and as being necessary for the effectiveness of the Asset Management activities.
- THESL need to determine and document their outsourcing activities for non-core assets and monitor asset performance and processes for sharing of knowledge and information related to these assets.
- THESL shall evaluate and report on the financial and non-financial performance of these assets, and how this influences overall risk-based decision-making criteria.

Appendix B GAP ANALYSIS INTERVIEW SESSIONS

Interviewee[8]	Interview Date
General Manager, Engineering	2020-10-06 2020-10-07 2020-10-08 2020-10-15
Manager, Engineering Services	2020-09-18 2020-10-01 2020-10-05 2020-10-06
Director, Regulatory Applications and Business Support	2020-09-24 2020-09-25
Manager, Regulatory Applications	2020-09-29
General Manager, Distribution Grid Operations and Emergency Management	2020-09-21
Controller	2020-09-18
Supervisor, Capital Planning	2020-09-18
Director, IT Portfolio Management	2020-09-22
Manager, Warehouse Management & Fleet Services	2020-09-28
Manager, Facilities and Building Security Operations	2020-09-17 2020-09-23
Director, Organizational Effectiveness	2020-09-28
Director, Talent Management	2020-10-06 2020-10-08
Manager Communication, Media & Public relations	2020-09-24
Supervisor, Financial Planning	2020-09-24

[8] *Organizational structure as of September 2020*

Interviewee[8]	Interview Date
Director, Sustainability & Training	2020-09-25
Manager, Grid Systems and Analytics	2020-09-29 2020-10-16
Director, Control Center	2020-09-21
Manager, Dispatch & Grid Emergency Management	2020-09-21
General Manager, Power System Services	2020-10-23
General Manager, Customer Care	2020-10-26
Director, Streetlighting Operations & Conservation and Demand Management	2020-10-21
Manager, Enterprise Risk Management & Policy	2020-09-30
Director, Standards & Technical Studies	2020-10-16
Director, Investment Planning	2020-09-30
General Manager, Design & Construction	2020-10-09
Manager, Capital Planning & Reporting	2020-09-18
Director, Corporate Account & External Reporting	2020-10-29
Director, Internal Audit & Compliance	2020-10-07
Director, IT Infrastructure Operations	2020-10-06
Supervisor, Engineering Services (John Piroli)	2020-10-20
Director, Project Management Offices	2020-10-26
Director, Enterprise Architecture and Cyber Security	2020-10-08
Manager, Supply Chain Services	2020-10-07
Director, Distribution Stations	2020-10-28
Director, Environmental, Health & Safety	2020-10-16
Director, Enterprise Project Management & Development	2020-11-09

Appendix C DETAILED ASSESSMENT AGAINST ISO 55001 'SHALL' STATEMENTS

AMCL is assessing THESL's conformance to each of the ISO 55001 clauses through a strict interpretation of the 71 'shall' statements. ISO/IEC Directives – Part 2 – Rules for the structure and drafting of International Standards, define 'shall' as:

- [Shall] shall be used to indicate requirements strictly to be followed to conform to the document and from which no deviation is permitted.

4.1 Understanding the organisation and its context

Requirement	**A) The organisation *shall* determine external and internal issues that are relevant to its purpose and that affect its ability to achieve the intended outcome(s) of its AM System.**		
Observations:	THESL's corporate strategy and associated business planning processes, including the AM Process, are guided by a set of principles that align with the utility's four corporate pillars i.e., Customer, Operations, People, and Financial – in a balanced way that promotes customer value and a sustainable business. These principles are an essential element in the determination and prioritizations of outcomes. THESL's AM objectives are to a large extent driven by relevant legislative and regulatory obligations and guidance such as the OEB's Distribution System Code ("DSC") and the Electricity Act, 1998. The corporate strategy and outcome objectives determine the overall direction for decision-making throughout the AM Process. Investment Planning and Portfolio Reporting is their system investment planning cycle process, which includes both long-term and short-term planning horizons. It is composed of four sets of activities: Principles, Strategies and Outcomes Development, Asset Needs Assessment, Portfolio Planning and Reporting.		
Conclusion:	☒ Compliant	☐ At risk	☐ Non-compliant
Action status:	☒ No action required. ☐ Action required:		

4.1 Understanding the organisation and its context

Requirement	**B) AM Objectives, included in the strategic Asset Management plan (SAMP), *shall* be aligned to, and consistent with, the organizational objectives.**		
Observations:	The organization has an organizational business plan in place which implements effective Asset Management. The alignment of AM objectives with organizational objectives is also evident.		
Conclusion:	☒ Compliant	☐ At risk	☐ Non-Compliant
Action status:	☒ No action required. ☒ Recommendation for further improvement: ☐ Action required: No further action is required for this clause, however, to enhance THESL's capability above conformance, THESL's organisational plan must acknowledge full support for the implementation, embedding and continual improvement of the AM System.		

4.2 Understanding the needs and expectations of stakeholders			
Requirement	**The organization *shall* determine:** • the stakeholders that are relevant to the AM System; • ...		
Observations:	THESL has roles and responsibilities defined and effectively implemented for external stakeholder engagement. Customer Engagement results were used to develop an enhanced Outcomes Framework for the 2020-2024 planning horizon which translates THESL's expenditure plan objectives into outcome categories that matter to the utility's customers. The framework is also aligned with the four corporate pillars and the OEB's Renewed Regulatory Framework ("RRF") Outcomes; structured around the following six outcome categories: Customer Service, Reliability, Safety, Environment, Public Policy, and Financial. Beyond its mandated service and conformance obligations, the broader objective of their AM process is to realize sustainable value from their assets for the benefit of customers and stakeholders. This requires continuously balancing near-term customer preferences with the need to ensure predictable performance and costs over the long-term for both current and future customers. THESL's regulatory team engage with regulatory bodies on technical standards. THESL's proactive public communications include incentivizing customers to move to a paperless billing. Their customer operations communications team deal with planned supply interruptions. A digital comms team manages the social media accounts e.g., Twitter being the main channel with around 150k followers. All customer contacts are classified for reporting purposes (complaints, billing enquiries, etc.). Also, the outage map is published on the company website and a subscribed email notification service is also available.		
Conclusion:	☒ Compliant	☐ At risk	☐ Non-Compliant
Action status:	☒ No action required. ☒ Recommendation for further improvement: ☐ Action required: Undertake a systematic stakeholder analysis with respect to the newly defined AM System to define an integrated set of stakeholder requirements across the asset lifecycles. Include in these clear criteria of THESL's corporate Asset Management decision-making to review stakeholder needs and requirements.		

4.3 Determining the scope of the AM System			
Requirement	**The organization *shall* determine the boundaries and applicability of the AM System to establish its scope. The scope *shall* be aligned with the SAMP and the Asset Management policy. When determining this scope, the organization *shall* consider:** **— the external and internal issues referred to in 4.1;** **— …**		
Observations:	All strategic stakeholders are effectively engaged throughout the planning process to understanding their requirements and have an opportunity to provide inputs and feedback. THESL has not formally defined or documented the scope and boundaries of its AM System with respect to the implementation of the ISO 55001 Asset Management standard. The boundaries also need to consider how AM System will interact with other existing management systems. The detail of the scope needs to reflect the external and internal issues identified in 4.1, the requirements identified in 4.2, alignment with newly developed Strategic Asset Management Plan (SAMP, see 4.4) and interfaces with other existing management systems.		
Conclusion:	☐ Compliant	☒ At risk	☐ Non-Compliant
Action status:	☐ No action required. ☒ Action required: Define the AM System scope with respect to THESL's organisation and its relationships to its stakeholders. Ensure the details of the scope reflects the external and internal issues identified in 4.1 and the requirements identified in 4.2.		

4.3 Determining the scope of the AM System			
Requirement	**The organization *shall* define the asset portfolio covered by the scope of the AM System. The scope *shall* be available as documented information.**		
Observations:	The boundaries need to be defined with respect to organization, geography, and technical (scope of physical assets). The detail of the scope needs to reflect the alignment with SAMP and interfaces with other management systems.		
Conclusion:	☐ Compliant	☒ At risk	☐ Non-Compliant
Action status:	☐ No action required. ☒ Action required: Define the AM System scope with respect to THESL's: • organization and its relationships to its stakeholders. • approaches, frameworks, and processes. • Scope of distribution Asset Management areas: 1) Distribution System Assets 2) Operational Buildings 3) SCADA/DATA Systems Ensure the detail of the scope reflects the external and internal issues identified in 4.1, the requirements identified in 4.2, alignment with SAMP and interfaces with other management systems.		

4.4 AM System			
Requirement	**The organization *shall* establish, implement, maintain and continually improve an AM System, including the processes needed and their interactions, in accordance with the requirements of this International Standard.**		
Observations:	An AM System is not yet formally established and documented. A clear interface with AM System needs to be defined with respect to functions, assets, and processes. The AM System will enable THESL to deliver, review, and continually improve its activities to achieve its organizational objectives and maximize value from its assets. Although THESL has set of interactive processes in place e.g., Investment Planning & Portfolio Reporting process (IPPR), ERP, Enterprise risk management framework, however they are not integrated and/or aligned with the AM policy e.g., system and capacity planning are not streamlined into a single processes and practice etc. THESL has not currently defined clear interfaces for AM system with respect to functions, assets, and processes.		
Conclusion:	☐ Compliant	☒ At risk	☐ Non-Compliant
Action status:	☐ No action required. ☒ Action required: Establish the AM System in accordance with Clause 4.4. It consists of a set of interacting processes, people, and information. Describe the AM System in an AM System Manual (or descriptor document). Ensure this is achieved using existing frameworks, approaches, processes, and procedures where possible, and across all elements of THESL's organization that are within the defined AM System scope.		

4.4 AM System			
Requirement	**The organization *shall* develop a SAMP which includes documentation of the role of the AM System in supporting achievement of the AM Objectives.**		
Observations:	THESL has not defined its Strategic Asset Management Plan (SAMP) yet as required by Clause 4.4, which includes documentation of the role of the AM System in supporting achievement of AM Objectives.		
Conclusion:	☐ Compliant	☒ At risk	☐ Non-Compliant
Action status:	☐ No action required. ☒ Action required: THESL is planning to define its Strategic Asset Management Plan (SAMP) between 2021-2023.		

5.1 Leadership and commitment

Requirement	**Top management *shall* demonstrate leadership and commitment with respect to the AM System by:** • ensuring that the Asset Management policy, the SAMP and AM Objectives are established and are compatible with the organizational objectives; …		
Observations:	Top management pro-actively manage organizational culture to support good practice Asset Management, however there is no clear framework for delineating the key Asset Management roles. Likewise, top management have established AM policy and AM objectives that are compatible with the organizational objectives, however, they have not effectively communicated the importance of Asset Management and the requirement for conformance to the AM System consistently across the company. The specific requirements for Clause 5.1 are not yet fulfilled, however these will be fulfilled once THESL's AM System is effectively defined and communicated.		
Conclusion:	☐ Compliant	☒ At risk	☐ Non-Compliant
Action status:	☐ No action required. ☒ Action required: Appoint a member of THESL's top management to take ownership of the AM System. Implement a cross-functional Asset Management Governance Committee (AMGC), chaired by the owner of the AM System, which will provide a focus for Asset Management governance leading up to and after certification to ISO 55001. Link Top Management competences from Clause 5.3 into this clause. Define a framework that works for THESL that delineates the key Asset Management roles i.e., seven capabilities defined by the IAM Competency Framework. Incorporate this framework into the AM System definition document and ensure the roles and responsibilities defined in that document also cover all the specific requirements of 5.1.		

5.2 Policy			
Requirement	**Top management *shall* establish an Asset Management policy that:** **— is appropriate to the purpose of the organization;** **— …**		
Observations:	Asset Management policy is in place and owned by the Executive Vice President and Chief Engineering and Construction Officer.		
Conclusion:	☒ Compliant	☐ At risk	☐ Non-Compliant
Action status:	☒ No action required. ☐ Action required:		

5.2 Policy			
Requirement	**The Asset Management policy *shall*:** **— be consistent with the organizational plan;** **— …**		
Observations:	This policy is approved by the Policy Administration Steering Committee (PASC) who is responsible for considering the impact of the proposed policy to corporate risks. The AM Policy has not been widely distributed or understood and a review of the AM Policy will be required following the rescoping of the AM System.		
Conclusion:	☐ Compliant	☒ At risk	☐ Non-Compliant
Action status:	☐ No action required. ☒ Action required: Communicate and implement the existing AM Policy to ensure its awareness within THESL is raised. Plan for the AMGC (see Clause 5.1) to review, update and re-communicate the policy at least once prior to an ISO Certification Audit.		

5.3 Organizational roles, responsibilities and authorities			
Requirement	**Top management *shall* ensure that the responsibilities and authorities for relevant roles are assigned and communicated within the organization.**		
Observations:	General roles and responsibilities for the asset related activities are defined, however for the governance of the AM System there are significant differences in opinion and lack of awareness across the organization.		
Conclusion:	☒ Compliant	☐ At risk	☐ Non-Compliant
Action status:	☒ No action required. ☒ Recommendation for further improvement: ☐ Action required: Compare existing THESL departmental roles and responsibilities against the AM System defined in 4.4. Define a framework that works for THESL that delineates the key Asset Management roles i.e., seven capabilities defined by the IAM Competency Framework. Incorporate this framework into the AM System definition document and ensure the roles and responsibilities defined in that document also cover all the specific requirements of 5.1.		

5.3 Organizational roles, responsibilities and authorities			
Requirement	**Top management *shall* assign the responsibility and authority for:** **— establishing and updating the SAMP, including AM Objectives;** **— …**		
Observations:	THESL does not have a RACI chart, however, it has alternative processes and policies in place which specify Asset Management responsibilities with expected outcomes.		
Conclusion:	☒ Compliant	☐ At risk	☒ Non-Compliant
Action status:	☒ No action required. ☒ Recommendation for further improvement: ☐ Action required: Reconcile in detail existing team and personal roles and responsibilities against the requirements of the newly defined AM System and fill any gaps. Define this in a RACI which is approved by the AMGC (see Clause 5.1). Refer to the 'IAM Competences Framework' for seven key roles for guidance. Also use this as basis for recruitment, selection, professional development, and training.		

6.1 Actions to address risks and opportunities for the AM System			
Requirement	**When planning for the AM System, the organization *shall* consider the issues referred to in 4.1 and the requirements referred to in 4.2 and determine the risks and opportunities that need to be addressed to:** **— give assurance that the AM System can achieve its intended outcome(s);** **— …**		
Observations:	In general, THESL has good approaches in place to provide assurance that the delivery of capital projects includes actions to address the risks and opportunities facing the AM System. THESL has internal metrics to track and ensure its safety and reliability outcomes required by its external stakeholders. As part of defining the scope of AM System (as discussed in 4.3 and 4.4), THESL need to complete the risk assessment of this AM System. Asset related risks are weighted in order of priority (i.e., high, medium, and low). For example, public safety is the highest risk category and hence a top priority.		
Conclusion:	☐ Compliant	☒ At risk	☐ Non-Compliant
Action status:	☐ No action required. ☒ Action required: Create an Asset Risk & Opportunity Management Framework which is consistent with the existing THESL's Corporate Risk Management Framework (and ISO 31000) and approved by the AMGC (see Clause 5.1). This framework also needs to be consistent with the requirements identified in 4.2 and 4.3. Development of 'Value Framework' is in progress which will enable investment to be prioritized to deliver highest value and prevent or reduce undesired effects and achieve continual improvement. This Value Framework must be consistent with the Risk Management Framework.		

6.1 Actions to address risks and opportunities for the AM System			
Requirement	**The organization *shall* plan:** **— actions to address these risks and opportunities, taking into account how these risks and opportunities can change with time;** **— …**		
Observations:	The Enterprise Risk Management (ERM) framework has been formally approved and is aligned with the ISO 31000 and ISO Guide 73. Risk assessment sophistication varies by business unit and individual and they are not necessarily its alignment with the framework. In fact, this framework is more focused toward strategic and operational risks of the distribution assets.		
Conclusion:	☐ Compliant	☒ At risk	☐ Non-Compliant
Action status:	☐ No action required. ☒ Action required: Implement the new asset risk management framework, ensuring full support through training, briefings and the review of all documents and processes that involve the assessment of risk. Define risk assessment and management competences within role profiles where required. In conjunction with key stakeholders define how the risk management framework will support the creation of risk-based plans for all stages of the asset lifecycle. Ensure this is incorporated into the SAMP.		

6.2.1 AM Objectives			
Requirement	**The organization *shall* establish AM Objectives at relevant functions and levels. When establishing its AM Objectives, the organization *shall* consider the requirements of relevant stakeholders and of other financial, technical, legal, regulatory and organizational requirements in the Asset Management planning process.**		
Observations:	THESL's Outcomes Framework translates expenditure plan objectives into outcome categories: Customer Service, Reliability, Safety, Environment, Public Policy, and Financial. These objectives are not consistently SMART. The alignment of AM Objective with organizational objectives is evident from their regular collaboration.		
Conclusion:	☐ Compliant	☒ At risk	☐ Non-Compliant
Action status:	☐ No action required. ☐ Recommendation for further improvement: ☒ Action required: Ensure all objectives are written in the SMART format and clarify where these are not. Formally issue and brief out the AM Objectives (as part of the SAMP). Ensure these AM Objectives are aligned to other organizational objectives and will deliver stakeholder requirements. Ensure these meet the specific requirements of 6.2.1.		

6.2.1 AM Objectives			
Requirement	**The AM Objectives *shall*:** **— be consistent and aligned with the organizational objectives;** **— …**		
Observations:	THESL uses the output from the 1) Principles, Strategies and Outcomes Development, 2) Asset Needs Assessment and 3) Portfolio Reporting to develop capital and maintenance investment plans. Decision-making criteria are not defined in alignment with AM objectives. Unprioritized asset needs identification processes are insufficient to justify steady state renewal and disposal requirements of assets. More discrete list of unprioritized list is planned for 2021. Strategic Asset Management planning (SAMP) is a critical requirement for this clause to enable the development of a top-down long-term work volumes and costs.		
Conclusion:	☐ Compliant	☒ At risk	☐ Non-Compliant
Action status:	☐ No action required. ☒ Action required: Incorporate the AM Objectives into the SAMP and ensure that the SAMP defines the required frameworks, approaches and processes to develop Asset Management plans which will deliver them. Ensure that the AM Objectives and the SAMP are fully integrated into other aspects of THESL's organisation and approach.		

6.2.1 AM Objectives			
Requirement	**The organization *shall* retain documented information on the AM Objectives.**		
Observations:	THESL has Asset Management Process overview where they have put together Asset Management principles, strategies, and outcomes. These objectives are not contained in the SAMP and have not yet communicated widely.		
Conclusion:	☐ Compliant	☒ At risk	☐ Non-Compliant
Action status:	☐ No action required. ☒ Action required: Ensure all AM Objectives are contained in the SAMP.		

6.2.2 Planning to achieve AM Objectives

Requirement	**The organization *shall* integrate the planning to achieve AM Objectives with other organizational planning activities, including financial, human resources and other support functions.**		
Observations:	Capital investment planning is an example of good practice which is defined and THESL follow it. It is a process where stakeholders and other requirements are well understood, and this process is well embedded. THESL's capital programs are grouped into the following four categories. Each program is assigned with one or more trigger drivers of work: 1) System Access Investments 2) System Renewal Investments 3) System Service Investments 4) General Plant Investments Operational and maintenance planning processes are in place and documented. These planning processes are not incorporated into the overall AM System.		
Conclusion:	☐ Compliant	☒ At risk	☐ Non-Compliant
Action status:	☐ No action required. ☒ Action required: Ensure that the AM Objectives and the SAMP are fully integrated into other aspects of the organisation and approach. Develop Asset Management plans which will achieve the SMART objectives, in a way that is consistent with the approach set out in the newly developed SAMP. Ensure these plans detail planned activities to the assets across their lifecycles, and activities to develop the capability of the AM System.		

6.2.2 Planning to achieve AM Objectives

Requirement	**The organization *shall* establish, document and maintain Asset Management plan(s) to achieve the AM Objectives. These Asset Management plan(s) *shall* be aligned with the Asset Management policy and the SAMP.**		
Observations:	THESL uses the output from the 1) Principles, Strategies and Outcomes Development, 2) Asset Needs Assessment and 3) Portfolio Reporting to develop capital and maintenance investment plans. Capital investment planning (e.g., "IPPR") is defined, embedded, and followed within THESL and there are various KPIs in place to manage deliverables. Decision-making criteria have not been explicitly defined as required by Clause 4.2. There is currently no integrated plan covering overall work volumes and costs – e.g., an integrated plan that justifies work volumes and costs across all stages of the assets' lifecycles. The long-term (i.e., 20+years) work volumes and costs do not align with agreed maintenance and renewal work volumes and costs. For example, capital work volumes and costs are largely driven by budget availability which varies from year to year. The modelling of lifecycle value utilizes optimized capital renewal requirements and maintenance costs e.g., CMMS is used to create metrics and reporting systems to ensure all assets are functioning as intended and minimize total lifecycle cost. THESL has plans for 2020-2024 period, however forward plans for new works go out as far as 50 years and moved through several planned stages before implementation.		
Conclusion:	☐ Compliant	☒ At risk	☐ Non-Compliant
Action status:	☐ No action required. ☒ Action required: Develop Asset Management plans which will achieve the AM Objectives, in a way that is consistent with the approach set out in the SAMP.		

6.2.2 Planning to achieve AM Objectives			
Requirement	**The organization *shall* ensure that the Asset Management plan(s) take(s) into account relevant requirements coming from outside the AM System.**		
Observations:	The AM System has not been explicitly defined; therefore, capital planning process cannot be incorporated into an overall AM System.		
Conclusion:	☐ Compliant	☒ At risk	☐ Non-Compliant
Action status:	☐ No action required. ☒ Action required: Ensure these plans detail planned activities to the assets across their lifecycles, and activities to develop the capability of the AM System.		

6.2.2 Planning to achieve AM Objectives			
Requirement	**When planning how to achieve its AM Objectives, the organization *shall* determine and document:** **— the method and criteria for decision making and prioritizing of the activities and resources to achieve its Asset Management plan(s) and AM Objectives;** **— …**		
Observations:	THESL is above conformance in budget planning and approval process which is required to deliver the AMP. Reprioritization of existing and emergent needs together and project selection is top-down constrained by budget. Financial planning support operational planning to balance workforce continuity with the resourcing strategy and risk associated with deferring work due to resourcing constraints. Their Asset Management planning does not utilize agreed unit costs to create the constrained AMP. Maintenance Plan: Maintenance requirements analysis (MRA) process is in place and well documented, THESL use reliability engineering tools i.e., FMECA, RCA, RCM etc. to optimize their inspection, maintenance and intervention regimes, however, THESL does not appear to have fully defined the quality requirements for these processes. This is one of the AM System requirements. Some asset plans are based on unit cost models, however it's not consistent across the asset base. Existing unit cost models need to be updated on an ongoing basis using actual cost data to ensure that up-to-date models can be developed. These plans also need to cover the entire lifecycle stages and associated risks and unit costs. There is very limited alignment between the existing AM strategies (which are not formalized as SAMP) and lifecycle value approaches.		
Conclusion:	☐ Compliant	☒ At risk	☐ Non-Compliant
Action status:	☐ No action required. ☐ Recommendation for further improvement: ☒ Action required: Build on the existing Asset Management Plans to develop plans for all stages of the assets' lifecycles, which should be developed in accordance with the integrated approach to be defined in the SAMP, and demonstrate the AM Objectives will be achieved. Review Asset Management plans against all the criteria listed above in 6.2.2.		

6.2.2 Planning to achieve AM Objectives

Requirement	The organization ***shall*** ensure that its Asset Management related risks are considered in the organization's risk management approach including contingency planning.		
Observations:	THESL has considered Asset Management related risks in their corporate risk management policy and using probability of failure and consequence of failure in their Asset Condition Assessment model. Existing and emergent investment needs are reprioritized together, ensuring some consistency in decision-making and project selection is top-down constrained by budget. THESL exceeded the conformance score in one of the sub-criteria of this clause, covering budget planning and approval processes required to deliver the AMP, however this plan does not cover the entire asset lifecycle stages. AMPs should also be focused on AM Objectives and newly developed SAMP soon. Contingency plans i.e., Emergency and Disaster Recovery Plan are in place that provide clear guidance on how THESL should respond to such situations. Technology plan is in development e.g., Smart Metering, Grid Modernization etc. This will enable them to leverage trends and changes in technology to improve its AM capability. There is no defined framework for the analysis of Asset Resilience. Resilience cover four 'R's. i.e., Redundancy (e.g., system design that allows for operational flexibility), Resistance (e.g., the ability of the system to withstand external demands without degradation or loss of functionality), Responsiveness (e.g., the ability to mobilize and sustain services in emergencies) and Recovery (e.g., the speed with which disruption can be resolved and the site returned to normal operation). THESL use FMECA, RCA, RCM etc. tools to optimize their maintenance and inspection regimes, a maintenance requirement analysis process is in place and well documented. A sustainable development strategy is in place and THESL considers the impact of climate change on its system as well as reducing environmental risk by eliminating PCBs by 2025. Another example is their 4kV conversion project which will reduce line losses, improving system efficiency and contribute to sustainability measures; however, the evaluation of sustainability benefits was undertaken retrospectively rather than being an investment driver.		
Conclusion:	☐ Compliant	☒ At risk	☐ Non-Compliant
Action status:	☐ No action required. ☐ Recommendation for further improvement: ☒ Action required: Ensure alignment with the Corporate Risk Management Framework (see the recommendation to implement an Asset Risk Assessment and Opportunity Framework under Clause 6.1.) Ensure that alignment is demonstrably embedded.		

7.1 Resources			
Requirement	**The organization *shall* determine and provide the resources needed for the establishment, implementation, maintenance and continual improvement of the AM System.**		
Observations:	There is top management commitment to providing the resources required to deliver plans and a resourcing strategy is in place to defines the approach to resourcing activities. Resource balancing is used to develop all resource plans enabling THESL to maximize utilization of its resources and to use internal staff for most of the work. Resources are planned and sufficient for the current technical delivery requirements; however, they may not be sufficient to support future AM System requirements. THESL need to identify the resources for the establishment, implementation, maintenance and continual improvement of Asset Management activities i.e., meeting the AM Objectives and implementing the AM Plan.		
Conclusion:	☒ Compliant	☐ At risk	☐ Non-Compliant
Action status:	☒ No action required. ☒ Recommendation for further improvement: ☐ Action required: Define the resources required to deliver the AM Objectives as defined in the AMP, utilizing the AM competence requirements defined in 5.1, 5.3, 7.1 and 7.2 next and reconcile existing resourcing levels against this.		

7.1 Resources			
Requirement	**The organization *shall* provide the resources required for meeting the AM Objectives and for implementing the activities specified in the Asset Management plan(s).**		
Observations:	Fixed resources are defined on an annual basis using 10+ years of historical data based on outages. Financial planning supports operational planning to balance workforce continuity with the resourcing strategy and includes an assessment of risk associated with deferring work due to resourcing constraints. Inventory and spares are managed reactively. Consumption patterns are reviewed quarterly for consumption, vendor performance on time delivery, shortage issues along with cost of holding inventory. THESL achieve all resource plans including utilizing the opportunity to mix the activities with other groups to accelerate the work i.e., planned outage and/or to cover the resource shortage for program delivery projects. THESL maximize the utilization of their resources and use internal staff for majority of the work.		
Conclusion:	☒ Compliant	☐ At risk	☐ Non-Compliant
Action status:	☒ No action required. ☒ Recommendation for further improvement: ☐ Action required: Develop and implement a plan for the Asset Management recruitment and training required to fulfil the resource requirements defined.		

7.2 Competence			
Requirement	**The organization *shall*:** **— determine the necessary competence of person(s) doing work under its control that affects its asset performance, Asset Management performance and AM System performance;** **— …**		
Observations:	THESL have good process in place to assess technical competence. There are adequate programmes available to enable staff to develop their technical competence. THESL's talent management strategy is tied-up to the headcount data managed from HR, contract management and procurement plan. Contractors manage their own training compliance processes. THESL has technical competency Management System inhouse such as Professional Engineer (P.Eng) License, however there are no specific AM Competencies defined to meet current and future Asset Management needs. For example, competency required to develop the whole life cost models or an Information Management System.		
Conclusion:	☐ Compliant	☒ At risk	☐ Non-Compliant
Action status:	☐ No action required. ☒ Action required: Build on the existing approaches to develop a Competence Management System for core and functional competences, ensuring that AM Competences required to deliver the AM Objectives are included and fully integrated for the development of THESL Asset Management capabilities. Develop a list of the AM Competence required to deliver the activities within the AM System (use a good practice framework like the IAM's if needed). Align these to the RACI developed in 5.3 and define the competences for each job role. Update job descriptions to reflect the new AM competency requirements and incorporate these into the existing CMS. Build approaches to developing AM Competences (training, IAMcert, DipIAM, Expert Coaching, Mentoring, RAMP etc.)		

7.3 Awareness			
Requirement	**Persons doing work under the organization's control, who can have an impact on the achievement of the AM Objectives, *shall* be aware of:** **— the Asset Management policy;** **— …**		
Observations:	Asset Management awareness is limited outside the core team. There is a perception that Asset Management is something that the Asset Management department does rather than an enterprise-wide management system. All staff are not aware of their specific roles in Asset Management hence there is an impact on their contribution to the effectiveness of the Asset Management activity.		
Conclusion:	☐ Compliant	☒ At risk	☐ Non-Compliant
Action status:	☐ No action required. ☒ Action required: Ensure that the Asset Management improvement plan is clearly communicated to all those within the scope of the AM System. Develop a training programme to increase understanding across the business of how different departments contribute to achieving the AM Objectives.		

7.4 Communication			
Requirement	**The organization *shall* determine the need for internal and external communications relevant to assets, Asset Management and the AM System including:** **— on what it will communicate;** **— …**		
Observations:	External communication channels are good and engagement with customers and regulators is well controlled. THESL internal communication relevant to Asset Management activity is limited outside the core team, impacting the awareness score as described earlier in 7.3. AM Policy is in place, but not communicated consistently outside the core team.		
Conclusion:	☒ Compliant	☐ At risk	☐ Non-Compliant
Action status:	☒ No action required. ☒ Recommendation for further improvement: ☐ Action required: Develop and implement a plan for communicating relevant Asset Management information to all internal stakeholders. Communication plans are needed to increase awareness outside of the Asset Management team once the relevant documents and AM System has been developed. Ensure the AMGC takes ownership of these communication plans with respect to approval and monitoring.		

7.5 Information requirements - General			
Requirement	**The organization *shall* determine its information requirements to support its assets, Asset Management, AM System and the achievement of its organizational objectives.**		
Observations:	Asset Management information requirements have not been defined across all Business Units within THESL. For example, the requirements for aligning the information in the financial Fixed Asset Register and Physical Asset Register have not been defined. Asset lifecycle Information requirements and criteria are not mapped to the decision-making process e.g., renewal, maintenance strategies, disposal planning, etc.		
Conclusion:	☐ Compliant	☐ At risk	☒ Non-Compliant
Action status:	☐ No action required. ☐ Recommendation for further improvement: ☒ Action required: Implementation of the Asset Information Strategy should ensure that clarity on information requirements is sufficient to guide all existing and future asset information development activities. Document the current structure of asset information systems including all links and dependencies between systems. Identify where systems and data currently support the AM System and its processes, and where it does not. Define the data requirements needed for each process. This should include current data use and potential new use of existing data, and the likely future information requirements based on the SAMP and the Asset Management plans.		

7.5 Information requirements – Implementation factors			
Requirement	**In determine its information requirements:** **a) the organization *shall* include consideration of:** **— the significance of the identified risks;** **— …**		
Observations:	Risk and criticality are not currently used in the determination of information requirements and there does not appear to be a clear definition of the roles and responsibilities for information and data.		
Conclusion:	☐ Compliant	☐ At risk	☒ Non-Compliant
Action status:	☐ No action required. ☐ Recommendation for further improvement: ☒ Action required: Develop an Asset Information Strategy as a stand-alone document or as part of the SAMP which defines the overall approach to defining asset information requirements to deliver the AM Objectives, and specifies the required attribute, quality and implementation standards. Ensure this contains the requirements for the alignment of financial and non-financial information. Consider using the requirements analysis and plan as the basis for an Asset Information Strategy that also consider broader asset information management needs, including requirements sufficient to guide all existing and future asset information development activities including technology and systems investments.		

7.5 Information requirements – Attributes			
Requirement	**In determine its information requirements:** **b) the organization *shall* determine:** **— the attribute requirements of identified information;** **— …**		
Observations:	Asset Information Standards are not well defined. No logical data model exists which can be aligned with asset information needs.		
Conclusion:	☐ Compliant	☐ At risk	☒ Non-Compliant
Action status:	☐ No action required. ☐ Recommendation for further improvement: ☒ Action required: Create a structured information methodology which defined all the required attributes. Define and implement plans to rectify any gaps in these requirements.		

7.5 Information requirements – Processes			
Requirement	**In determine its information requirements:** **c) the organization *shall* specify, implement and maintain processes for managing its information;**		
Observations:	THESL specifies information it requires contractors to collect and audits them, however when the requirements are not specified (for example 'As-Built' data), contractors collect information based on their understanding and judgement. Inconsistent reports were noted during the assessment on the quality of the data being collected. This suggests that the information THESL specifies may be inconsistent.		
Conclusion:	☐ Compliant Notes:	☐ At risk Notes:	☒ Non-Compliant Notes:
Action status:	☐ No action required. ☐ Recommendation for further improvement: ☒ Action required: Document the current structure of asset information systems including all links and dependencies between systems. Identify where systems and data currently support the AM System and its processes, and where it does not.		

7.5 Information requirements – Alignment with other Systems			
Requirement	**In determine its information requirements:** **d) the organization *shall* determine the requirements for alignment of financial and non-financial terminology relevant to Asset Management throughout the organization;**		
Observations:	The requirements for aligning the information in the financial Fixed Asset Register and Physical Asset Register have not been defined.		
Conclusion:	☐ Compliant	☐ At risk	☒ Non-Compliant
Action status:	☐ No action required. ☐ Recommendation for further improvement: ☒ Action required: Asset information requirements should extend to the requirements for the alignment of financial and non-financial information (specifically the financial and non-financial asset registers).		

7.5 Information requirements – Consistency across Interfaces			
Requirement	**In determine its information requirements:** **e) the organization *shall* ensure that there is consistency and traceability between the financial and technical data and other relevant non-financial data, to the extent required to meet its legal and regulatory requirements while considering its stakeholders' requirements and organizational objectives.**		
Observations:	THESL is currently developing an engineering data warehouse to streamline data access and perform "big data" calculations that can support planning and system investment strategies. In parallel, the utility has been deploying new data blending and analytics software and has integrated software into business processes to improve productivity and drive new insights.		
Conclusion:	☐ Compliant	☐ At risk	☒ Non-Compliant
Action status:	☐ No action required. ☐ Recommendation for further improvement: ☒ Action required: Ensure the requirements for data collection and quality are defined for all assets and for all activities within the AM System in accordance with the requirements of Clause 7.5.		

7.6.1 Documented Information – General

Requirement	**The organization's AM System *shall* include:** **— documented information as required by this International Standard;** **— …**		
Observations:	There are good data governance processes covering regulatory reportable data with defined owners and verification. However, non-regulatory data captured during the capital and maintenance delivery process is not as well controlled or defined. For example, for unit cost data, newly installed asset attributes and geolocations there is no defined data governance, owners, verification, and subsequent data standards. Also, no information requirements are defined (see 7.5), hence quality, consistency, and validity of data varies. A Data Population Plan does not appear to exist, so data collection and analysis is ad-hoc and not according to a consistent integrated approach.		
Conclusion:	☐ Compliant	☐ At risk	☒ Non-Compliant
Action status:	☐ No action required. ☐ Recommendation for further improvement: ☒ Action required: Review in detail the documented information required by the following, and ensure all documented information is relevant and controlled: • ISO 55001 • THESL's legal and regulatory requirements • The AM System (*other than those identified above*)		

7.6.2 Documented Information – Creating and Updating			
Requirement	**When creating and updating documented information the organization *shall* ensure appropriate:** **— identification and description (e.g. a title, date, author, or reference number);** **— …**		
Observations:	Data and information are maintained in several locations including off-line spreadsheets. It is important to understand that the relevant data should be available in timely manner should you required it to make informed decisions. Each individual area of the business has a particular asset register.		
Conclusion:	☐ Compliant	☐ At risk	☒ Non-Compliant
Action status:	☐ No action required. ☐ Recommendation for further improvement: ☒ Action required: The Asset information system shall be in place and configure to collect/manage data and information in accordance with the asset information strategy and standards. Review the specific requirements of 7.6 against THESL's current documentation control systems. These specific requirements cover general requirements, when creating and updating documented information and control of these documented information.		

7.6.3 Documented Information – Control of Documented Information			
Requirement	**Documented information required by the AM System and by this International Standard *shall* be controlled to ensure:** **a) it is available and suitable for use, where and when it is needed;** **b) …**		
Observations:	Control of documented information appears to be through the Intranet which allows access to employees to the last versions of documentation. Where access should not be available to all then restrictions could be put in place. Technical standards are managed in a systematic manner. However, the dependence on delivery contractors defining information for input into the Maintenance Management Systems means THESL may or may not get the information it requires. Another challenge is related to the control of asset documentation. This has a significant impact on the asset lifecycle stages handover process and risk of missing data and/or delays in updating asset and operational records.		
Conclusion:	☐ Compliant	☐ At risk	☒ Non-Compliant
Action status:	☐ No action required. ☐ Recommendation for further improvement: ☒ Action required: A consolidated asset register should be established and configured to collect/manage data and information in accordance with the asset information strategy and standards.		

7.6.3 Documented Information – Control of Documented Information			
Requirement	**For the control of documented information, the organization *shall* address the following activities, as applicable:** **— distribution, access, retrieval and use;** **— …**		
Observations:	Control of documented information appears to be through the Intranet which allows access by employees to the last versions of documentation. There are good data governance processes covering regulatory reportable data with defined owners and verification. However, non-regulatory data captured during the capital and maintenance delivery process is not as well controlled or defined. For example, for unit cost data, newly installed asset attributes and geolocations there is no defined data governance, owners, verification, and subsequent data standards. Also, no information requirements are defined (see 7.5), hence quality, consistency, and validity of data varies.		
Conclusion:	☐ Compliant	☐ At risk	☒ Non-Compliant
Action status:	☐ No action required. ☒ Recommendation for further improvement: ☒ Action required: Update existing documentation with latest version and/or create new version to make it suitable for use and make them available to all relevant internal stakeholders. It is also important to protect them by putting adequate restrictions in place.		

7.6.3 Documented Information – Control of Documented Information			
Requirement	**Documented information of external origin determined by the organization to be necessary for the planning and operation of the AM System *shall* be identified, as appropriate, and controlled.**		
Observations:	When new assets go into service, data is collected using paper-based equipment changeout forms. A pilot project has been on-going to digitize this form to capture asset and operational data and minimize errors, inconsistencies, and missing information.		
Conclusion:	☐ Compliant	☐ At risk	☒ Non-Compliant
Action status:	☐ No action required. ☐ Recommendation for further improvement: ☒ Action required: The Asset information system shall be in place and configure to collect/manage data and information in accordance with the asset information strategy and standards. Review document request requirements against the requirements of the new AM system.		

8.1 Operational planning and control

Requirement	**The organization *shall* plan, implement and control the processes needed to meet requirements, and to implement the actions determined in 6.1, the Asset Management plan(s) determined in 6.2, and the corrective and preventive actions determined in 10.1 and 10.2 by:** **— establishing criteria for the required processes;** **— …**		
Observations:	Overall, THESL has developed its capital programs to maintain and improve reliability and safety, meet service and compliance obligations, address load capacity and growth needs, improve contingency constraints, or make necessary day-to-day operational investments. The choices made by the utility reflects a balance between customer preferences, affordability, and prioritized outcomes with the overriding objective of delivering value for money. An effective methodology for the management of capital program is in place including regular reports on the performance of the program. Operational planning and control of capital delivery is an example of good practice and is well embedded. Standards and procedures containing the maintenance and inspection regimes (including defect codes) for all assets are in place. Similarly, shutdown & outage planning processes are in place which enable the strategic optimization of access plans. The systems engineering approach does not enable effective alignment of business case benefits into project requirements and therefore benefits realization is not robust. Baseline configuration is established in the basic asset register; but not through a systematic commissioning and change management processes.		
Conclusion:	☐ Compliant	☒ At risk	☐ Non-Compliant
Action status:	☐ No action required. ☐ Recommendation for further improvement: ☒ Action required: No actions are required for the delivery of capital plans. THESL will need to be able to demonstrate that capital delivery processes are adhered to during a certification audit. For other areas of operational planning and control (including operations, maintenance and shutdown management) it is recommended that THESL verify that for each area processes are defined and followed reliably prior to the certification audit. THESL needs to clearly identify the criteria, information and processes required to control operations, and provide sufficient assurance that they are operating the assets in accordance with these. It is suggested this be included in the asset class strategies for key asset types such as transformers, overhead poles, operational buildings etc. Design and implement annual planning requirements in accordance with the SAMP and clause 6.2; monthly reporting requirements in accordance with clause 9.1; transparent risk assessment and management in accordance with clause 6.2.2; and regular review of the achievement of AM Objectives.		

8.2 Management of change			
Requirement	**Risks associated with any planned change, permanent or temporary that can have an impact on achieving the AM Objectives, *shall* be assessed before the change is implemented.**		
Observations:	An overall organisational 'Change Management Framework' on organizational change or system change has not been defined, however, clear 'approval for modification' and project change control processes exist which could be utilised once the AM System is defined.		
Conclusion:	☐ Compliant	☒ At risk	☐ Non-Compliant
Action status:	☐ No action required. ☒ Action required: Define an overall risk-based change management framework based on existing approaches and external good practice. Ensure this approach includes the identification and management of all changes within THESL in the most appropriate way, for example: • Managing day-to-day change (such as asset or project changes) through embedded processes. • Managing medium-scale changes (such as minor organizational or system implementation changes) through specific projects and good practice guidelines. • Managing major changes (such major organizational redesign) through specific programmes under the authority of the AMGC.		

8.2 Management of change			
Requirement	**The organization *shall* ensure that such risks are managed in accordance with 6.1 and 6.2.2.**		
Observations:	Asset changes are not completed in accordance with the organisational Change Management Framework which is not established yet. The Corporate Risk Management Framework appears to be good practice, but is not fully integrated into Asset Management, or the specific requirement to risk assess changes that may affect the achievement of AM Objectives.		
Conclusion:	☐ Compliant	☒ At risk	☐ Non-Compliant
Action status:	☐ No action required. ☒ Action required: Define an overall risk-based change management process based on existing approaches and external good practice. Ensure the new overall risk-based change management process is effectively aligned to the Corporate Risk Management Framework.		

8.2 Management of change			
Requirement	**The organization *shall* control planned changes and review the unintended consequences of changes, taking action to mitigate any adverse effects, as necessary.**		
Observations:	No processes are in place to control the planned changes and review unintended consequences of changes.		
Conclusion:	☐ Compliant	☒ At risk	☐ Non-Compliant
Action status:	☐ No action required. ☒ Action required: Define an overall risk-based change management process based on existing approaches and external good practice. Ensure the new overall risk-based change management process is effectively implemented and embedded.		

8.3 Outsourcing			
Requirement	**When the organization outsources any activities that can have an impact on the achievement of its AM Objectives, it *shall* assess the associated risks. The organization *shall* ensure that outsourced processes and activities are controlled.**		
Observations:	A sourcing strategy is in place that defines THESL's approach to outsourcing its activities. Existing procurement and supply chain processes deliver products and services that effectively support delivery of the organization's AM Objectives including the ability to adapt to a changing workload. THESL validate the capabilities of their suppliers prior to any kind of engagement. Reliability growth plans are not documented where a large majority of work is outsourced.		
Conclusion:	☒ Compliant	☐ At risk	☐ Non-Compliant
Action status:	☒ No action required. ☒ Recommendation for further improvement: ☐ Action required: No actions are required for the management of general outsourcing arrangements (for example contracts and suppliers), however outsourcing agreements would benefit from a review against the information requirements from the supply chain (see clauses 7.5 & 7.6).		

8.3 Outsourcing			
Requirement	**The organization *shall* determine and document how these activities will be controlled and integrated into the organization's AM System. The organization *shall* determine:** **a) the processes and activities that are to be outsourced (including the scope and boundaries of the outsourced processes and activities and their interfaces with the organization's own processes and activities);** **b) …**		
Observations:	Existing procurement and supply chain processes do deliver products and services that effectively support delivery of the organisation's AM Objectives. Supply chain is limited by resources available to perform key functions. Supply chain lacks a coherent resourcing strategy and hence the value from supply chain is not leveraged.		
Conclusion:	☒ Compliant	☐ At risk	☐ Non-Compliant
Action status:	☒ No action required. ☐ Recommendation for further improvement: ☐ Action required:		

8.3 Outsourcing			
Requirement	**When outsourcing any activities, the organization *shall* ensure that:** **— the outsourced resources meet the requirements of 7.2, 7.3 and 7.6;** **— the performance of the outsourced activities is monitored in accordance with 9.1.**		
Observations:	THESL validate the capabilities of their suppliers prior to any kind of engagement. A sourcing strategy is in place that defines THESL's approach to outsourcing its activities. Several performance measures have been developed from KPI list of measures.		
Conclusion:	☒ Compliant	☐ At risk	☐ Non-Compliant
Action status:	☒ No action required. ☐ Recommendation for further improvement: ☐ Action required:		

9.1 Monitoring, measurement, analysis and evaluation – Setting Requirements			
Requirement	**The organization *shall* determine:** **a) what needs to be monitored and measured;** **b) …**		
Observations:	In developing its approach to performance measurement, THESL considered the OEB's guidance, including the Renewed Regulatory Framework for Electricity Distributors ("RRF").		
Conclusion:	☐ Compliant	☒ At risk	☐ Non-Compliant
Action status:	☐ No action required. ☒ Action required: Ensure monitoring, measurement, analysis, and evaluation is effectively targeted across the AM System scope and balanced to meet the requirements of the AM System and the achievement of THESL's AM objectives (see clause 7.5).		

9.1 Monitoring, measurement, analysis and evaluation – Setting Requirements			
Requirement	**The organization *shall* determine:** **c) when the monitoring and measuring *shall* be performed;** **d) …**		
Observations:	THESL is proposing 15 custom measures for the 2020-2024 plan period. These measures are incremental to the measures contained in the Electricity Distributor Scorecard ("EDS") and the Electricity Service Quality Requirements ("ESQR"), for a total of 44 measures reported to the OEB annually.		
Conclusion:	☐ Compliant	☒ At risk	☐ Non-Compliant
Action status:	☐ No action required. ☒ Action required: Build on the proposed measures with a focus onleading indicators (which appear to be deficient).		

9.1 Monitoring, measurement, analysis and evaluation - Reporting			
Requirement	**The organization *shall* evaluate and report on** **— the asset performance;** **— …**		
Observations:	THESL monitor and manage the overall maintenance plan against output (lagging) KPIs but have not considered the systematic monitoring, measurement, analysis, and evaluation of leading indicators to assure achievement of KPIs. Financial outcomes are monitored and reviewed on a regular basis by analysing underlying trends.		
Conclusion:	☐ Compliant	☒ At risk	☐ Non-Compliant
Action status:	☐ No action required. ☒ Action required: Ensure monitoring, measurement, analysis, and evaluation is effectively targeted across the AM System scope and balanced to meet the requirements of the AM System and the achievement of THESL's AM objectives (see clause 7.5).		

9.1 Monitoring, measurement, analysis and evaluation			
Requirement	**The organization *shall* evaluate and report on the effectiveness of the processes for managing risks and opportunities.**		
Observations:	THESL uses known risks to focus on the asset health performance and performance monitoring. They use Asset Condition Assessment model to calculate the health index, probability of failure and consequence of failure. An Asset Condition Assessment model is used to derive an asset health index. The maturity of the AM system is not periodically assessed/reviewed against agreed good practice targets.		
Conclusion:	☐ Compliant	☒ At risk	☐ Non-Compliant
Action status:	☐ No action required. ☒ Action required: Ensure these are aligned to the requirements detailed under 8.1 and 8.3.		

9.1 Monitoring, measurement, analysis and evaluation			
Requirement	**The organization *shall* retain appropriate documented information as evidence of the results of monitoring, measurement, analysis and evaluation.**		
Observations:	The maturity of the AM system is not periodically assessed/reviewed against agreed good practice targets. Financial outcomes are monitored and reviewed on a regular basis by analysing underlying trends.		
Conclusion:	☐ Compliant	☒ At risk	☐ Non-Compliant
Action status:	☐ No action required. ☒ Action required: Set out how these high-level measures will be reviewed and analysed through the process of management review defined under 9.3. Ensure the AMGC has an overview of all key performance indicators.		

9.1 Monitoring, measurement, analysis and evaluation			
Requirement	**The organization *shall* ensure that its monitoring and measurement enables it to meet the requirements of 4.2.**		
Observations:	Visualization/performance hubs is utilized within THESL but is not fully embedded or integrated into the system.		
Conclusion:	☐ Compliant	☒ At risk	☐ Non-Compliant
Action status:	☐ No action required. ☒ Action required: Ensure these are aligned to the requirements detailed under 4.2. Consider (it is not a requirement) implementation of a Performance Management Framework and stringent overview by the AMGC. Ensure these are aligned to the requirements detailed under 8.1 and 8.3.		

9.2 Internal audit – Conducting			
Requirement	**"The organization *shall* conduct internal audits at planned intervals to provide information to assist in the determination on whether the AM System:"** **a) conforms to:** **— the organization's own requirements for its AM System;** **— …**		
Observations:	Internal audit of the specific scope of the AM System is not in place. THESL's internal audit process uses known risks and ensures the use of competent auditors. Audit findings are monitored and reviewed by the internal audit team.		
Conclusion:	☐ Compliant	☒ At risk	☐ Non-Compliant
Action status:	☐ No action required. ☒ Action required: Establish an overall audit plan for the scope of the AM System. Build on existing plans and resources where possible, drawing on the existing internal audit team to support this. Ensure the audit plan is reviewed and approved by the AMGC and that the outputs of audit activity are reported and actioned as required by the AMGC.		

9.2 Internal audit – audit programme(s)			
Requirement	**The organization *shall*:** **a) plan, establish, implement and maintain an audit programme(s), including the frequency, methods, responsibilities, planning requirements and reporting. The audit programme(s) *shall* take into consideration the importance of the processes concerned and the results of previous audits;** **b) …**		
Observations:	A risk-based process for defining an audit plan is in place. The ERP group provide input to the 3-year audit plans. THESL's audit process use knows risks and ensure the use of competent auditors. For example, they use KPMG as their 3rd party auditor. Additional audit support is bought in as required.		
Conclusion:	☐ Compliant	☒ At risk	☐ Non-Compliant
Action status:	☐ No action required. ☒ Action required: Ensure that however is managing the compliance audit be it internal audit or third-party external auditors that they are trained as per best industry standards.		

9.3 Management review			
Requirement	**Top management *shall* review the organization's AM System, at planned intervals, to ensure its continuing suitability, adequacy and effectiveness.**		
Observations:	Formal management review and performance management framework is in place, although this is not focused on the scope of the AM System.		
Conclusion:	☐ Compliant	☒ At risk	☐ Non-Compliant
Action status:	☐ No action required. ☒ Action required: Establish an overall AM System management review framework for periodic review of the overall AM System. Build on the existing review and performance management framework where possible and focus this on the scope of the AM System defined in Clause 4.3 and 4.4.		

9.3 Management review			
Requirement	**The management review *shall* include consideration of:** **a) the status of actions from previous management reviews;** **b) The outputs of the management review shall include decisions related to continual improvement opportunities and any need for changes (see 8.2) to the AM System.**		
Observations:	Systematic review of performance indicators and other information is undertaken periodically; however due to the issues identified under clause 7.5 and 7.6, information inconsistencies may affect these management reviews.		
Conclusion:	☐ Compliant	☒ At risk	☐ Non-Compliant
Action status:	☐ No action required. ☒ Action required: Ensure the AMGC has full accountability for management review activities including input from risk assessments, audits and performance indicators and reports. Consider adopting a 'management review' calendar which defines the review and approval cycles for all key AM System artefacts (such as AM Policy, Objectives, SAMP and AMPs).		

9.3 Management review			
Requirement	**The organization *shall* retain documented information as evidence of the results of management reviews.**		
Observations:	Performance Status Report (PSR) for Power System Analytics, Power System Operational technology and Grid System and Analytics are prepared.		
Conclusion:	☐ Compliant	☒ At risk	☐ Non-Compliant
Action status:	☐ No action required. ☒ Action required: Define the requirements for retaining documented information within the Asset Management System definition.		

10.1 Nonconformity and corrective action			
Requirement	**When a nonconformity or incident occurs in its assets, Asset Management or AM System the organization *shall*:** **a) react to the nonconformity or incident, and, as applicable:** **— …**		
Observations:	THESL effectively identify and prioritize reactive work. There is a process in place to identify root causes of non-conformances, faults, failures, and defects and to identify appropriate mitigations measures. Nonconformity and corrective / preventive action with respect to the AM System does not yet exist, but it is anticipated that the existing QMS capabilities and scope will provide a solid foundation for this.		
Conclusion:	☒ Compliant	☐ At risk	☐ Non-Compliant
Action status:	☒ No action required. ☒ Recommendation for further improvement: ☐ Action required: Establish a process for recording, prioritizing, and managing nonconformities and corrective actions resulting from implementing and monitoring the AM System.		

10.1 Nonconformity and corrective action – Appropriateness			
Requirement	**Corrective actions *shall* be appropriate to the effects of the nonconformities or incident encountered.**		
Observations:	Nonconformity and corrective / preventive action with respect to the AM System does not yet exist, but it is anticipated that the existing QMS capabilities and scope will provide a solid foundation for this. THESL's fault response resources are in place with defined responsibilities and effective communication. THESL review and report the lessons learned from faults and incidents		
Conclusion:	☒ Compliant	☐ At risk	☐ Non-Compliant
Action status:	☒ No action required. ☐ Action required:		

10.1 Nonconformity and corrective action – Documentation			
Requirement	**The organization *shall* retain documented information as evidence of:** **— the nature of the nonconformities or incident and any subsequent actions taken;** **— …**		
Observations:	THESL review and report the lessons learned from faults and incidents. A prioritized list of preventive and corrective actions is tracked, analysed, and reported to all relevant Management Review meetings. Risks and opportunities inherent in field activities are pro-actively identified and managed.		
Conclusion:	☒ Compliant	☐ At risk	☐ Non-Compliant
Action status:	☒ No action required. ☐ Action required: Collate good practices together and put in into the AM system manual while ensuring the process is outlined in detail and systematically. Define further written processes, if required. Develop an overall framework for description in the AM Manual (see Clause 4.4)		

10.2 Preventive action			
Requirement	**The organization *shall* establish processes to proactively identify potential failures in asset performance and evaluate the need for preventive action.** **When a potential failure is identified the organization *shall* apply the requirements of 10.1.**		
Observations:	Operators identify potential failures in asset performance at the monthly meetings and preventive actions are agreed there. There is evidence of a proactive risk identification culture within field/operational staff. Preventive and corrective actions are tracked in a single, accessible system for periodic reporting. Owners are allocated and regular reports from the system enable tracking of the actions to closure.		
Conclusion:	☒ Compliant	☐ At risk	☐ Non-Compliant
Action status:	☒ No action required. ☐ Action required: Establish a process for recording, prioritizing, and managing preventive actions resulting from implementing and monitoring the AM System. Collate good practices together and put in into the AM system manual while ensuring the process is outlined in detail and systematically. Define further written processes, if required.		

10.3 Continual improvement			
Requirement	**The organization *shall* continually improve the suitability, adequacy and effectiveness of its Asset Management and the AM System.**		
Observations:	Top management encourage a culture of collaborative continual improvement and provide a clear focus on achievement of the Asset Management Strategy and Objectives. A culture of continual improvement is evident from existing and upcoming programs i.e., Enhanced Outcomes Framework for the 2020-2024 planning horizon. THESL has transitioned from the Asset Condition Assessment (ACA) methodology originally adopted in 2008 to a model that provides more accurate and comprehensive condition-based analytics, and better supports longer-term expenditure planning. THESL is currently developing a data warehouse to streamline data access and perform "big data" calculations that can support planning and system investment strategies, alongside deploying new data blending and analytics software. The existing enterprise systems are to be consolidated into one system (ERP System) so that data integrity can be improved. This will provide teams across THESL access to one system with accurate and up-to-date information. Tactical contingency plans are created, implemented, tested, and continually improved in accordance with the agreed processes and AMPs are modified accordingly. The resilience Analysis process is incomplete. It is evident from the current ISO 55000 gap analysis, development of roadmap exercise and aspiration for the certification that THESL intend to enhance their existing capabilities and mature their practices.		
Conclusion:	☐ Compliant	☒ At risk	☐ Non-Compliant
Action status:	☐ No action required. ☒ Action required: Establish continual improvement of the AM System and make it an integral activity defined in the AM System definition document. Implement and maintain a CI Register for the AMGC for CI opportunities identified through management review. Ensure each section of the AM System Manual include a short sentience on how the clause is continually improved and who is accountable. Ensure that a Plan-Do-Check-Act cycle is always followed and formulating an AM system manual. THESL should have the ability to demonstrate that they are doing improvements continually and in a timely manner.		

NBM ENGINEERING

DAILY ACTIVITY REPORT

Date: 2024-03-02

Weather: 4 °C Drizzle

Project	141 Bay ELEC Private Work	TH Contact	Kris Velss
TH Project #	C-200002-X19001-HS001	Address	141 Bay St. (CC9439)
TH Scope #			
NBM Project #	H1-TH23-0730	Inspector	Rod Finlay
Type of Work	Electrical	Role	Compliance Inspector
		Scope of Work	Critical Task - Cable Spike

DAILY SITE ROSTER

Contractor	Powerline Plus	Approx. # of Crew Members	7
Foreperson	Joe Shawihat	Others On Site	TPS PDO

YES = Item is required for scope and *was followed*
NO = Item is required for scope but *was not followed* (Potential NCR)
N/A = Not required for the current scope inspected

GENERAL — SAFETY

YES	NO	N/A	
■	☐	☐	Work completed in accordance with Toronto Hydro Rule Book & EUSR.
■	☐	☐	Work completed in accordance with Toronto Hydro Standards & Procedures.
■	☐	☐	Contractor set-up adheres to MTO Book 7.
■	☐	☐	Site Supervisor on site.
■	☐	☐	Pay duty officer on site & appropriately stationed.
☐	☐	■	Pedestrian traffic safely re-routed.
☐	☐	■	Appropriate hold-offs have been documented. Hold off number (if applicable): _____
☐	☐	■	Appropriate locates are on site.
■	☐	☐	First-aid kits present on site.
■	☐	☐	Work Protection complies with Utility Work Protection Code (UWPC).

GENERAL — QUALITY

YES	NO	N/A	
■	☐	☐	Notice of Project (NOP) is displayed on site.
■	☐	☐	Contractor installations are completed as per design.
■	☐	☐	Contractor installations are completed as per standards.
☐	☐	■	Cut permits approved & on site.
☐	☐	■	Correct processes followed (e.g. Change Orders).
■	☐	☐	Critical tasks completed correctly.
☐	☐	■	Materials installed as per Bill of Materials.
■	☐	☐	Photos taken where necessary.
☐	☐	■	Installation & removal of equipment documented as required (equipment change-out forms).
■	☐	☐	Site & adjacent sidewalks / roadways are kept clean & organized.

NOTES

Topics of Discussion

Switching Delay, adjacent cable chambers, scope of work, drawings, CC 9439, circuit being worked on, cable ID, confined space entry, cable ID labels,

Outstanding Items (Toronto Hydro)

N/A

Outstanding Items (NBM Engineering)

N/A

Outstanding Items (Contractor)

N/A

Comments

On site 7:30am for 8am cable spike, informed of delay, paper and verbal tailboard (recorded) completed - auditor signed on, performed work site inspection - CC 9439 while waiting, left site and returned to witness spike in the afternoon, appropriate traffic control in place - TPS PDO on site, all required PPE in use, confined space entry form completed and updated as required, UWPC incomplete as switching not completed, inspected vehicle and personal safety equipment and tools - Tr.# 1024.

PHOTOS

Traffic looking south to work site at Front St. & Bay St.

Traffic looking south to work site from SW corner of Front St. & Bay St.

PHOTOS

Work Location CC 9439

Work Site/PPE

Fire Ext. Checked Fully Charged

First Aid Kit

Inspector Signature Rod Finlay

Digitally signed by Rod Finlay
DN: cn=Rod Finlay, ou=Users, email=rodf@nbmengineering.com
Date: 2024.03.04 11:32:33 -05'00'

ADDITIONAL PHOTOS (OPTIONAL)

Burn Kit

Eye Wash

LLT's

SRL's x 2 checked in date and good working order

NBM ENGINEERING

CABLE IDENTIFICATION RECORD

Date: 2024-03-02

Project: 141 Bay ELEC Private Work
TH Contact: Kris Velss
Address: 141 Bay St.
NBM Project #: H1-TH23-0730
Inspector: Rod Finlay
TH Project #: C-200002-X19001-HS001

DAILY SITE ROSTER

Contractor: PLP
Approx. # of Crew Members: 7
Foreperson: Joe Showihat
Other Companies On Site: TPS PDO

PART 1: CABLE IDENTIFICATION

YES = Required for scope and *was followed*
NO = Required for scope but *was not followed* (Potential NCR)
N/A = Not required for the current scope inspected

YES	NO	N/A	
☑	☐	☐	Confirm prints, drawings, data records, work protection documents, nomenclature, and location.
☑	☐	☐	Gas Detection test completed.
☑	☐	☐	Hold off: Confined Space
☑	☐	☐	Contractor supervisor/manager on site.
☑	☐	☐	Connect cable ID equipment and conduct test (complete minimum 1 of the below methods and check upon successful completion).

- ☑ VCI
- ☐ EZ-Cable ID
- ☐ Hiptronic
- ☐ Fault Locator
- ☐ Continuity Tester

☑ ☐ ☐ Install Cable Label(s) (ensure cable label has ALL the following information and check to confirm).

- ☑ Date cable identified
- ☑ Method used to identify cable
- ☑ Name of workers identifying and checking cable
- ☐ Location of cable fault (if applicable)
- ☑ Feeder number (if applicable)

☑ ☐ ☐ Additional Cable Verification Methods (complete minimum 2 of the below methods and check upon successful completion).

- ☑ Verify by counting duct numbers in at least (1) adjacent chamber
- ☑ Verify applicable nomenclature (e.g., location, cable tag, feeder#) and ensure similar to drawings/records
- ☑ Eliminate all other cables in location with cable ID equipment, ensuring transmitted signal is only reviewed on one feeder/cable.
- ☐ Identify/trace contents (cable type) of adjacent ducts in relation to the cable being identified
- ☐ Tug, move, tap on cables at both ends
- ☐ Fish ducts
- ☐ Shine flashlight beams through duct
- ☐ Ammeter load test
- ☐ Visually locate fault on cable

Additional Information / Comments:

PART 2: SPEARING / SPIKING RECORD

☐ ☐ ☑ Trace cable if not spearing/ spiking at exact work location and place a coloured tape marker for reference (check once completed). ☐ Trace Cable ☑ Not required

☑ ☐ ☐ Spear/ spike cable to be performed by competent worker (EUSR 119-9, EUSR 141-10).

☑ ☐ ☐ Confirm spearing/ spiking was effective.

Inspector Name, Signature & Date: Rod Finlay
Digitally signed by Rod Finlay
DN: cn=Rod Finlay, ou=Users, email=rodf@nbmengineering.com
Date: 2024.03.04 11:55:49 -05'00'

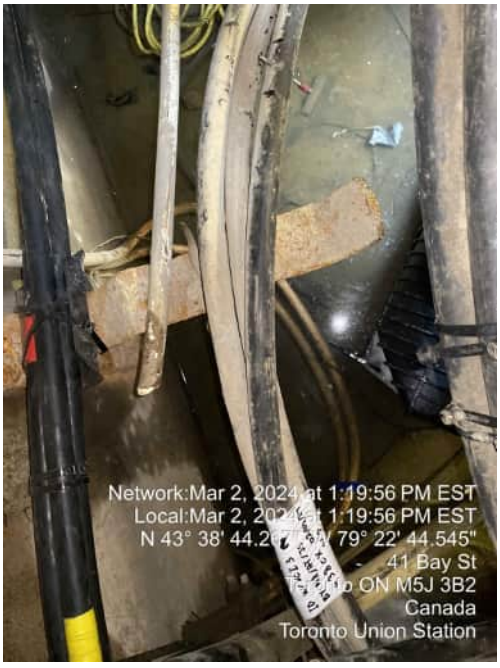
Certified Crew Leader Name, Signature & Date:

PHOTOS

Work Location (CC9439)

Cable ID

Cable ID Successful

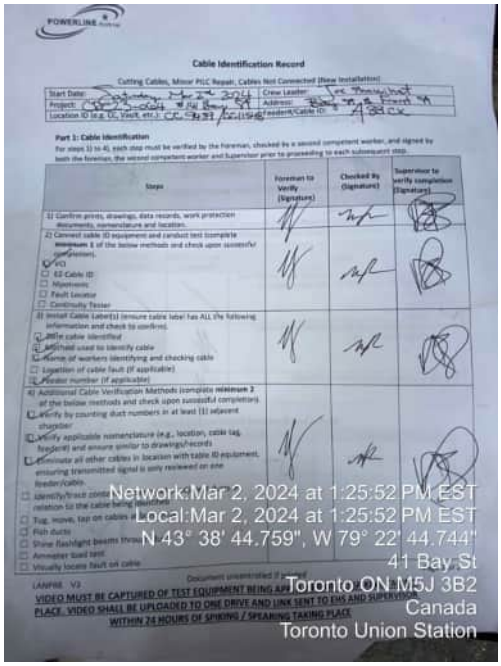


Cable Labelled

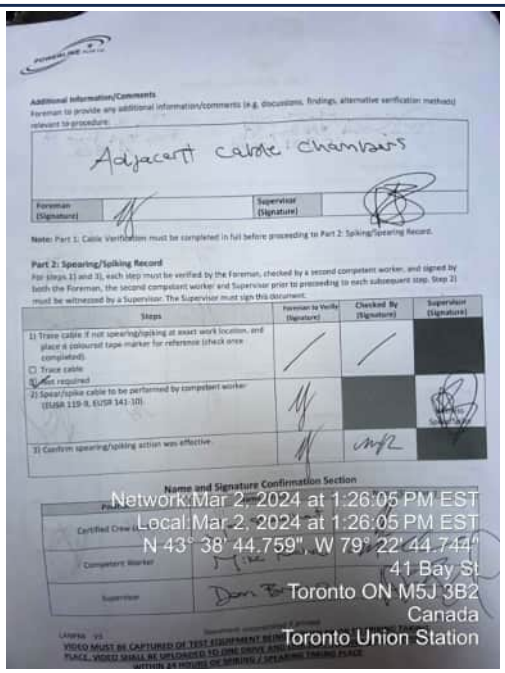
CABLE IDENTIFICATION RECORD

PHOTOS

Cable Spike Successful



PLP Cable ID Record Form (PG.1)



PLP Cable ID Record Form (PG.2)

Spike Tool Installed

Wade Avenue 77 – Temp Cap

C-230038-W10502-HT003

TABLE OF CONTENTS

TABLE OF FIGURES

PROJECT INFORMATION

PROJECT LOCATION(S):	77 Wade Avenue, Toronto, Ontario
PROJECT TYPE:	Overhead Services, Transformers, and Poles Installation
WBS ELEMENT NUMBER:	C-230038-W10502-HT003
PM ORDER NUMBER:	1000572973 and 1000572976
TORONTO HYDRO CONTACT:	Akiff Maredia
PROJECT START DATE:	November 7, 2023
PROJECT END DATE:	February 14, 2024
CONTRACTOR:	Powerline Plus Ltd.
CONTRACTOR'S FOREMAN:	Cody Anderson
INSPECTOR(S):	Cornel Pascal (ELI)

PROJECT SUMMARY

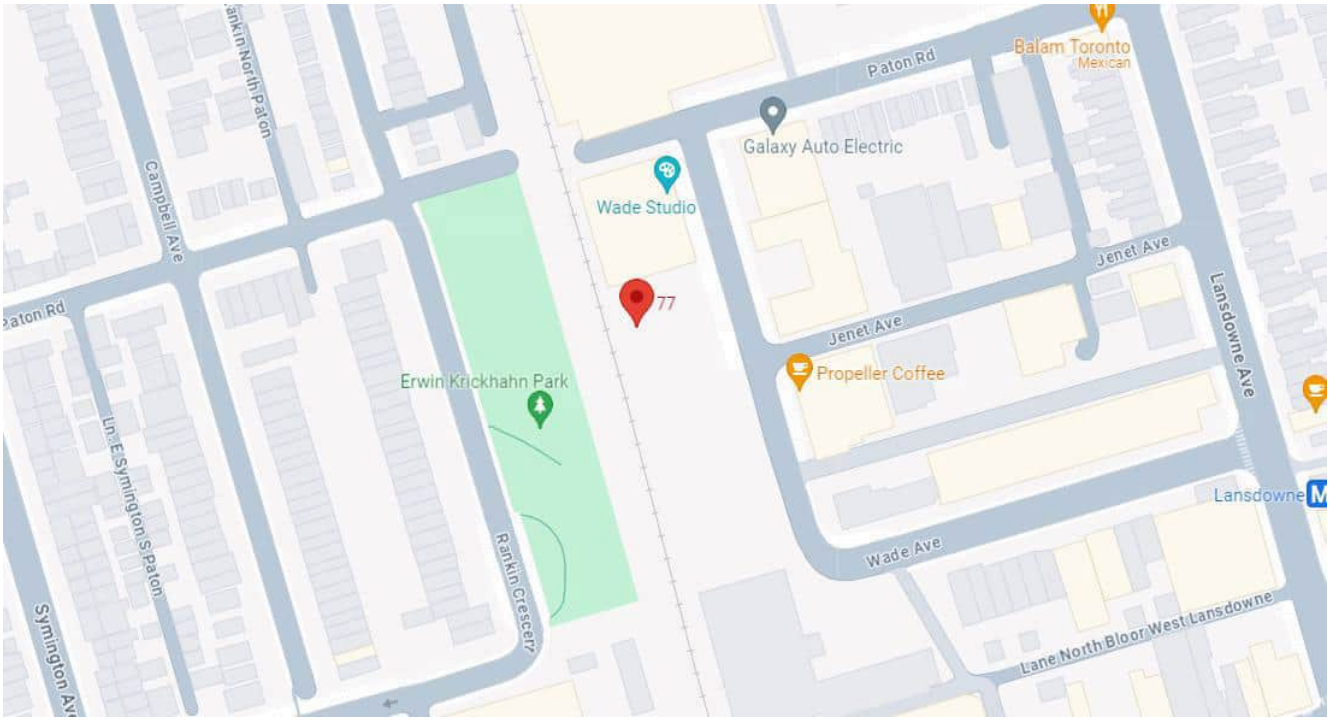


Figure 1 – Project Location

On February 14, 2024, Powerline Plus Ltd. (PLP) completed the project, which involved the installation of a 3-phase transformer at existing pole P27, as well as the installation of various poles and overhead primary and secondary conductors at new locations along 77 Wade Avenue, Toronto, Ontario.

PROJECT TIMELINES AND MILESTONES

Figure 2 - Project Timeline

AUDITOR SITE VISITS

Month of Visit: November, 2023

Inspector: Cornel Pascal (ELI)

Notes:

- On November 7, 2023, the crew worked on installing a bank of 3-phase transformers (OT24584) on pole P27 and installed the cutout switch. However, the transformers were of the wrong voltage and need to come back again.
- The contractor continued the work the next day and installed a new bank of 3-phase transformers.
- They connected secondary to the new transformer and framed new poles P20 and P50.
- Transferred service wires and streetlight to pole P20.
- Contractor energized OT24584 on pole P27 and connection had ESA approval.
- Contractor set-up adheres to MTO Book 7.
- All work was completed in accordance with Toronto Hydro standards and procedures.

FINAL INSPECTION NOTES AND DEFICIENCIES

On February 14, 2024, the auditor, Cornel Pascal, verified the project. NBM was not notified during the installation of poles P20 and P50, however, these were inspected post-construction. Several deficiencies were identified, including the installation of the wrong class of pole in the field where class 2 was required per design, but class 3 was installed instead, which is weaker. Additionally, there was missing stenciling on new poles P50 and P20, and asphalt restoration issues on various poles, which will be completed in spring. A quality NCR has been issued to the contractor. The contractor needs to provide designer confirmation and approval from TH on the changes to the original design relating to the class of pole used.

NON-COMPLIANCE REPORTS

The below NCR was issued during the duration and completion of the project:

NCR Type	NCR Number	Date Issued	Date Closed	Details
Quality	QUA-5608	February 15, 2024	Open	- Drawing states that existing 600/347V secondary needs to be transferred to new P20, but conductor has not been transferred. - Missing pole nomenclature on P20 and P50. - P50 needs asphalt restoration for: pole base, anchor and additional hole made for pole. - P11 needs asphalt restoration at anchor. - P58 needs asphalt restoration at ground rod. - Drawing calls for P20 to be installed as a class 2 wood pole, but class 3 has been installed.

INCOMPLETE TICKETS

There were no INC's issued during the duration and completion of the project:

INC Type	INC Number	Date Issued	Date Closed	Details
N/A	N/A	N/A	N/A	N/A

CHANGE ORDERS

The below change orders were issued during the duration and completion of the project:

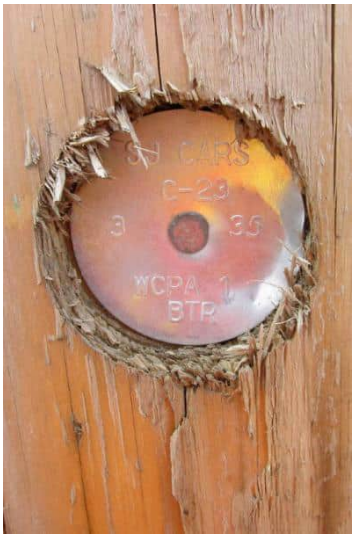
CO#	Date Requested	Date Approved	Details
Change Order # 1	January 11, 2024	January 19, 2024 (Rejected)	Captured unit for Premium Rates – incremental rates - work rescheduled from December 6, 2023 to December 13, 2023.
Change Order # 2	January 19, 2024	January 19, 2024 (Rejected)	Resubmission of Change Order # 1.
Change Order # 3	January 19, 2024	January 31, 2024	Resubmission of Change Order # 2.

AS-CONSTRUCTED VERIFICATION

After examining the as-constructed drawings and photos submitted by PLP, the on-site inspector, Cornel Pascal, has verified that all the mark-ups on the as-built drawings are accurate. The contractor has redlined the drawing approved by Toronto Hydro, confirming the changes in the class of pole installed; class 3 was used, as supported by the analysis report.

PHOTOS

P20 – Pole Installation
(Secondary Conductor and Stenciling Issues Fixed)



P20 – Pole Tag

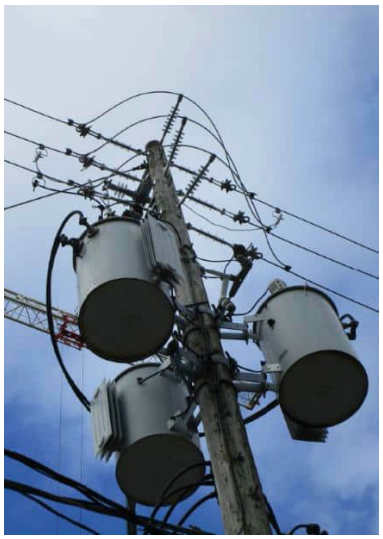
P50 – Pole Installation
(Stenciling Issue Fixed)

P50 – Pole Tag

P11 (Existing Pole) – Guying Installation

P11 (Existing Pole) – Overhead Conductors

P58 OT400445 (Existing) – 3-PH Double Dead-End Configuration



P58 OT400445 – Overhead Conductors Installation

P77 – Temporary Service for Construction Site

P27 OT24584 – 3-PH Transformer Installation

P27 OT24584 – 3-PH Transformer Installation

P27 – Guying Installation

APPENDIX A – AS-BUILT DRAWINGS

THIS DRAWING SET REFLECTS THE LATEST CUSTOMER NOTIFICATION LIST DATE: ______ (MM/DD/YYYY)
DRAWINGS REV#: ______
APPROVED BY: ______

TORONTO HYDRO
LOAD CONNECTIONS
C-230038-W10502-HT003
77 WADE TEMP
WADE AVE

GENERAL NOTES

1. PLUMB POLES AS REQUIRED.
2. TRIM TREES ALONG ROUTE AS REQUIRED.
3. AS PER THE REQUIREMENTS OF BILL 208. THE FOLLOWING "DESIGNATED SUBSTANCES" MAY BE ENCOUNTERED ON THE PROJECT:
MERCURY - MERCURY VAPOR LAMPS AND STREET LIGHT RELAYS
ETHYLENE OXIDE - POLYETHYLENE INSULATED CABLES
SILICA - CURRENT LIMITED FUSES AND LIGHTNING ARRESTERS(4kV).
4. IN INSTANCES WHERE AN ISOLATED AND UNDERGROUND LINE IS IN CLOSE PROXIMITY OF, AND FOLLOWS THE SAME GENERAL ROUTE OF AN ENERGIZED OVERHEAD LINE. IT IS POSSIBLE FOR THE ISOLATED LINE TO BE CHARGED BY INDUCTION. EXERCISE DUE CAUTION.
5. NEW POLES AND EQUIPMENT ARE TO BE NUMBERED AS PER CONSTRUCTION STANDARD SECTION 21. EXISTING POLE AND EQUIPMENT LOCATIONS ARE TO BE RELABLED AS INDICATED. BOTH THE NEW LOCATION NUMBER AND FORMER (IN BRACKETS) ARE SHOWN AT EACH POLE/EQUIPMENT LOCATION. (i.e. P1234(123)).
6. CONTRACTOR TO PERFORM ALL NECESSARY SWITCHING AND FINAL ENERGIZATION.
7. JOINT-USE ARRANGEMENTS WITH BELL CANADA, ROGERS CABLE AND ENBRIDGE MUST BE COORDINATED BY THE CONTRACTOR.
8. STREET LIGHTING INSTALLATION SHALL BE INSPECTED AND APPROVED BY THE ELECTRICAL SAFETY AUTHORITY (ESA)
9. MINIMUM HORIZONTAL CLEARANCE FROM FOREIGN UTILITIES SHALL BE MAINTAINED IN ACCORDANCE WITH APPENDIX 'O' AND TREE PROTECTION ZONE CLEARANCES SHALL BE ADHERED TO AS PER APPENDIX 'F' OF THE CITY OF TORONTO'S MUNICIPAL CONSENT REQUIREMENTS.
10. CONTRACTOR RESPONSIBLE FOR OBTAINING HOLD-OFFS WHEN NECESSARY
11. ASSUME THAT ALL CABLES ARE ENERGIZED AND OPERATING AT A NORMAL VOLTAGE OF 750 VOLTS OR MORE UNLESS OTHERWISE STATED.
12. ALL WORK ON THIS DRAWING SHALL BE PERFORMED BY THE CONTRACTOR UNLESS OTHERWISE STATED.
13. COMPLETE ALL PRELIMINARY WORK TO MINIMIZE POWER INTERRUPTION TO CUSTOMER.
14. IF NOT DIMENSIONED. POLE TO BE MOVED 0.5m OF EXISTING LOCATION, IN LINE WITH EXISTING POLE LINE.
15. ANY DAMAGE TO THE EXISTING UTILITIES IS TO BE DOCUMENTED AND WILL REQUIRE IMMEDIATE REPAIR. THE COST OF THE REPAIR IS THE RESPONSIBILITY OF THE CONTRACTOR.
16. CONTRACTOR TO OBTAIN AND RECORD THE HORIZONTAL AND VERTICAL LOCATION OF PROPOSED AND EXISTING INFRASTRUCTURE AS PER STD 31-0800.
17. RETURN RECOVERED CABLE, EQUIPMENT AND ASSOCIATED HARDWARE TO THESL STORE.

AS BUILT

AS CONSTRUCTED ROAD CUT						
PERMIT #:	STREET #:		TO #:		FROM #:	
	RATED DEPTH [RD] (mm)	DEPTH [D] (mm)	WIDTH [D] (mm)	LENGTH [D] (mm)	PREMIUM FACTOR	TOTAL (sq.m)
ASPHALT						
BOULEVARD (DRIVEWAY)						
LOCAL ROAD						
ARTERIAL AND COLLECTOR ROADS						
GRIND AND PAVE						
CONCRETE						
SIDEWALK	85	100	200	300	1.17	0.2 sq.m
MONOLITHIC CURB AND S/W						
ROAD BASE						

CUT PERMIT INFORMATION				
THESL APPLICATION #	PERMIT #	FROM	TO	STREET
THA-F-2023-XXXXX	XXXXXXXX			

DRAWING INDEX			
SHEET	DRAWING #	REV #	DRAWING TYPE
1	2023-1007806	0	TITLE SHEET
2	2023-1007807	0	PRIMARY SCHEMATIC
3	2023-1007808	0	ELECTRICAL PLAN

AS CONSTRUCTED
ELECTRICAL / CIVIL WITH CHANGES AS SHOWN ON THIS DRAWING
Municipality: ET, EY, NY, YK, TO, SC
Marked By — Date: 1/10/24
Approved by Toronto Hydro NBM — Cornel Pascal
Digitally signed by Cornel Pascal, cn=Cornel Pascal, ou=Users, email=cornelp@nbmengineering.com, 2024.03.05 09:18:48 -05'00'
CONTRACTOR COMPANY NAME — 1/10/24
This is to certify that the construction as recorded in this drawing is consistent with the approved plan, Standard Designs, work instruction and that approved equipment has been used.

CERTIFICATE OF APPROVAL

THIS WORK INSTRUCTION HAS BEEN ASSEMBLED UTILIZING ONLY CERTIFIED CONSTRUCTION STANDARDS, SPECIFICATIONS, APPROVED EQUIPMENT AND MEETS SAFETY REQUIREMENTS OF SECTION 4 OF THE ONTARIO REGULATION 22/04.

JOHN HECIMOVIC — NAME OF ENGINEER — DATE
SIGNATURE OF P.ENG. — ELECTRICAL DESIGN SUPERVISOR — POSITION

CPC23-036 — POWERLINE PLUS Ltd.

ODAN·DETECH CONSULTING ENGINEERS
The Odan/Detech Group Inc. 5230 SOUTH SERVICE ROAD, BURLINGTON, ONTARIO, L7L 5K2

rev.	date	description of revision	by	design approval	construction approval
0	2023/09/28	ISSUED FOR CONSTRUCTION	L.H.	J.H.	S.R.

TORONTO HYDRO

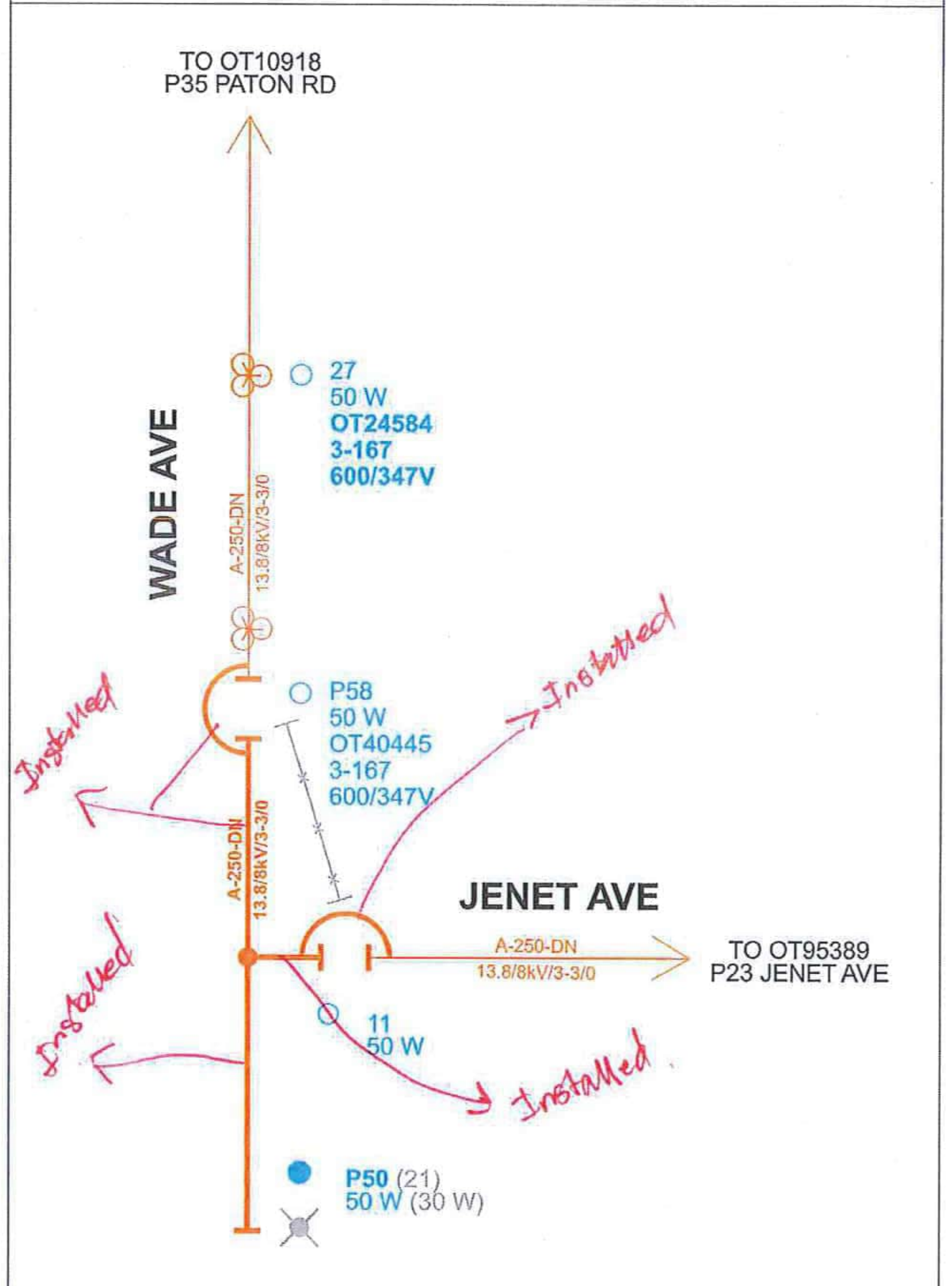
TORONTO HYDRO REVIEWED BY
Department: CPE
Contract Administrator: ARIFF MAREDIA
Signature:
Date: Oct 02, 2023

project reference #: C-230038-W10502-HT003	civil design:	date:
drawn by: L. HOANG	civil design approval:	date:
department/division: CPE	electrical design: L. HOANG, ODAN DETECH	date: 2023/07/13
district: TORONTO	electrical design approval: J. HECIMOVIC, ODAN DETECH	date: 2023/07/13
scale: N.T.S; sheet size: D	construction approval: S. RUSCETTI, PLP	date: 2023/07/13

location: WADE AVE
project title: 77 WADE TEMP
dwg. type: TITLE PAGE
dwg. no.: 2023–1007806 — sheet no. 1 of 3 — rev. no. 0

$$dateSS

SITE: 77 WADE AVE



FEEDER A-250-DN

PRIMARY SCHEMATIC LEGEND

SYMBOL	DESCRIPTION
	PROPOSED
(orange line)	OVERHEAD 3-PHASE PRIMARY CABLE (SIZE AS INDICATED)
(filled dot)	POLE (TORONTO HYDRO OWNED) (UNSCALED)
(transformer symbol)	THREE 1-PHASE WYE POLE-MOUNTED TRANSFORMER
(small dot)	CONNECTION NODE OR TAP
	EXISTING
(thin line)	OVERHEAD 3-PHASE PRIMARY CABLE (SIZE AS INDICATED)
(open circle)	POLE (TORONTO HYDRO OWNED) (UNSCALED)
(transformer symbol)	THREE 1-PHASE WYE POLE-MOUNTED TRANSFORMER
	REMOVED
(crossed line)	OVERHEAD 3-PHASE PRIMARY CABLE (SIZE AS INDICATED)
(crossed pole)	POLE (TORONTO HYDRO OWNED) (UNSCALED)

DISCONNECTION OF UNUSED LINE WORK INSTRUCTIONS:

THE FOLLOWING PROCEDURES ARE MANDATORY IN ORDER TO COMPLY WITH THE REQUIREMENTS OF SECTION 11 "DISCONNECTION OF UNUSED LINES" OF ONTARIO REGULATION 22/04. NO EXCEPTIONS ARE THEREFORE PERMITTED. IF REMOVING AND/OR ABANDONING DISTRIBUTION LINES OF 750 VOLTS OR MORE, EITHER DIRECT BURIED OR IN UNDERGROUND DUCTS, THE FOLLOWING PROCEDURES ARE TO BE OBSERVED IN ORDER:

- REMOVE THE LINES COMPLETELY. MARK THE LINES AS "REMOVED" ON AS-BUILT DRAWING(S). SEND THE AS-BUILT DRAWING(S) TO THE CONTRACT ADMINISTRATOR AT TORONTO HYDRO.
- IF NOT REMOVED, DISCONNECT AND GROUND THE LINES AS PER TORONTO HYDRO STANDARD #16-0020. MARK THE LINES AS "GROUNDED" ON THE AS-BUILT DRAWING(S). SEND THE AS-BUILT DRAWING(S) TO THE CONTRACT ADMINISTRATOR AT TORONTO HYDRO.
- IF REMOVAL OR GROUNDING OF SUCH LINES IS NOT PRACTICAL, MARK THE LINES AS "UNGROUNDED" ON AS-BUILT DRAWING(S). SEND THE AS-BUILT DRAWING(S) TO THE CONTRACT ADMINISTRATOR AT TORONTO HYDRO. IN ADDITION, CONTACT THE SUPERVISOR, STANDARDS & MATERIALS SECTION AT TORONTO HYDRO WITH THE INFORMATION SUCH AS VOLTAGE, FEEDER DESIGNATION, AND LOCATION OF SUCH LINES.

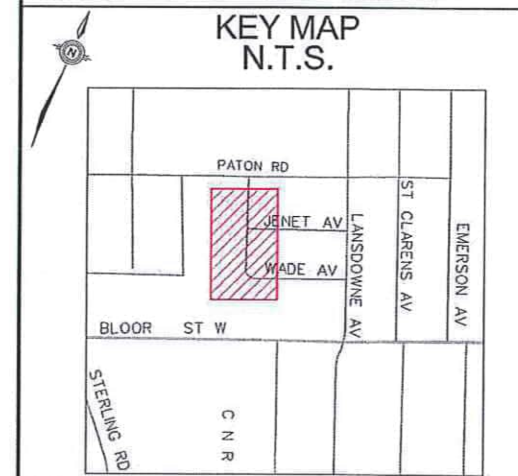
FIELD VALIDATION
☐Conceptual Primary Schematic
☐Preliminary Primary Schematic
SIGN-OFF
J. HECIMOVIC — Supervisor (Print Name & Signature)
J. HECIMOVIC — Planner/Designer (Print Name & Signature)

AS CONSTRUCTED — ☐ ELECTRICAL ☐ CIVIL — WITH CHANGES AS SHOWN ON THIS DRAWING.
Marked By — Approved by Toronto Hydro (NBM Inspector: Cornel Pascal) — CONTRACTOR / COMPANY NAME
Municipality: ☐ET ☐EY ☐NY ☐YK ☐TO ☐SC
Date: 1/10/24, 1/10/24, 1/10/24, 1/10/24, 1/10/24

AS BUILT

REFER TO TITLE SHEET DRAWING #2023-1007806 FOR ACCOMPANYING PROJECT DRAWINGS

KEY MAP
N.T.S.



CERTIFICATE OF APPROVAL

THIS WORK INSTRUCTION HAS BEEN ASSEMBLED UTILIZING ONLY CERTIFIED CONSTRUCTION STANDARDS, SPECIFICATIONS, APPROVED EQUIPMENT AND MEETS SAFETY REQUIREMENTS OF SECTION 4 OF THE ONTARIO REGULATION 22/04.

JOHN HECIMOVIC — NAME OF ENGINEER — DATE
SIGNATURE OF P.ENG. — ELECTRICAL DESIGN SUPERVISOR — POSITION

CPC23-036

POWERLINE PLUS Ltd.

ODAN·DETECH CONSULTING ENGINEERS

rev.	date	description of revision	by	design approval	construction approval
0	2023/09/28	ISSUED FOR CONSTRUCTION	LH	J.H.	S.R.

TORONTO HYDRO

TORONTO HYDRO REVIEWED BY
Department: CPE
Contract Administrator: AKIFF MAREDIA
Date: Oct 02, 2023

project reference # C-230038-W10502-HT003	civil design	date
drawn by L. HOANG	civil design approval	date
department/division CPE	electrical design L. HOANG, ODAN DETECH	date 2023/07/13
district TORONTO	electrical design approval J. HECIMOVIC, ODAN DETECH	date 2023/07/13
scale N.T.S / sheet size D	construction approval S. RUSCETTI, PLP	date 2023/07/13

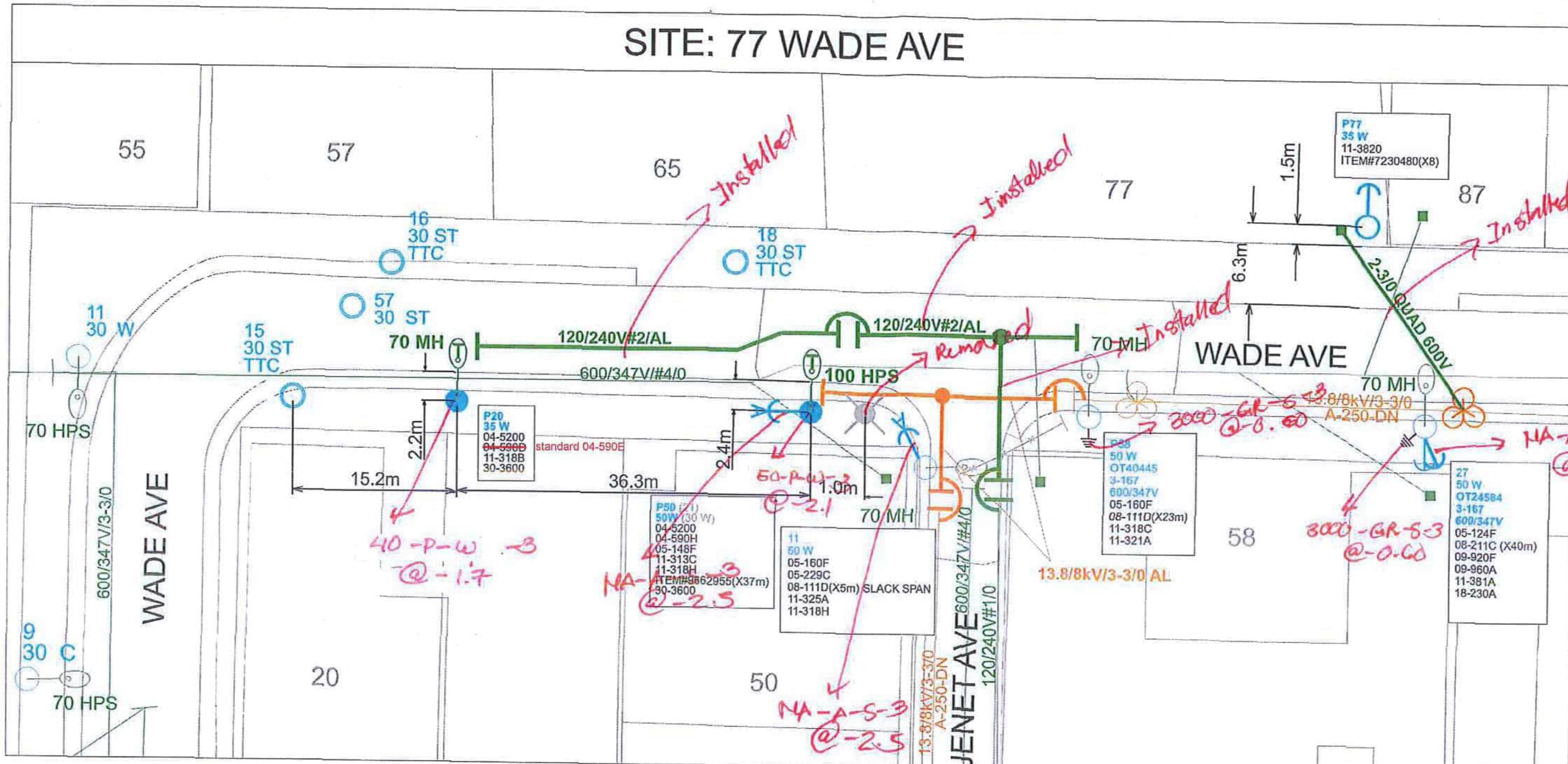
location: WADE AVE
project title: 77 WADE TEMP
dwg. type: PRIMARY SCHEMATIC

dwg. no.	sheet no.	rev. no.
2023–1007807	2 of 3	0

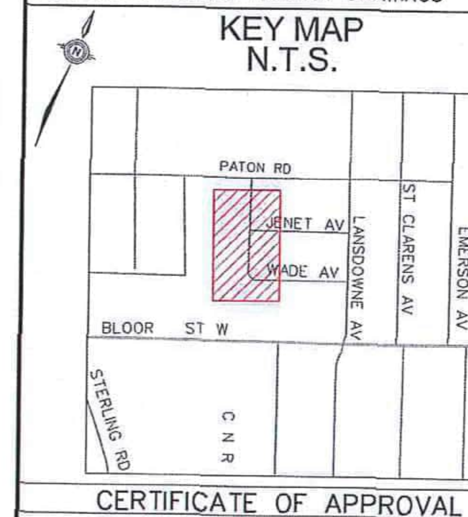
$$date$$

REFER TO TITLE SHEET DRAWING #2023-1007806 FOR ACCOMPANYING PROJECT DRAWINGS

SITE: 77 WADE AVE



KEY MAP
N.T.S.



CERTIFICATE OF APPROVAL

THIS WORK INSTRUCTION HAS BEEN ASSEMBLED UTILIZING ONLY CERTIFIED CONSTRUCTION STANDARDS, SPECIFICATIONS, APPROVED EQUIPMENT AND MEETS SAFETY REQUIREMENTS OF SECTION 4 OF THE ONTARIO REGULATION 22/04.

JOHN HECIMOVIC — NAME OF ENGINEER — DATE

SIGNATURE OF P.ENG. — ELECTRICAL DESIGN SUPERVISOR — POSITION

POWERLINE PLUS Ltd.

CPC23-036

ODAN·DETECH CONSULTING ENGINEERS

ELECTRICAL LEGEND

SYMBOL	DESCRIPTION
	PROPOSED
	OVERHEAD 3-PHASE PRIMARY CABLE (SIZE AS INDICATED)
	OVERHEAD SECONDARY CABLE (SIZE AS INDICATED)
	PRIMARY DEAD-END 3-PHASE OR 1-PHASE
	SECONDARY DEAD-END 1-PHASE
	HOME SUPPLY POINT
	STREET LIGHT WITH PHOTOCELL
	POLE (TORONTO HYDRO OWNED) (UNSCALED)
	POLE (FOREIGN) (UNSCALED)
	THREE 1-PHASE WYE POLE-MOUNTED TRANSFORMER
	DOWN GUY WITH ANCHOR
	STRUT GUY
	GROUND POINT
	REMOVED
	OVERHEAD 3-PHASE PRIMARY CABLE (SIZE AS INDICATED)
	POLE (TORONTO HYDRO OWNED) (UNSCALED)
	POLE (FOREIGN) (UNSCALED)
	EXISTING
	OVERHEAD 3-PHASE PRIMARY CABLE (SIZE AS INDICATED)
	OVERHEAD SECONDARY CABLE (SIZE AS INDICATED)
	PRIMARY DEAD-END 3-PHASE OR 1-PHASE
	SECONDARY DEAD-END 1-PHASE
	POLE (TORONTO HYDRO OWNED) (UNSCALED)
	POLE (FOREIGN) (UNSCALED)
	STREET LIGHT WITH PHOTOCELL
	TRANSFER
	STREET LIGHT WITH PHOTOCELL
	GROUND POINT

GUYING AND ANCHORING SCHEDULE

POLE DETAILS		GUYING DETAILS				ANCHOR DETAILS		
POLE NUMBER	STREET NAME	GUYING TYPE	ATTACHMENT HEIGHT (m)	STRUT BAR HEIGHT (m)	GUYING STANDARD	LEAD LENGTH (m)	ORIENTATION	ANCHORING STANDARD
27	WADE	DOWN	7.25m, 7.55m	-	07-510GX2	3.0m	NE	07-210D
11	JENET	STRUT	11.2, 12.3m	3.5m	07-522G	3.0m	W	07-210D
P50	WADE	STRUT	11.15m, 12.4m	3.5m	07-522G	3.0m	S	07-210D

WORK BY TORONTO HYDRO:

1. SUPPLY AND INSTALL PROPOSED 3-PHASE TRANSFORMER BANK AT EXISTING POLE 27 AS PER STD. 11-381A AND 11-3820.
2. SUPPLY AND INSTALL 2-3/0 QUADPLEX SECONDARY CONDUCTOR FROM EXISTING POLE 27 TO CUSTOMER POLE AS PER STD. 11-381A AND 11-3820.
3. INSTALL PROPOSED GUYING AND ANCHOR AT EXISTING POLE 27 AS PER STD. 07-210D AND 07-510G AS SHOWN.
4. SUPPLY AND INSTALL PROPOSED 35' WOOD POLE P20 AS PER STD. 04-5200 AND 04-590D. FRAME POLE P20 AS PER STD. 11-318B. TRANSFER SECONDARY TO PROPOSED POLE 20 AND TRANSFER STREETLIGHT FROM EXISTING POLE 57 TO PROPOSED POLE 20 AS PER STD. 30-3600. DISCONNECT AND REMOVE STREETLIGHT FEED TO EXISTING POLE 57.
5. SUPPLY AND INSTALL PROPOSED 50' WOOD POLE 50 AS PER STD. 04-5200 AND 04-590H. FRAME NEW POLE AS PER STD. 05-148F, 11-313C AND 11-318H. INSTALL #2 AL TRIPLEX CONDUCTOR FROM POLE P58 TO PROPOSED POLE P20 (ITEM# 9662925 X50m) AS SHOWN. TRANSFER EXISTING STREETLIGHT TO PROPOSED P50 AS PER 30-3600. TRANSFER SECONDARY LATERALS TO PROPOSED POLE P50 FROM EXISTING POLE 21. REMOVE EXISTING 30' WOOD POLE 21.
6. INSTALL PROPOSED GUYING AND ANCHOR AT PROPOSED POLE P50 AS PER STD. 07-210D AND 07-522G.
7. RE-FRAME EXISTING PRIMARY CONDUCTOR AT EXISTING POLE P58 AS PER STD. 05-160F.
8. INSTALL NEW PRIMARY CONDUCTOR FROM EXISTING POLE P58 TO PROPOSED POLE P50 AS PER STD. 08-111D.
9. RE-FRAME EXISTING POLE 11 AS PER STD. 05-160F. SLACK SPAN PROPOSED 5m OF 3/0 ACSR CONDUCTOR TO MID-SPAN TAP AS PER STD. 05-229C.
10. *INSTALL PROPOSED GUYING AND ANCHOR AT EXISTING POLE 11 AS PER STD. 07-210D AND 07-522G.*
11. INSTALL 120.240V SECONDARY MID-SPAN TAP FROM EXISTING POLE 11 AS PER 11-325A TO PROPOSED SECONDARY CONDUCTOR.

WORK BY CUSTOMER:

1. SUPPLY AND INSTALL PROPOSED 35' CUSTOMER-OWNED POLE P77 AS PER TORONTO HYDRO STANDARDS.
2. SUPPLY AND INSTALL DOWNGUY AND ANCHOR (3.0m LEAD LENGTH) AS PER TORONTO HYDRO STANDARDS.
3. CUSTOMER TO SUPPLY AND INSTALL WEATHERHEAD, SERVICE MAST AND CLEVIS AS PER STD. 11-3820.
4. OBTAIN ESA AUTHORIZATION PRIOR TO ENERGIZATION.

DISCONNECTION OF UNUSED LINE WORK INSTRUCTIONS:

THE FOLLOWING PROCEDURES ARE MANDATORY IN ORDER TO COMPLY WITH THE REQUIREMENTS OF SECTION 11 "DISCONNECTION OF UNUSED LINES" OF ONTARIO REGULATION 22/04. NO EXCEPTIONS ARE THEREFORE PERMITTED. IF REMOVING AND/OR ABANDONING DISTRIBUTION LINES OF 750 VOLTS OR MORE, EITHER DIRECT BURIED OR IN UNDERGROUND DUCTS, THE FOLLOWING PROCEDURES ARE TO BE OBSERVED IN ORDER:

- REMOVE THE LINES COMPLETELY. MARK THE LINES AS "REMOVED" ON AS-BUILT DRAWING(S). SEND THE AS-BUILT DRAWING(S) TO THE CONTRACT ADMINISTRATOR AT TORONTO HYDRO.
- IF NOT REMOVED, DISCONNECT AND GROUND THE LINES AS PER *TORONTO HYDRO STANDARD #16-0020. MARK THE LINES AS "GROUNDED"* ON THE AS-BUILT DRAWING(S). SEND THE AS-BUILT DRAWING(S) TO THE CONTRACT ADMINISTRATOR AT TORONTO HYDRO.
- IF REMOVAL OR GROUNDING OF SUCH LINES IS NOT PRACTICAL, MARK THE LINES AS "UNGROUNDED" ON AS-BUILT DRAWING(S). SEND THE AS-BUILT DRAWING(S) TO THE CONTRACT ADMINISTRATOR AT TORONTO HYDRO. IN ADDITION, CONTACT THE SUPERVISOR, STANDARDS & MATERIALS SECTION AT TORONTO HYDRO WITH THE INFORMATION SUCH AS VOLTAGE, FEEDER DESIGNATION, AND LOCATION OF SUCH LINES.

FIELD VALIDATION

☐ Conceptual Primary Schematic
☐ Preliminary Primary Schematic

SIGN-OFF

J. HECIMOVIC — Supervisor (Print Name & Signature)
J. HECIMOVIC — Planner/Designer (Print Name & Signature)

AS CONSTRUCTED

☑ ELECTRICAL ☐ CIVIL WITH CHANGES AS SHOWN ON THIS DRAWING.

Municipality: ☐ ET ☐ EY ☐ NY ☐ TK ☑ TO ☐ SC

Marked By — Date 1/10/24
Approved by Toronto Hydro — NBM Inspector — Cornel Pascal

Digitally signed by Cornel Pascal DN: cn=Cornel Pascal, ou=Users, email=cornelp@nbmengineering.com Date: 2024.03.05 09:19:54 -05'00'

CONTRACTOR COMPANY NAME — 1/10/24

This is to certify that the construction as recorded on this drawing is consistent with the approved plan, Standard Designs, or work instruction and that approved equipment has been used.

rev.	date	description of revision	by	design approval	construction approval
0	2023/09/28	ISSUED FOR CONSTRUCTION	LH	J.H.	S.R.

TORONTO HYDRO

TORONTO HYDRO REVIEWED BY
Department: CPE
Contract Administrator: AKIFF MAREDIA
Signature:
Date: Oct 02, 2023

project reference #: C-230038-W10502-HT003		civil design:	date: yyyy/mm/dd
drawn by: L. HOANG		civil design approval:	date: yyyy/mm/dd
department/division: CPE		electrical design: L. HOANG, ODAN DETECH	date: 2023/07/13
district: TORONTO		electrical design approval: J. HECIMOVIC, ODAN DETECH	date: 2023/07/13
scale: N.T.S	sheet size: D	construction approval: S. RUSCETTI, PLP	date: 2023/07/13

location: WADE AVE

project title: 77 WADE TEMP

dwg. type: ELECTRICAL PLAN

dwg. no.	sheet no.	rev. no.
2023-1007808	3 Of 3	0

$$date$$

TORONTO HYDRO - ELECTRIC SYSTEM LIMITED

PROJECT NUMBER: 231-60000-11

THESL PROJECT NUMBER: P-220200-WD151001

NGF1 OH VC W. PCB PHASE 1A
PROJECT FINALIZATION REPORT

FEBRUARY 21, 2024

CONFIDENTIAL

TORONTO HYDRO

CONSTRUCTION FOLDER AND FORM(S)

Project Name/Location NGF1 OH VC W. PCB PHASE 1A		CAPEX
Project # P-220200-WD151001	W.O. #	OPEX
Work Request #		DB
Construction DRP Munish Multani		CLAIMS
Work # 416-994-6424	Mobile #	
Design Supervisor Francine Xu		
Work # 647-281-9338	Mobile #	
Design Technician Salah Rana		
Work # 905-761-8156	Mobile #	

Feeders Associated with Project:	Type of Work Location(s):	Project Management Date of Issue:
55-M4	Armel Ct, Albion Road	
NG-F1		October 31, 2022
Notice of Project #: 23eN681639 23eN738662	Scheduled Completion Date December 31, 2023	

REPORT NUMBER: 231-60000-11_REPT-0001_R.0

NGF1 OH VC W. PCB PHASE 1A

PROJECT FINALIZATION REPORT

THESL

PROJECT FINALIZATION REPORT (REV. 0)
CONFIDENTIAL

PROJECT NO.: 231-60000-11
THESL PROJECT NUMBER: P-220200-WD151001
DATE: FEBRUARY 21, 2024

WSP
100 COMMERCE VALLEY DRIVE WEST
THORNHILL, ONTARIO, L3T 0A1 CANADA
T: +1 905-882-1100

WSP.COM

CONTRIBUTORS

Owner: Toronto Hydro - Electric System Limited			
Contractor: Valard Construction LP			
Auditor: WSP Canada		**Signature**	**Date**
Site Auditor(s):	Doug Jamieson Electrical Auditor		Feb 21 2024
Prepared by:	Diya George PCO		Feb 21 2024
Approved by:	Kamran Fallahi WSP DRP for A&V Program		Feb 21 2024

Notes:

Contractor to confirm on Civil GCF
Contractor to provide revised ECF Summary Sheet

TABLE OF CONTENTS

APPENDICES

For remaining Appendices, please check zipped folder with title "Appendices.zip".

1 PROJECT BACKGROUND

1.1 GENERAL INFORMATION

THESL Project #	P-220200-WD151001
Project Name	NGF1 OH VC W. PCB PHASE 1A
Department	CPW
Pre-Job Meeting Date	Feb 9 2023
THESL Contract Administrator (CA)	Francine Xu
Contractor	Valard
Construction Period	MAY 2023 -JAN 2024
WSP Field Auditor(s)	Doug Jamieson
WSP Certified Engineer	Kamran Fallahi
Audit Period	MAY 2023 -JAN 2024
Attainment Date	DEC 22 2023
# of NCRs	N/A
GCF Score	94.4%

Project Location

TORONTO HYDRO

NGF1 OH VC W. PCB PHASE 1A

P-220200-WD151001

KEY MAP

Project Drawings

DRAWING INDEX			
SHEET	**DRAWING #**	**REV #**	**DRAWING TYPE**
1	2022-018815	3	TITLE SHEET
2	2023-1008621	0	DETAILS
3	2022-018816	1	PRIMARY SCHEMATIC
4	2022-018817	3	OH & ELECTRICAL PLAN
5	2022-018818	3	CIVIL PLAN 1of 2
6	2022-018819	3	CIVIL PLAN 2 of 2

1.2 SCOPE BRIEF DESCRIPTION

High Level Description of Work

The scope of work included to rebuild the existing aged and unreliable overhead infrastructure on feeder NGF1 including poles with non-standard insulators and extension brackets , conductors , overhead transformers and vault transformers

1.3 ASSETS INSTALLATION AND REMOVAL

- 1 Transformer install and removal.
- 1 Pole install and removal.

2 PROJECT AUDIT SERVICE DESCRIPTION

The scope of work for the Project audit services involved evaluating the Project Execution with attending in the Pre-job meeting, site inspection during execution and finally close out the Project. It also involved QA functions and high-level oversight of QC of construction activities have been performed by Contractor as listed below:

- Attending in Pre-Con meeting.
- Performed audit of all the Project activities and compared them with the required standard and best practice.
- Verified material/equipment acquired by contractor (delivered by THESL to the Contractor) is in accordance with the Bill of Material (Prelim BOM attached) and is in accordance with THESL standard specifications.
- Verified contractors' adherence to Applicable Laws & Guidelines and Safety.
- Conducted QA and workmanship verification/reporting to confirm construction work conforms to construction drawings approved by THESL, THESL standards and specifications and Canadian regulation.
- Conducted site inspection and provided Audit field support and audit daily report and prepared report on deficiencies.
- Validated and documented all the required construction changes from original design using Change Order process. Validate completion of all changes.
- Prepared all of document/report safety infractions and reflecting site safety and field safety awareness in site daily report.
- Observed project execution and reviewed contractor performance in order to check for any non-comply situation and in case of any issue, to raise a Quality, Safety or Admin Non-Compliance Reports to contractor.
- Validated all required forms, permits and approvals before any execution on job site.
- Verified Contractor UPCMS Billing sheets.
- Verified Contractor Change Orders. (Not applicable for this project)
- Verified markup drawings and As-Built drawings that have been prepared by Contractor.

3 APPENDICES SUMMARY

ITEM	STATUS / COMMENT	APPENDIX REF.
Certificate of Substantial Completion	Completed	Appendix A
Final Quality Assurance Checklist	Completed	Appendix B
Final Walkdown Checklist	Completed	Appendix C
Non-Compliance Reports	N/A	N/A
Prelim BOM Verification Report	Completed	Appendix E
Critical Task Checklist	Completed	Appendix F
Pre-Job Meeting Memo and EHS Form	Completed	Appendix G
Completed Contractor UPCMS Billing Sheets and Supporting Documentation	Completed	Refer to folder “Appendices.zip”
Contractor Close-Out GCF Verification Checklist	Completed	Refer to folder “Appendices.zip”
THESL Department Requisition (Electrical)	Completed	Refer to folder “Appendices.zip”
Asset Installation Checklist	Completed	Refer to folder “Appendices.zip”
Change Orders and Change Order Log	Completed	Refer to folder “Appendices.zip”
Equipment Change out Record	Completed	Refer to folder “Appendices.zip”
Nomenclature Labelling Report	Completed	Refer to folder “Appendices.zip”
ECF Summary Sheet	Completed	Refer to folder “Appendices.zip”
Investment Recovery Forms	Completed	Refer to folder “Appendices.zip”
As Built Drawings Signed	Completed	Refer to folder “Appendices.zip”
GCF Back Signed	Completed	Refer to folder “Appendices.zip”
Street Light Change Forms	N/A	N/A
Material Return Forms	Completed	Refer to folder “Appendices.zip”
TPTF Forms	Completed	Refer to folder “Appendices.zip”

APPENDIX

A CERTIFICATE OF SUBSTANTIAL COMPLETION

FORM 6
CERTIFICATE OF SUBSTANTIAL PERFORMANCE OF THE CONTRACT UNDER SECTION 32 OF THE ACT

Construction Lien Act

Ontario / Toronto ,

(County/District/Regional Municipality/Town/City in which premises are situated)

Armel Court and Albion Road, Toronto, ON M9W 3P1, Canada ,

(street address and city, town, etc., or, if there is no street address, the location of the premises)

This is to certify that the contract for the following improvement:

P-220200-WD151001 - NGF1 OH VC W. PCB PHASE 1A

(short description of the improvement)

to the above premises was substantially performed on December 22, 2023 .

(date substantially performed)

Date certificate signed: February 21 2024 .

LICENSED PROFESSIONAL ENGINEER
K. FALLAHI
100196231
2024-2-21
PROVINCE OF ONTARIO

WSP Canada - Kamran Fallahi

(payment certifier where there is one)

Toronto Hydro Electric System Limited

(owner and contractor, where there is no payment certifier)

Name of owner: Toronto Hydro Electric System Limited

Address for service: 14 Carlton Street, Toronto, ON, M5B 1K5

Name of contractor: Valard Construction LP

Address for service: 4209 99 Street, Edmonton Alberta T6E 5V7, Canada

Name of payment certifier (where applicable): WSP Canada

Address: 100 Commerce Valley Drive East, Thornhill, Ontario, L3T 0A1

(Use A or B, whichever is appropriate)

☐ A. Identification of premises for preservation of liens:

NA

(where liens attach to premises, reference to lot and plan number or instrument registration number)

☑ B. Office to which claim for lien must be given to preserve lien:

Toronto Hydro Electric System - LTD (14 Carlton Street, Toronto, ON, M5B 1K5)

(where liens do not attach to premises)

APPENDIX

B FINAL QUALITY ASSURANCE CHECKLIST

Final Quality Assurance Checklist

Electrical Inspector:	Civil Inspector:	Audit Date:
Doug Jamieson		**Feb. 6, 2024**
Project Number:	**Project Name:**	
P-220200-WD151001	**NGF1 OH VC W. PCB PHASE 1A**	

No.	Project Deficiency List Sign Off (Safety, Quality) Status	Yes	No	N/A	Comments
1	Safety NCRs	☐	☒	☐	
2	Quality and Administrative NCRs	☐	☒	☐	
3	Incomplete Work Ticket	☐	☒	☐	
4	All Safety, Quality and Administrative NCRs have been resolved and closed	☐	☒	☐	
5	All Incomplete Work Ticket NCRs have been submitted for follow-up	☐	☒	☐	
6	All deficiencies (including ESA identified deficiencies) have been rectified by the Contractor	☐	☒	☐	
No.	**As-Built Drawings Status**	**Yes**	**No**	**N/A**	**Comments**
7	All as-built drawings have been submitted and verified by auditor	☒	☐	☐	
8	All as-built drawings have been stamped and signed	☒	☐	☐	
9	Any CVP or 34-1000 Deviation from the approved drawings	☒	☐	☐	
10	All changes and deviations from design are marked-up on the As-Built drawings	☒	☐	☐	
11	As-built drawings match with the Nomenclature and ECF forms	☒	☐	☐	
12	Drawings are complying with CSA-S250 & 31-0800 and are all clear/readable	☐	☐	☐	
No.	**Safety**	**Yes**	**No**	**N/A**	**Comments**
13	All of the activities performed in safety manner	☒	☐	☐	
14	Traffic Paid Duty	☒	☐	☐	
15	Is the site left safe and ready to operate	☒	☐	☐	
16	Is there any hazards left on site after day-work is finished	☐	☒	☐	

No.	Adherence to Critical Task Checklist (Civil)	Yes	No	N/A	Comments
17	Vaults/Chamber Build	☐	☐	☒	
18	Remove/Lift Slab test at vault	☐	☐	☒	
19	Breaking into ducts or ductbanks containing energized cable	☐	☐	☒	
20	Duct radius installation	☒	☐	☐	
21	Mandrelling of ducts	☒	☐	☐	
22	Pumping of water from structures	☐	☒	☐	
23	Cutting of Asphalt on City roads	☒	☐	☐	
24	Tunneling & boring	☐	☒	☐	
25	Directional drilling	☐	☒	☐	
26	Core Drilling into Energized Vaults/Chambers	☐	☒	☐	
27	Drain connection to City sewer	☐	☒	☐	
28	Customer communication	☐	☒	☐	
29	Multiple contractor on Site	☒	☐	☐	
30	Site Restoration for City Road, Sidewalk and customer driveway have been completed as per standard and there was no outstanding restoration	☒	☐	☐	
No.	**Adherence to Critical Task Checklist (Electrical)**	**Yes**	**No**	**N/A**	**Comments**
31	Power Interruptions have been audited by site inspector	☒	☐	☐	
32	Life support	☐	☒	☐	
33	Working at a Hydro One Transformer Station Facility	☐	☒	☐	
34	Cable Identification/ Spearing	☐	☒	☐	
35	Transportation of Dangerous Goods or working in vicinity of hazardous materials	☐	☒	☐	
36	Inter-utility coordination	☐	☒	☐	
37	Delta to Wye Conversion	☐	☒	☐	
38	Padmounted Tx, Submersible Tx, Vault Tx, and Padmounted Switchgear final installation photographs prior to energization	☒	☐	☐	
No.	**Design Change / Change Order**	**Yes**	**No**	**N/A**	**Comments**
39	Any Design Change	☒	☐	☐	
40	Any Field Change	☐	☒	☐	
41	Any Change Order	☒	☐	☐	Still waiting for THESL
No.	**Professional Conduct**	**Yes**	**No**	**N/A**	**Comments**

42	Outage letters were issued on a timely basis	☒	☐	☐	
43	Customer requests & issues were dealt with & resolved in a Professional manner	☒	☐	☐	
44	Contractor dealt with public in a courteous and cooperative manner	☒	☐	☐	
45	Proper signage posted on construction site as per THESL and MCR requirements	☒	☐	☐	
46	Cut Permits are valid during cutting of City Road/Side walks	☒	☐	☐	

No.	Lessons Learned & Areas for Improvement	Comments
47	**For Contractor**	
48	**For Auditor**	none

APPENDIX

C FINAL WALKDOWN CHECKLIST

THESL - Final Walkdown Checklist (Regular)	
WSP Inspector Representative:	Doug.jamieson@wsp.com
Contractor Representative:	No
Date:	2024-01-17
THESL Department:	CPW
Project Number:	231-60000-11
Project Location:	Armed crt
THESL CA:	Francine
THESL Project Number:	
Project Name:	Ngf1

1- SITE OBSERVATION/VERIFICATION					
No.	**Finding**	**YES**	**NO**	**N/A**	**Comments**
1-1	Project scope of work has been completed as defined in IFC drawings	☑	☐	☐	
	All equipment been installed and energized as per final primary schematic	☑	☐	☐	
	All assets requiring P&C have been commissioned (if applicable)	☐	☐	☑	
1-2	All electrical work removal (including OH, UG and street lighting) has been completed	☑	☐	☐	
	All civil work removal has been completed	☑	☐	☐	
	All cables are either: - Properly terminated at both ends, or	☑	☐	☐	
	- Not terminated, and capped at both ends following THESL standard	☑	☐	☐	
1-3	All site area has been cleaned up and comply with City standard and MCR requirements	☑	☐	☐	Spring clean up required
	Site has been left safe with no undue hazards as per Ontario Reg 22/04	☑	☐	☐	
1-4	All temporary restorations have been completed as per MCR	☑	☐	☐	
	All customer restorations are completed, and debris removed	☑	☐	☐	
1-5	Is there any pole with 3rd party attachments has been remained on site	☑	☐	☐	At albion
	Has TPTF form been submitted by contractor	☐	☑	☐	
1-6	Nomenclature, phase markings etc. are installed as per standard	☑	☐	☐	
1-7	Field drawings have been checked for partial energization stamp, date and signed	☑	☐	☐	
1-8	All Site modification/changes captured either as As-Built or Red-Line Drawings	☐	☑	☐	Not yet
1-9	All deficiencies found have been sent to the Contractor for follow-up (Refer to Section-2)	☐	☐	☑	None found

1-10	Others	☐	☑	☐	

Inspector sign off:

WSP Inspector Representative: Doug.jamieson@wsp.com

(First name, Last name)

Date of the Final Walkdown 2024-01-17

(Year, Month, Day)

Inspector Signature: 

APPENDIX

D NON-COMPLIANCE REPORTS

(Not applicable)

APPENDIX

E BOM VERIFICATION REPORT

														WSP Verification							
Order	Activity	Reservation	Item number of reservation	Requirements date	Material	Material Description	Requirement Quantity	Base Unit of Measure	Removed quantity	Difference Quantity	Quantities as per original Estimate	Issued (Delivered) Quantities	Used Quantities	Differences Quantities (Issued - Used on site)	WSP Comments	Record of Returned items	Material Returned	$/unit	$ Need Return	$ Returned	
1000465854	0020	529901	1	1/16/2023	1400019	POLE 55' WESTERN RED CEDAR CLASS 2 AS	1	EA	1	0	1	1	1	0	1 installed			$ 1,778.69	$ -		
1000465858	0020	529904	2	2/21/2023	2500023	ANCHOR EXPANSION 12" DIAMETER ANCHOR	1	EA	1	0	1	1	1	0				$ 112.69	$ -		
1000465859	0020	529906	5	1/16/2023	6380011	INDICATOR FAULT UG 1PH INTEGRAL DISPLAY	3	EA	3	0	3	3	3	0				$ 235.74	$ -		
1000465859	0020	529906	1	1/16/2023	6663301	TRANSFORMER PADMOUNTED 3PH 150KVA	1	EA	1	0	1	1	1	0	1 installed			$22,784.12	$ -		
1000465856	0110	529902	53	1/16/2023	7105045	WIRE #2 19 STR CU SD AS PER ASTM B8	1	M	1	0	21	221	21	200	Material returned	MR 71355	180	$ 8.35	$ 1,669.94	$ 1,502.95	
1000465856	0120	529902	83	1/16/2023	7105045	WIRE #2 19 STR CU SD AS PER ASTM B8	1	M	1	0											
1000465858	0050	529904	26	2/21/2023	7105045	WIRE #2 19 STR CU SD AS PER ASTM B8	15	M	15	0											
1000465858	0060	529904	33	2/21/2023	7105045	WIRE #2 19 STR CU SD AS PER ASTM B8	1	M	1	0											
1000465882	0030	529908	5	1/16/2023	7105045	WIRE #2 19 STR CU SD AS PER ASTM B8	3	M	3	0											
1000465881	0030	529907	6	1/16/2023	7150236	CABLE QUAD 3 500 KCMIL CU XLPE/PVCJ	20	M	20	0	20	20	36	-16	Material returned	MR 71356	12	$ 132.05	-$ 2,112.74	$ 1,584.55	
1000465882	0080	529908	27	1/16/2023	7180050	RMO CABLE 1C 1/0 CU 28KV AS PER LATEST	300	M	616	-316	300	616	579	37	Material returned	MR 71354	40	$ 23.42	$ 866.43	$ 936.68	
1000465858	0030	529904	6	2/21/2023	7190130	<<< WIRE STEEL GUY 3/8" GRADE 180 (75M	30	M	75	-45	70	150	70	80	Item negligible. No need to return.			$ 2.45	$ 196.00		
1000465858	0040	529904	22	2/21/2023	7190130	<<< WIRE STEEL GUY 3/8" GRADE 180 (75M	40	M	75	-35											
1000465882	0080	529908	30	1/16/2023	9656456	CABLE TRIPLEX 1/0 AL USEI 90 BLACK/	10	M	290	-280	10	290	10	280	Material returned	MR 71354	280	$ 4.94	$ 1,382.88	$ 1,382.88	
1000465856	0120	529902	70	1/16/2023	9664048	SWITCH 200A 25KV SMD20 POWER FUSE FOR PO	3	EA	3	0	3	3	3	0	3 installed			$ 523.25	$ -		
1000465856	0090	529902	47	1/16/2023	9664153	PIPE, RISER, GALV 4" X 8', SCHEDULE 40	1	EA	1	0	1	1	0	1	0 as per JIS, No response, item assumed scrapped			$ 254.24			
1000465882	0020	529908	3	1/16/2023	100000025	KIT SPLICE COLD SHRINK 28KV FOR SPLICING	3	EA	3	0	3	3	0	3	Material returned	MR 71354	3	$ 363.77	$ 1,091.32	$ 1,091.32	
1000465856	0080	529902	42	1/16/2023	100001623	8' NON-FLANGED PVC U GUARD, SIZE 4"	2	EA	2	0	8	8	8	0				$ 176.88	$ -		
1000465856	0120	529902	67	1/16/2023	100001623	8' NON-FLANGED PVC U GUARD, SIZE 4"	6	EA	6	0											
1000465881	0020	529907	2	1/16/2023	7223032	CONNECTOR AL TERMINAL BUS "E"TYPE 6 - 2	3	EA	3	0	3	3	3	0				$ 97.58	$ -		
1000465856	0120	529902	87	1/16/2023	7700014	ARRESTER SURGE 21KV CLASS FOR 28KV GRDY	3	EA	3	0	3	3	3	0				$ 99.59	$ -		
1000465882	0030	529908	13	1/16/2023	7810040	TERMINATION KIT COLD SHRINK 28 KV 1/0 AL	3	EA	3	0	3	3	3	0				$ 127.14	$ -		
1000465856	0120	529902	68	1/16/2023	8220072	<<< BANDING STAINLESS STEEL, 3/4" X	3	FT	100	-97	3	100	3	97	Item negligible. No need to return.			$ 1.11			
1000465856	0080	529902	43	1/16/2023	9656533	GUARD CABLE 3 1/4" X 9' GALV	1	EA	1	0	1	1	1	0				$ 90.20	$ -		
1000465856	0120	529902	72	1/16/2023	9656698	BRACKET ARRESTER CUTOUT 3 PH DOUBLE	1	EA	1	0	1	1	1	0				$ 297.21	$ -		
1000465856	0120	529902	65	1/16/2023	9656892	STIRRUP EQUIPMENT GROUNDING FOR OPEN	3	EA	3	0	3	3	3	0				$ 112.20	$ -		
1000465856	0030	529902	20	1/16/2023	9663940	CROSSARM FIBREGLASS 7' 6" FOR DEADEND	1	EA	1	0	1	1	1	0				$ 408.56	$ -		
1000465858	0050	529904	24	2/21/2023	2470102	ROD 3/4" X 10' GRD STEEL GALV	1	EA	1	0	1	1	1	0				$ 27.71			
1000465858	0060	529904	31	2/21/2023	2470102	ROD 3/4" X 10' GRD STEEL GALV	1	EA	1	0	1	1	0	1	only 1 installed, remaining to be returned. No response, item assumed scrapped			$ 27.71			
1000465858	0070	529904	34	2/21/2023	2470102	ROD 3/4" X 10' GRD STEEL GALV	4	EA	4	0	4	4	0	4	only 1 installed, remaining to be returned. No response, item assumed scrapped			$ 27.71			
1000465882	0030	529908	8	1/16/2023	2200011	CLOTH SANDING GRIT P120 J WEIGHT	0.100	EA	0	0.100	0	0	0	0	Nothing to return						
1000465882	0020	529908	1	1/16/2023	9664193	<<< DUSTER SHEETING MILL ENDS WHITE	1	EA	1	0	1	1	1	0	Nothing to return						
1000465882	0030	529908	10	1/16/2023	9664193	<<< DUSTER SHEETING MILL ENDS WHITE	0.040	EA	0	0.040	0	0	0	0	Nothing to return						
1000465882	0060	529908	26	1/16/2023	9664193	<<< DUSTER SHEETING MILL ENDS WHITE	0.080	EA	0	0.080	0	0	0	0	Nothing to return						
1000465856	0090	529902	45	1/16/2023	2310024	STRAP PIPE 4" GALV STEEL 2 HOLE NO	6	EA	6	0	6	6	6	0	Nothing to return						
1000465856	0070	529902	36	1/16/2023	2320012	TIE CABLE TY-RAP NATURAL 8" LENGTH	1	EA	1	0	1	1	1	0	Nothing to return						
1000465856	0120	529902	84	1/16/2023	2320046	TIE CABLE TY-RAP BLACK 7.8" LENGTH	3	EA	3	0	3	3	3	0	Nothing to return						
1000465882	0050	529908	21	1/16/2023	2320047	TIE CABLE TY-RAP BLACK 14.6" LENGTH	3	EA	3	0	3	3	3	0	Nothing to return						
1000465858	0020	529904	1	2/21/2023	2400022	ANCHOR ROD 1" X 8' TRIPLE EYE AS PER	1	EA	1	0	1	1	1	0	Nothing to return						
1000465856	0020	529902	5	1/16/2023	2420202	BRACKET 9" POST TYPE STAND OFF	2	EA	2	0	2	2	2	0	Nothing to return						
1000465856	0020	529902	1	1/16/2023	2420238	BRACKET 15" POLE TOP ARMLESS 1 PIECE	1	EA	1	0	1	1	1	0	Nothing to return						
1000465858	0050	529904	29	2/21/2023	2430010	GUARD CABLE 3/4" X 8' GALV U TYPE	1	EA	1	0	1	1	1	0	Nothing to return						
1000465858	0050	529904	23	2/21/2023	2430025	GUARD CABLE 1/2" X 8' U TYPE B.	2	EA	2	0	2	2	2	0	Nothing to return						
1000465856	0080	529902	40	1/16/2023	2430041	GUARD STRAP 3 1/4" AS PER SPEC C83.55	6	EA	6	0	6	6	6	0	Nothing to return						
1000465882	0080	529908	31	1/16/2023	2430041	GUARD STRAP 3 1/4" AS PER SPEC C83.55	24	EA	24	0	24	24	24	0	Nothing to return						
1000465858	0030	529904	11	2/21/2023	2450001	CLAMP 3 BOLT FOR GUYING AS PER CSA	4	EA	4	0	4	4	4	0	Nothing to return						
1000465858	0040	529904	16	2/21/2023	2450001	CLAMP 3 BOLT FOR GUYING AS PER CSA	4	EA	4	0	4	4	4	0	Nothing to return						
1000465858	0030	529904	12	2/21/2023	2450007	GRIP PREFORMED FOR 3/8" GUY WIRE AS PER	6	EA	6	0	6	6	6	0	Nothing to return						
1000465858	0040	529904	13	2/21/2023	2450007	GRIP PREFORMED FOR 3/8" GUY WIRE AS PER	10	EA	10	0	10	10	10	0	Nothing to return						
1000465858	0030	529904	9	2/21/2023	2450011	GUY GUARD 2 1/4" ROUND X 7' POLYETHYLENE	2	EA	2	0	2	2	2	0	Nothing to return						
1000465882	0080	529908	37	1/16/2023	2450011	GUY GUARD 2 1/4" ROUND X 7' POLYETHYLENE	5	EA	5	0	5	5	5	0	Nothing to return						
1000465858	0030	529904	10	2/21/2023	2450013	GUY HOOK COMBINATION TYPE FOR 5/8" DIA	2	EA	2	0	2	2	2	0	Nothing to return						
1000465858	0030	529904	7	2/21/2023	2450018	INSULATOR 11" GUY STRAIN ROD	2	EA	2	0	2	2	2	0	Nothing to return						
1000465858	0040	529904	14	2/21/2023	2450018	INSULATOR 11" GUY STRAIN ROD	4	EA	4	0	4	4	4	0	Nothing to return						
1000465858	0040	529904	15	2/21/2023	2450026	GUY THIMBLE GALVANIZED 5/8" CLEVIS PIN	2	EA	2	0	2	2	2	0	Nothing to return						
1000465858	0030	529904	3	2/21/2023	2450039	SLEEVE SERVI FOR 3/8" GUY WIRE	2	EA	2	0	2	2	2	0	Nothing to return						
1000465858	0040	529904	17	2/21/2023	2450039	SLEEVE SERVI FOR 3/8" GUY WIRE	2	EA	2	0	2	2	2	0	Nothing to return						
1000465856	0020	529902	2	1/16/2023	2460028	STUD INSULATOR 3/4" X 1 7/8" AS PER CSA	3	EA	3	0	3	3	3	0	Nothing to return						
1000465856	0030	529902	14	1/16/2023	2510022	BOLT OVAL EYE 5/8" X 6" AS PER CSA	2	EA	2	0	2	2	2	0	Nothing to return						
1000465856	0050	529902	23	1/16/2023	2510027	BOLT OVAL EYE 5/8" X 16"- 11 UNC CW	1	EA	1	0	1	1	1	0	Nothing to return						
1000465856	0060	529902	31	1/16/2023	2510027	BOLT OVAL EYE 5/8" X 16"- 11 UNC CW	1	EA	1	0	1	1	1	0	Nothing to return						
1000465856	0120	529902	75	1/16/2023	2510120	BOLT MACHINE 3/8" X 1" GALV HEX HEAD	3	EA	3	0	3	3	3	0	Nothing to return						
1000465856	0020	529902	3	1/16/2023	2510188	BOLT MACHINE 5/8" X 10"- 11 UNC SQUARE	3	EA	3	0	3	3	3	0	Nothing to return						
1000465856	0040	529902	21	1/16/2023	2510188	BOLT MACHINE 5/8" X 10"- 11 UNC SQUARE	1	EA	1	0	1	1	1	0	Nothing to return						
1000465856	0020	529902	4	1/16/2023	2510190	BOLT MACHINE 5/8" X 12" 11 UNC SQUARE	2	EA	2	0	2	2	2	0	Nothing to return						
1000465856	0030	529902	9	1/16/2023	2510190	BOLT MACHINE 5/8" X 12" 11 UNC SQUARE	2	EA	2	0	2	2	2	0	Nothing to return						
1000465856	0110	529902	56	1/16/2023	2510190	BOLT MACHINE 5/8" X 12" 11 UNC SQUARE	2	EA	2	0	2	2	2	0	Nothing to return						
1000465856	0120	529902	78	1/16/2023	2510190	BOLT MACHINE 5/8" X 12" 11 UNC SQUARE	2	EA	2	0	2	2	2	0	Nothing to return						
1000465856	0120	529902	86	1/16/2023	2510202	BOLT MACHINE 5/8" X 14"- 11 UNC SQUARE	2	EA	2	0	2	2	2	0	Nothing to return						
1000465858	0040	529904	19	2/21/2023	2510222	BOLT MACHINE 3/4" X 12"- 10 UNC SQUARE	4	EA	4	0	4	4	4	0	Nothing to return						
1000465858	0030	529904	5	2/21/2023	2510223	BOLT MACHINE 3/4" X 14"- 10 UNC SQUARE	2	EA	2	0	2	2	2	0	Nothing to return						

														WSP Verification							
Order	Activity	Reservation	Item number of reservation	Requirements date	Material	Material Description	Requirement Quantity	Base Unit of Measure	Removed quantity	Difference Quantity	Quantities as per original Estimate	Issued (Delivered) Quantities	Used Quantities	Differences Quantities (Issued - Used on site)	WSP Comments	Record of Returned items	Material Returned	$/unit	$ Need Return	$ Returned	
1000465856	0120	529902	62	1/16/2023	2510414	BOLT-ASSEMBLY EVERDUR HEX HEAD	6	EA	6	0	6	6	6	0	Nothing to return						
1000465859	0020	529906	14	1/16/2023	2510414	BOLT-ASSEMBLY EVERDUR HEX HEAD	5	EA	5	0	5	5	5	0	Nothing to return						
1000465881	0040	529907	8	1/16/2023	2510414	BOLT-ASSEMBLY EVERDUR HEX HEAD	16	EA	16	0	16	16	16	0	Nothing to return						
1000465856	0030	529902	10	1/16/2023	2520024	NUT OVAL EYE 5/8" AS PER CSA C83.84	1	EA	1	0	1	1	1	0	Nothing to return						
1000465856	0050	529902	24	1/16/2023	2520024	NUT OVAL EYE 5/8" AS PER CSA C83.84	1	EA	1	0	1	1	1	0	Nothing to return						
1000465858	0040	529904	20	2/21/2023	2520026	NUT EYE 3/4" GALV AS PER THES	4	EA	4	0	4	4	4	0	Nothing to return						
1000465856	0050	529902	26	1/16/2023	2520042	NUT SQUARE 5/8" GALV BOLT	1	EA	1	0	1	1	1	0	Nothing to return						
1000465856	0120	529902	88	1/16/2023	2520055	NUT HEX 3/8"- 16 STEEL GALV AS PER	3	EA	3	0	3	3	3	0	Nothing to return						
1000465856	0020	529902	6	1/16/2023	2530003	WASHER GALV SQUARE 2" X 2" X 11/16"	6	EA	6	0	6	6	6	0	Nothing to return						
1000465856	0020	529902	8	1/16/2023	2530020	WASHER CURVED SQUARE GALV 2" X 2"	4	EA	4	0	4	4	4	0	Nothing to return						
1000465856	0030	529902	11	1/16/2023	2530020	WASHER CURVED SQUARE GALV 2" X 2"	2	EA	2	0	2	2	2	0	Nothing to return						
1000465856	0040	529902	22	1/16/2023	2530020	WASHER CURVED SQUARE GALV 2" X 2"	2	EA	2	0	2	2	2	0	Nothing to return						
1000465856	0050	529902	27	1/16/2023	2530020	WASHER CURVED SQUARE GALV 2" X 2"	2	EA	2	0	2	2	2	0	Nothing to return						
1000465856	0110	529902	52	1/16/2023	2530020	WASHER CURVED SQUARE GALV 2" X 2"	4	EA	4	0	4	4	4	0	Nothing to return						
1000465856	0120	529902	63	1/16/2023	2530020	WASHER CURVED SQUARE GALV 2" X 2"	3	EA	3	0	3	3	3	0	Nothing to return						
1000465856	0060	529902	30	1/16/2023	2530024	WASHER CURVED SQUARE GALV 3" X 3"	2	EA	2	0	2	2	2	0	Nothing to return						
1000465858	0030	529904	8	2/21/2023	2530025	WASHER CURVED SQUARE GALV 3" X 3"	2	EA	2	0	2	2	2	0	Nothing to return						
1000465858	0040	529904	21	2/21/2023	2530025	WASHER CURVED SQUARE GALV 3" X 3"	8	EA	8	0	8	8	8	0	Nothing to return						
1000465856	0120	529902	79	1/16/2023	2530081	WASHER GALV STEEL 3/8" AS PER CSA	3	EA	3	0	3	3	3	0	Nothing to return						
1000465856	0030	529902	12	1/16/2023	2530084	WASHER GALV STEEL 5/8" AS PER CSA	2	EA	2	0	2	2	2	0	Nothing to return						
1000465856	0120	529902	77	1/16/2023	2530084	WASHER GALV STEEL 5/8" AS PER CSA	5	EA	5	0	5	5	5	0	Nothing to return						
1000465859	0020	529906	15	1/16/2023	2530100	WASHER BELLEVILLE 1/2" STEEL AS PER	10	EA	10	0	10	10	10	0	Nothing to return						
1000465856	0120	529902	80	1/16/2023	2540031	STAPLE STEEL GALV 1-1/2" X 3/8"	3	EA	3	0	3	3	3	0	Nothing to return						
1000465858	0050	529904	25	2/21/2023	2540031	STAPLE STEEL GALV 1-1/2" X 3/8"	20	EA	20	0	20	20	20	0	Nothing to return						
1000465856	0080	529902	41	1/16/2023	2550002	LAG SCREW 1/4" X 4" GALV GIMLET POINT	12	EA	12	0	12	12	12	0	Nothing to return						
1000465856	0090	529902	44	1/16/2023	2550002	LAG SCREW 1/4" X 4" GALV GIMLET POINT	12	EA	12	0	12	12	12	0	Nothing to return						
1000465882	0080	529908	32	1/16/2023	2550002	LAG SCREW 1/4" X 4" GALV GIMLET POINT	50	EA	50	0	50	50	50	0	Nothing to return						
1000465856	0120	529902	71	1/16/2023	2550023	LAG SCREW 1/2" X 4" GALV FETTER	3	EA	3	0	3	3	3	0	Nothing to return						
1000465858	0030	529904	4	2/21/2023	2550023	LAG SCREW 1/2" X 4" GALV FETTER	2	EA	2	0	2	2	2	0	Nothing to return						
1000465856	0090	529902	46	1/16/2023	5230009	CONDUIT PVC RIGID 4" IN 10' LENGTHS	2	EA	2	0	2	2	2	0	Nothing to return						
1000465882	0050	529908	22	1/16/2023	5240030	TUBING POLYETHYLENE 2" INSIDE DIAMETER	2	EA	2	0	2	2	2	0	Nothing to return						
1000465885	0020	529911	2	1/16/2023	7020006	FUSE 600V 10A 100KA I.R. FAST-ACTING	1	EA	1	0	1	1	1	0	Nothing to return						
1000465885	0020	529911	1	1/16/2023	7030139	FUSEHOLDER WATERTIGHT 600V 30A FOR	1	EA	1	0	1	1	1	0	Nothing to return						
1000465858	0070	529904	35	2/21/2023	7105160	WIRE 2/0 19 STR CU SD AS PER ASTM B8	24	M	24	0	24	24	24	0	Nothing to return						
1000465856	0120	529902	74	1/16/2023	7110010	CABLE #2 19STR CU SD PE BLACK TX DROP	5	M	5	0	5	5	5	0	Nothing to return						
1000465882	0040	529908	17	1/16/2023	7150162	CABLE #2 7STR CU 600V TW75 BLACK AS PER	3	M	3	0	3	3	3	0	Nothing to return						
1000465885	0020	529911	3	1/16/2023	7155155	CABLE 2C #12 SOL CU WITH #14 SOL CU	3	M	3	0	3	3	3	0	Nothing to return						
1000465856	0060	529902	32	1/16/2023	7210028	DEAD END CLAMP SPRING LOADED FOR #4-	1	EA	1	0	1	1	1	0	Nothing to return						
1000465856	0030	529902	13	1/16/2023	7210029	DEAD END CLAMP SPRING LOADED FOR 3/0	3	EA	3	0	3	3	3	0	Nothing to return						
1000465856	0110	529902	54	1/16/2023	7210047	CLAMP HOT LINE GENERAL PURPOSE AL CU	1	EA	1	0	1	1	1	0	Nothing to return						
1000465856	0120	529902	73	1/16/2023	7210047	CLAMP HOT LINE GENERAL PURPOSE AL CU	1	EA	1	0	1	1	1	0	Nothing to return						
1000465856	0070	529902	35	1/16/2023	7210050	GRIP WEDGE FOR #4 - 1/0 ACSR WITH	1	EA	1	0	1	1	1	0	Nothing to return						
1000465856	0120	529902	85	1/16/2023	7210054	GRIP CABLE SINGLE OFFSET EYE FOR 1	3	EA	3	0	3	3	3	0	Nothing to return						
1000465882	0080	529908	34	1/16/2023	7210070	CHAIN LINK DOUBLE EYE STRAIGHT 9/16" X	6	EA	6	0	6	6	6	0	Nothing to return						
1000465856	0050	529902	28	1/16/2023	7210135	CLAMP FOR LASHING WIRE CSA G164	2	EA	2	0	2	2	2	0	Nothing to return						
1000465856	0060	529902	34	1/16/2023	7210135	CLAMP FOR LASHING WIRE CSA G164	1	EA	1	0	1	1	1	0	Nothing to return						
1000465856	0070	529902	37	1/16/2023	7210135	CLAMP FOR LASHING WIRE CSA G164	2	EA	2	0	2	2	2	0	Nothing to return						
1000465856	0050	529902	29	1/16/2023	7210137	CLAMP MESSENGER STRAIGHT EN# 13E SP* CSA	1	EA	1	0	1	1	1	0	Nothing to return						
1000465859	0020	529906	10	1/16/2023	7211040	CONNECTOR AL TERMINAL LUG TINNED 2/0 STR	2	EA	2	0	2	2	2	0	Nothing to return						
1000465882	0080	529908	28	1/16/2023	7211044	CONNECTOR CU TERMINAL LUG, 3/0 STD OR	3	EA	3	0	3	3	3	0	Nothing to return						
1000465881	0020	529907	3	1/16/2023	7211078	CONNECTOR AL TERMINAL LUG TINNED 4/0	6	EA	6	0	6	6	6	0	Nothing to return						
1000465881	0020	529907	1	1/16/2023	7211088	CONNECTOR AL TERMINAL LUG 500KCMIL 2	3	EA	3	0	3	3	3	0	Nothing to return						
1000465859	0020	529906	9	1/16/2023	7211142	CONNECTOR AL TERMINAL LUG TINNED 1/0 STR	3	EA	3	0	3	3	3	0	Nothing to return						
1000465881	0040	529907	9	1/16/2023	7211444	CONNECTOR CU TERMINAL LUG TINNED 300 STR	2	EA	2	0	2	2	2	0	Nothing to return						
1000465881	0040	529907	7	1/16/2023	7211484	CONNECTOR CU TERMINAL LUG TINNED 500 STR	6	EA	6	0	6	6	6	0	Nothing to return						
1000465882	0080	529908	29	1/16/2023	7211484	CONNECTOR CU TERMINAL LUG TINNED 500 STR	3	EA	3	0	3	3	3	0	Nothing to return						
1000465882	0060	529908	24	1/16/2023	7212172	SLEEVE AL NON TENSION REDUCING 1/0	2	EA	2	0	2	2	2	0	Nothing to return						
1000465882	0020	529908	4	1/16/2023	7212616	SLEEVE CU NON TENSION TINNED 2/0 STR	3	EA	3	0	3	3	3	0	Nothing to return						
1000465882	0030	529908	6	1/16/2023	7213014	CONNECTOR CU SPLIT BOLT TINNED CW	3	EA	3	0	3	3	3	0	Nothing to return						
1000465882	0040	529908	16	1/16/2023	7213038	CONNECTOR CU SPLIT BOLT 2/0 STR - #6 STR	1	EA	1	0	1	1	1	0	Nothing to return						
1000465856	0070	529902	39	1/16/2023	7214016	CONNECTOR BOLTED AL OH MID SPAN	3	EA	3	0	3	3	3	0	Nothing to return						
1000465882	0080	529908	33	1/16/2023	7214016	CONNECTOR BOLTED AL OH MID SPAN	24	EA	24	0	24	24	24	0	Nothing to return						
1000465858	0070	529904	36	2/21/2023	7214200	CONNECTOR CU GRD WRENCH LOC 3/4" ROD	6	EA	6	0	6	6	6	0	Nothing to return						
1000465858	0050	529904	27	2/21/2023	7214201	CONNECTOR GRD ROD AMPACT	1	EA	1	0	1	1	1	0	Nothing to return						
1000465858	0060	529904	32	2/21/2023	7214201	CONNECTOR GRD ROD AMPACT	1	EA	1	0	1	1	1	0	Nothing to return						
1000465882	0040	529908	15	1/16/2023	7214413	CONNECTOR CU U BOLT PARALLEL GRV	1	EA	1	0	1	1	1	0	Nothing to return						
1000465881	0020	529907	4	1/16/2023	7223064	COVER SLEEVE EPDM RUBBER FOR 2 HOLE NEMA	18	EA	18	0	18	18	18	0	Nothing to return						
1000465856	0120	529902	66	1/16/2023	7230030	CONNECTOR AMPACT AL TAP #4 ACSR TO #4	3	EA	3	0	3	3	3	0	Nothing to return						
1000465856	0120	529902	89	1/16/2023	7230050	CONNECTOR AMPACT AL TAP 1/0 ACSR	9	EA	9	0	9	9	9	0	Nothing to return						
1000465856	0110	529902	55	1/16/2023	7230060	CONNECTOR AMPACT AL TAP 2/0 ACSR	1	EA	1	0	1	1	1	0	Nothing to return						
1000465856	0100	529902	49	1/16/2023	7230090	CONNECTOR AMPACT AL TAP 2/0 ACSR	3	EA	3	0	3	3	3	0	Nothing to return						
1000465858	0050	529904	28	2/21/2023	7230100	CONNECTOR AMPACT AL TAP 2/0 STR TO	1	EA	1	0	1	1	1	0	Nothing to return						
1000465882	0080	529908	36	1/16/2023	7230100	CONNECTOR AMPACT AL TAP 2/0 STR TO	12	EA	12	0	12	12	12	0	Nothing to return						
1000465882	0080	529908	35	1/16/2023	7230130	CONNECTOR AMPACT AL TAP 4/0 ACSR	12	EA	12	0	12	12	12	0	Nothing to return						
1000465856	0100	529902	50	1/16/2023	7231355	COVER AMPACT TAP CONNECTORS 600V	3	EA	3	0	3	3	3	0	Nothing to return						
1000465885	0020	529911	5	1/16/2023	7231375	COVER AMPACT TAP CONNECTORS MINIWEDGE	3	EA	3	0	3	3	3	0	Nothing to return						
1000465856	0110	529902	57	1/16/2023	7231380	CARTRIDGE AMPACT YELLOW	3	EA	3	0	3	3	3	0	Nothing to return						
1000465856	0100	529902	51	1/16/2023	7231385	CARTRIDGE AMPACT BLUE	3	EA	3	0	3	3	3	0	Nothing to return						

														WSP Verification						
Order	Activity	Reservation	Item number of reservation	Requirements date	Material	Material Description	Requirement Quantity	Base Unit of Measure	Removed quantity	Difference Quantity	Quantities as per original Estimate	Issued (Delivered) Quantities	Used Quantities	Differences Quantities (Issued - Used on site)	WSP Comments	Record of Returned items	Material Returned	$/unit	$ Need Return	$ Returned	
1000465856	0110	529902	59	1/16/2023	7231385	CARTRIDGE AMPACT BLUE	1	EA	1	0	1	1	1	0	Nothing to return						
1000465858	0050	529904	30	2/21/2023	7231385	CARTRIDGE AMPACT BLUE	1	EA	1	0	1	1	1	0	Nothing to return						
1000465856	0120	529902	69	1/16/2023	7231395	CARTRIDGE AMPACT WHITE	12	EA	12	0	12	12	12	0	Nothing to return						
1000465859	0020	529906	6	1/16/2023	7240001	ELBOW LOADBREAK 1/0 AL 28KV 200A	3	EA	3	0	3	3	3	0	Nothing to return						
1000465859	0020	529906	7	1/16/2023	7240004	BUSHING INSERT LOADBREAK 28KV 200A	6	EA	6	0	6	6	6	0	Nothing to return						
1000465859	0020	529906	8	1/16/2023	7240021	CAP PROTECTIVE INSULATED CW PROBE	3	EA	3	0	3	3	3	0	Nothing to return						
1000465856	0110	529902	60	1/16/2023	7251065	CONNECTION AMPACT STIRRUP 556.5 THRU	3	EA	3	0	3	3	3	0	Nothing to return						
1000465856	0120	529902	81	1/16/2023	7251095	CONNECTOR STIRRUPS GROUNDING AS PER	3	EA	3	0	3	3	3	0	Nothing to return						
1000465882	0050	529908	20	1/16/2023	7360306	CRADLE INSULATING FOR STD UG ARM AS PER	1	EA	1	0	1	1	1	0	Nothing to return						
1000465856	0050	529902	25	1/16/2023	7600001	TAPE ELECTRICAL VINYLE 3/4 "X 66' X	1	EA	1	0	1	1	1	0	Nothing to return						
1000465856	0060	529902	33	1/16/2023	7600001	TAPE ELECTRICAL VINYLE 3/4 "X 66' X	1	EA	1	0	1	1	1	0	Nothing to return						
1000465856	0070	529902	38	1/16/2023	7600001	TAPE ELECTRICAL VINYLE 3/4 "X 66' X	1	EA	1	0	1	1	1	0	Nothing to return						
1000465856	0120	529902	76	1/16/2023	7600001	TAPE ELECTRICAL VINYLE 3/4 "X 66' X	2	EA	2	0	2	2	2	0	Nothing to return						
1000465859	0020	529906	17	1/16/2023	7600001	TAPE ELECTRICAL VINYLE 3/4 "X 66' X	1	EA	1	0	1	1	1	0	Nothing to return						
1000465882	0020	529908	2	1/16/2023	7600001	TAPE ELECTRICAL VINYLE 3/4 "X 66' X	1	EA	1	0	1	1	1	0	Nothing to return						
1000465882	0030	529908	7	1/16/2023	7600001	TAPE ELECTRICAL VINYLE 3/4 "X 66' X	2	EA	2	0	2	2	2	0	Nothing to return						
1000465882	0040	529908	18	1/16/2023	7600001	TAPE ELECTRICAL VINYLE 3/4 "X 66' X	1	EA	1	0	1	1	1	0	Nothing to return						
1000465882	0040	529908	19	1/16/2023	7600007	TAPE RUBBER MASTIC 1KV 2" X .065	1	EA	1	0	1	1	1	0	Nothing to return						
1000465859	0020	529906	20	1/16/2023	7600012	TAPE VINYL 3/4" X 66' X 0.007" THICKNESS	1	EA	1	0	1	1	1	0	Nothing to return						
1000465882	0030	529908	9	1/16/2023	7600012	TAPE VINYL 3/4" X 66' X 0.007" THICKNESS	2	EA	2	0	2	2	2	0	Nothing to return						
1000465859	0020	529906	18	1/16/2023	7600013	TAPE VINYL 3/4" X 66' X 0.007" THICKNESS	1	EA	1	0	1	1	1	0	Nothing to return						
1000465882	0030	529908	11	1/16/2023	7600013	TAPE VINYL 3/4" X 66' X 0.007" THICKNESS	2	EA	2	0	2	2	2	0	Nothing to return						
1000465882	0030	529908	12	1/16/2023	7600014	TAPE VINYL 3/4" X 66' X 0.007" THICKNESS	2	EA	2	0	2	2	2	0	Nothing to return						
1000465859	0020	529906	19	1/16/2023	7600015	TAPE VINYL 3/4" X 66' X 0.007" THICKNESS	1	EA	1	0	1	1	1	0	Nothing to return						
1000465859	0020	529906	3	1/16/2023	7600026	TAPE INSULATING VINYL MASTIC 600V 4"	1	EA	1	0	1	1	1	0	Nothing to return						
1000465858	0040	529904	18	2/21/2023	7630052	GUY STRAIN INSULATOR 54" ROD CLEVIS/	2	EA	2	0	2	2	2	0	Nothing to return						
1000465856	0030	529902	15	1/16/2023	7630057	INSULATOR DEAD END 28KV AS PER CEA	3	EA	3	0	3	3	3	0	Nothing to return						
1000465856	0110	529902	61	1/16/2023	7630066	INSULATOR RISER SUPPORT 35KV AS PER CEA	2	EA	2	0	2	2	2	0	Nothing to return						
1000465856	0020	529902	7	1/16/2023	7630102	INSULATOR UNIVERSAL LINE POST 35KV. AS	3	EA	3	0	3	3	3	0	Nothing to return						
1000465856	0120	529902	64	1/16/2023	7903986	BUCKLE 3/4" BANDING STEEL	6	EA	6	0	6	6	6	0	Nothing to return						
1000465856	0030	529902	17	1/16/2023	8220681	MARKER WHITE PHASE ADHESIVE 3" ROUND	1	EA	1	0	1	1	1	0	Nothing to return						
1000465859	0020	529906	12	1/16/2023	8220681	MARKER WHITE PHASE ADHESIVE 3" ROUND	1	EA	1	0	1	1	1	0	Nothing to return						
1000465856	0030	529902	18	1/16/2023	8220683	MARKER BLUE PHASE ADHESIVE 3" ROUND	1	EA	1	0	1	1	1	0	Nothing to return						
1000465859	0020	529906	13	1/16/2023	8220683	MARKER BLUE PHASE ADHESIVE 3" ROUND	1	EA	1	0	1	1	1	0	Nothing to return						
1000465856	0030	529902	19	1/16/2023	8220688	MARKER RED PHASE ADHESIVE 3" ROUND	1	EA	1	0	1	1	1	0	Nothing to return						
1000465859	0020	529906	11	1/16/2023	8220688	MARKER RED PHASE ADHESIVE 3" ROUND	1	EA	1	0	1	1	1	0	Nothing to return						
1000465882	0030	529908	14	1/16/2023	8940004	ALCOHOL ISOPROPYL 99% PURE 500 ML	2	EA	2	0	2	2	2	0	Nothing to return						
1000465859	0020	529906	4	1/16/2023	8940010	CAP CABLE END HEAT SHRINK FOR	2	EA	2	0	2	2	2	0	Nothing to return						
1000465856	0090	529902	48	1/16/2023	9652703	COUPLING PIPE GALV NOMINAL 4"	1	EA	1	0	1	1	1	0	Nothing to return						
1000465882	0060	529908	23	1/16/2023	9655813	DEGREASER PF SOLVENT 32 OZ BOTTLE CW	4	EA	4	0	4	4	4	0	Nothing to return						
1000465885	0020	529911	4	1/16/2023	9656247	CONNECTOR AMPACT AL MINIWEDGE	3	EA	3	0	3	3	3	0	Nothing to return						
1000465881	0020	529907	5	1/16/2023	9656992	HORIZONTAL 1" PANEL 7 POSITION CABLE	1	EA	1	0	1	1	1	0	Nothing to return						
1000465882	0060	529908	25	1/16/2023	9657056	SLEEVE INSULATING #8 TO 2/0 ROLL ON TYPE	2	EA	2	0	2	2	2	0	Nothing to return						
1000465856	0120	529902	82	1/16/2023	9662293	BOLT CARRIAGE GALV 3/8" X 1 1/2"	3	EA	3	0	3	3	3	0	Nothing to return						
1000465859	0020	529906	16	1/16/2023	9662341	PADLOCK ABLOY KEYED GROUP 7 25MM	1	EA	1	0	1	1	1	0	Nothing to return						
1000465856	0110	529902	58	1/16/2023	9662733	WIRE 2/0 SOL CU MHD AS PER ASTM B2	1	EA	1	0	1	1	1	0	Nothing to return						
1000465856	0030	529902	16	1/16/2023	9663964	WASHER GALV RECTANGLAR 3-1/2" X 4-1/2"	4	EA	4	0	4	4	4	0	Nothing to return						
1000465859	0020	529906	2	1/16/2023	9665812	LABEL WARNING, ADHESIVE TYPE FOR LOW	2	EA	2	0	2	2	2	0	Nothing to return						
																				$ 6,498.38	
						Total Material Released for the project	**$ 58,183.77**														
						Total Material to be returned	**$ 6,498.38**														
						Total Material for project	**$ 51,685.39**														

APPENDIX

F CRITICAL TASK CHECKLIST

Critical Task Checklist

Project #: P-220200-WD151001
Project Name: NGF1 OH VC W. PCB PHASE 1A
Contractor: VALARD
THESL Contract Administrator: Francine Xu

Note: Contractor must give Auditors 24 hours notice before starting tasks which Auditor must witness.

Req'd?		Critical Task:	Action:	Notes:
Civil:				
N		Vaults/Chamber Build	Auditor must witness concrete testing	
N		Remove/lift slab test at vault	Contractor to lift slab to check that there is no seal, its solid and sits properly without rocking. Auditor must witness test lift	
Y		Breaking into ducts or ductbanks containing cable	Qualified staff must be on site, holdoffs in effect and contractor safety procedures and legislative requirements followed. Auditor must witness some of breaking into ducts or ductbanks containing cable and fill out checklist. ~~Contractor to sign off on checklist.~~	
Y		Duct radius installation	Auditor must attempt to witness prior to cement pour. If auditor visit is impractical, contractor to provide photo demonstrating compliance to standard. Photo must be provided no later than 24 hours after pour.	
Y		Mandrelling of ducts	Auditor must witness mandrelling	
Y		Core Drilling into Energized Vaults/Chambers	Auditor must witness some of core drilling and fill out checklist. Contractor to sign off on checklist.	
N		Shoring design compliance for Cable chambers, network vaults, shafts	Auditor to confirm shoring in place is compliant with contractor drawings on site.	
N		Drain connection to City sewer	Auditor must witness connection	
Electrical:				
Y		Power Interruptions	Contractor to notify customers / THESL Cust. Ops.	
N		Working at a Hydro One Transformer Station Facility	Permits/Qualified staff/Authorization	
N		Cable Identfication/ Spearing	Auditor must witness some of spiking/spearing and fill out check list. Contractor to sign off on checklist.	
N		Inter-utility coordination	Communication protocol followed	
N		Energizations requiring ESA signoff: - Delta Wye Conversions - Voltage conversion meter base replacements - O/H to U/G meter base replacements	Auditor confirms ESA permits taken out & Submitted with Monthly Billing	
Y		Padmounted Tx, Submersible Tx, Network/Vault Tx, and Padmounted Switchgear final installation photographs prior to energization.	Padmounted Tx, Submersible Tx, Network/Vault Tx, Protector & Padmounted Switchgear final photographs sent to Auditor for verification within 24 hours of energization/commissioning if Auditor not on site to witness final installation.	
Environmental				
Y		Transportation of Dangerous Goods. For example, contaminated water pumped from structures	~~Auditor witness and record quantities.~~ THESL CA/FA sign off manifest. Contractor to provide 24 hours notice to auditor/CA/FA prior to pumping.	
Y		Working in vicinity of hazardous materials (AILC, PILC, RILC, Asbestos in city roads, asbestoc pipe, etc.)	Contractor PPE/procedures followed, For example, for cutting of asphalt on city roads, Auditor to verfiy cut sizes and remediation.	
Other - Project Specific:				
N		Heavy Equipment/Materials in or on top of Below Grade Structures	U/G parking, vaults, and chambers should all be indicated on construction drawings	

APPENDIX

G PRE-JOB MEETING MEMO AND EHS FORM

231-60000-11-PJMA-2023

PRE-JOB MEETING MEMO

PROJECT INFORMATION	
Project Name /WBS Number:	P-220200-WD151001 WKPG NGF1 Conversion with PCBs Repl PH1A
Project Department:	CPW
Project CA.:	Francine Xu
Project FA:	Ken Abram
Contractor:	Valard
External Parties : (MTO, MOSAIC, CTS, Metrolinx, etc.)	n/a

MEETING INFORMATION	
Meeting Location: (THESL offices or through WebEx)	WebEx
Meeting Date:	Feb 9, 2023
Time.:	3:30 pm – 4:30 pm
Timekeeper:	Valentyna Fofana

ATTENDEES

Name	Title	Company	Email	Signature
Francine Xu	CA	THESL	fxu@torontohydro.com	Francine Xu Digitally signed by Francine Xu DN: cn=Francine Xu, email=fxu@torontohydro.com Date: 2023.02.21 17:30:57 -05'00'
Ken Abram	FA	THESL	kabram@torontohydro.com	
Aisha Tousif		THESL	atousif@torontohydro.com	
Usman Mazhar		THESL	umazhar@torontohydro.com	
Shannon Jackson		THESL	sjackson@torontohydro.com	n/a
Sunny Nagah		THESL	snagah@torontohydro.com	
Dustin Hutton		Valard	dhutton@valard.com	
Nick Dong		Valard	nxdong@valard.com	
Breanne Kellar		Valard	bkellar@valard.com	
Aby Isac		Valard	aisac@valard.com	
Vidhi Shah		Valard	vshah@valard.com	
Salah Rana		Valard	srana@valard.com	
Valentyna Fofana	PCO	WSP	Valentyna.Fofana@wsp.com	
Kamran Fallahi	DRP	WSP		
Doug Jamieson	COI	WSP	doug.jamieson@wsp.com	
Elham Zarepour	CVI	WSP	Elham.Zarepour@wsp.com	DocuSigned by: Elham Zarepour

TOPICS		
MATTERS ARISING	**ACTION**	**NOTES**
1.0 Safety Moment	All	
2.0 Introductions	All	
3.0 Project scope 3.1 Background information 3.2 Notice of Project Expiration 3.3 Estimated construction completion (Project Attainment Forecast Date)	THESL CA	 3.2 Jan 2023 to Dec 2023 3.3. Oct 2023
4.0 Design GCF Presentation 4.1 Design presentation by designer. Design by: ☒ **Contractor** ☐ THESL 4.2 Posting of drawings been completed? ☒Yes ☐No ☐N/a 4.3 Digitization complete? ☒Yes ☐No ☐N/a 4.4 Designer has confirmed: ▪ All 3 wire 600V services & 4 wire 347/600V services affected by the scope of this work have been identified. ☐Yes ☐No ☒N/a ▪ Design meets current standard for connections. ☐Yes ☐No ☒N/a ▪ Changes are identified on the drawings ☐Yes ☐No ☒N/a 4.5 Field checked for new assets? ☐Yes ☐No ☒N/a 4.6 AODA clearances met? ☒Yes ☐No ☐N/a 4.7 Latest construction standards used? ☒Yes ☐No ☐N/a 4.8 Any Deviation from THESL Standards? ☐Yes ☐No ☒N/a 4.9 DGO approval received for construction package? ☐Yes ☒No ☐N/a 4.10 Delta-wye conversion required? ☐Yes ☐No ☒N/a (If yes, metering GCF must be prepared) 4.11 Co-generators identified? ☐Yes ☐No ☒N/a 4.12 Shoring required? (If yes, require signed shop drawings) ☐Yes ☐No ☒N/a 4.13 Take-off sheets provided? ☒Yes ☐No ☐N/a 4.14 Job Instruction Sheet finalized and signed by CA? ☒Yes ☐No ☐N/a 4.15 Any Specific construction notes to be considered? ☐Yes ☐No ☒N/a	All	 4.2 Updated drawings (with property owner sign off) to be provided. 4.6 4.9 Preliminary 4.13 4.14

TOPICS (Cont.)

MATTERS ARISING	ACTION	NOTES
5.0 Permits and Notifications - Identify special permit conditions and DRPs. 5.1 City of Toronto Cut Permit– Construction DRP ☐Yes ☒No ☐N/a 5.2 HONI – Construction DRP ☐Yes ☒No ☐N/a 5.3 Ministry of Environment (MoE) – EHS Representative ☐Yes ☐No ☒N/a 5.4 Permit for working in the active rail corridor-Metrolinx ☐Yes ☐No ☒N/a 5.5 Ministry of Transportation – Construction DRP ☐Yes ☐No ☒N/a 5.6 City Parks – EHS Representative/Construction DRP ☐Yes ☐No ☒N/a 5.7 TRCA (Toronto and Region Conservation Authority) ☐Yes ☐No ☒N/a 5.8 Toronto & Region Conservation Authority - EHS Rep. ☐Yes ☐No ☒N/a 5.9 Notice of Project – Construction DRP ☒Yes ☐No ☐N/a 5.10 Form 1000 – Construction DRP ☒Yes ☐No ☐N/a (Form 1000 to be presented for the subcontractors as well if any) 5.11 If there is excavation, a private water discharge permit is required if any ground water is pumped out ☐Yes ☐No ☒N/a 5.12 OTHERS – Please indicate	Contractor/ Designer	5.1 Exemption request sent – for 0.5m. Expecting decision. Breanne to provide an update. 5.10 Valard to have on site.
6.0 Material availability 6.1 Is there any Electrical Material required to be delivered ☒Yes ☐No ☐N/a 6.2 Who is suppling Materials ☒THESL ☐External 3rd Party (CTS, MOSAIC) 6.3 Is there outstanding materials? If so, what is the estimated delivery date? 6.4 Does Contractor have temporary Material Lay-down Area? ☐Yes ☐No ☒N/a 6.5 Does contractor have permit for the lay-down area? ☐Yes ☐No ☒N/a	Contractor/ THESL CA	6.3 TR delivered. Pending material to be delivered Feb 21 & March.

TOPICS (Cont.)

MATTERS ARISING	ACTION	NOTES
7.0 Construction Readiness, work schedule and site safety 7.1 Multiple contractor on-site coordination ☒Yes ☐No ☐N/a 7.2 Review Construction Schedule ☒Yes ☐No ☐N/a 7.3 Any Priority of work execution ☐Yes ☐No ☒N/a 7.4 Tree trimming requirements ☐Yes ☐No ☒N/a 7.5 Arborist or TPZ is required ☐Yes ☐No ☒N/a 7.6 THESL general Rules, PPE, FR clothing, etc. 7.7 Vacuum Truck safety, Dead man Trigger ☒Yes ☐No ☐N/a 7.8 Locates drawings are required ☒Yes ☐No ☐N/a 7.9 Premium hour authorization ☐Yes ☒No ☐N/a 7.10 Road Occupancy Permits ☐Yes ☐No ☒N/a 7.11 Traffic management Plan been submitted & approved ☒Yes ☐No ☐N/a 7.12 Site Pre-con meeting with City scheduled or conducted ☐Yes ☐No ☒N/a 7.13 Traffic & Pedestrian Control Pay Duty is required ☐Yes ☐No ☒N/a 7.14 Outage backup plan ☐Yes ☐No ☒N/a 7.15 Tunneling, Notice for tunnels ☐Yes ☐No ☒N/a 7.16 Directional Drilling ☐Yes ☐No ☒N/a 7.17 Jack and Bore ☐Yes ☐No ☒N/a 7.18 Core Drilling into Energized Vaults/Chambers ☐Yes ☐No ☒N/a 7.19 Break and Tie-in to existing duct bank ☒Yes ☐No ☐N/a 7.20 Shoring drawings been approved by P.Eng & available ☐Yes ☐No ☒N/a 7.21 COVID-19 Safety Awareness	Contractor/ THESL CA	7.2 March start (approx. 4 days civil) TPZ on the private property requirements to confirm. Be mindful of the tree protection. 7.4 . 7.8 Valard to request 7.10 Private property 7.11 On the tailboard 7.13

TOPICS (Cont.)		
MATTERS ARISING	**ACTION**	**NOTES**
8.0 Customer communication letters required? Have all the following Customer Letters been issued by either Toronto Hydro or Contractors?	THESL Customer Comm Rep	
8.1 Customer General Letter (Civil) – THESL Issued ☐Yes ☐No ☒N/a		8.1
8.2 Life Support ☐Yes ☒No ☐N/a		
8.3 Potential Customer issue/complains/concern ☐Yes ☒No ☐N/a		
8.4 Customer Equipment Letters (Civil) – Toronto Hydro Issued		
8.4.1 Pad mount Transformers ☒Yes ☐No ☐N/a		
8.4.2 Submersible Transformers ☐Yes ☐No ☒N/a		
8.4.3 Switch Gear ☐Yes ☐No ☒N/a		
8.4.4 Sight Line ☐Yes ☐No ☒N/a		
8.4.5 Splice Boxes ☐Yes ☐No ☒N/a		
8.4.6 Tap Boxes ☐Yes ☐No ☒N/a		
8.4.7 Poles Relocation and New Pole Location – As outlined in the Customer List submitted by the designer		8.4.7 Aisha to confirm with CoCo if issued.
* Property with Pre-Existing Pole - New Pole installed greater than one meter on the same property ☒Yes ☐No ☐N/a		
* Property without Pre-Existing Pole has pole installed ☐Yes ☐No ☐N/a		
8.5 Customer Week Before Letter (Civil – UG & OH) ☒Yes ☐No ☐N/a		8.5 & 8.6 To be issued by Valard
Contractor Issued (Posted to Toronto Hydro FTP Site or e-mailed to customeroperationsnotification@torontohydro.com)		
8.6 Customer Outage Letter (Electrical) ☒Yes ☐No ☐N/a		
Contractor Issued (Posted to Toronto Hydro FTP Site or e-mailed to customeroperationsnotification@torontohydro.com)		

TOPICS (Cont.)		
MATTERS ARISING	**ACTION**	**NOTES**
9.0 Contractor Safety 9.1 Contractor Procedures provided ☒Yes ☐No ☐N/a 9.2 Work Hazards and Contractor Safety Plan 9.3 Risk Management and Hazard Mitigation/Control 9.4 Tail Board and Work Plan Steps and Site Rules 9.5 Incident reporting & investigation 9.6 First Aid, Emergency Rescue procedures 9.7 House Keeping/Environmental Plan and Public Protection	Contractor/ THESL CA	
10.0 Field Change / Design Changes 10.1 Field change to be addressed through THESL Standard 34-1000 and Appendix A of the Construction Verification Program (CVP). 10.2 Field changes to be addressed and get THESL approval in advance	All	
11.0 Billing and Change orders process 11.1 For any Change Order, pre-approval to be obtained from THESL CA 11.2 Change Order to be submitted through online process with all supportive documents 11.3 Change orders to be submitted as per PSO Calendar 11.4 Contractor to provide monthly billing as per PSO Calendar including just approved change orders 11.5 For Premium for weekend and night shift, time sheet to be provided 11.6 Contractor to submit Pandemic change order as per THESL instruction and Calendar 11.7 Contractor to attach the verified billing of the month to the Pandemic change order for verification purposes	All	

TOPICS (Cont.)		
MATTERS ARISING	**ACTION**	**NOTES**
12.0 Close Out process 12.1 Contractor to return the GCF to WSP within 15 days from attainment dated 12.2 GCF documents to be prepared as per GCF check list 12.3 As-Built drawing to be prepared as per CSA-S250-011 (THESL 31-0800) 12.4 Before and after photos to be taken as per THESL instruction for each asset	All	12.4 Valard to ensure to take before/after photos.
13.0 Critical Task List review Go through latest "Critical Task Checklist" (must be pre-filled by designer prior to pre-job meeting) 13.1 Contractor must give Auditors 24 hours notice before starting tasks which Auditor must witness as per critical task check list	All	13.1 Valard to revise Critical task checklist. 24hr notification distribution list: – Inspector – Valentyna.Fofana@wsp.com – THESLAudit@wsp.com (WSP general email for audit projects) – DRP - Kamran.Fallahi@wsp.com
14.0 Important notes / Other tasks 14.1 Review photograph requirements to capture all required details of each asset. Go through individual photograph requirements for before and after pictures 14.1.1 Photos must be provided (with tape measure) for installation of 100mm triple mix topsoil prior to sodding 14.1.2 Photos must be provided after restoration is completed (specially for areas with public access i.e. sidewalk, roadway, driveway, parking lots, etc.) 14.2 Discuss and note any other tasks that may be required from Contractor or Auditor	Auditor/ Contractor	14.1 Restorations to be completed

*** NOTE: Field Supervisor to have a copy of the signed Pre-Job Meeting Agenda on site**

Toronto Hydro Electric System Limited
Contractor Environment, Health & Safety Pre-Job Meeting Form – Construction Projects
(FRM-1810-100, Revision 5)

This Pre-Job meeting form is for Construction Projects only. If your project is non-construction (i.e. maintenance, service, staffing), use FRM-1810-157 Contractor Environment, Health & Safety Pre-Job Meeting Form – Non-Construction (Maintenance, Consulting and Staffing Agencies). For further details on the requirements outlined in this form, refer to PRG-1810-030 Contractor Safety Management Program.

Note: When a contractor company is identified in Part B as the constructor, Part H must be completed and signed off.

Meeting Location: WebEx	**Meeting Date:** 9 Feb, 2023
Meeting Start Time: 3:30 pm	**Meeting End Time:** 4:30 pm

PART A: CONTRACT INFORMATION

Name of THESL Contract Administrator	Francine Xu
Contractor Company	Valard
Start Date	Feb 2023
Target Completion Date	Dec 2023
Description of Work	PCB TX Replacement
Work Location/Address	Albion Rd & Armel Crt

PART B: CONSTRUCTION PROJECT INFORMATION

Constructor	Valard
Name of Primary Site Contract	Foreman - TBD

PART C: PROJECT TEAM/KEY ROLES

ROLE	NAME	COMPANY	CONTACT NUMBER	IN ATTENDANCE (Y/N)
Contract Administrator	Francine Xu	Toronto Hydro		y
Auditor	Elham Zarepour	WSP		y
Contractor	Dustin Hutton	Valard		y
Inspector	Doug Jamieson	WSP		y
FA	Ken Abram	THESL		y

PART D: REQUIREMENT VERIFICATION FOR CONTRACTORS
Check the boxes (✓) to indicate that each item has been reviewed and the requirements are understood.

☒ Confirm contractor has an A or B grade in ISNetworld	☒ Review incident reporting requirements as outlined in the Contractor Safety Management Program (PRG-1810-030)
☒ All contractors accessing THESL work centres are required to complete Contractor Orientation and sign the Work Centre Orientation Acknowledgement Form (FRM-5200-037)	☒ If station work is required, all contractors must be aware that • PIA (Person In Attendance) must be present when entering a station or the individual entering the station has taken Stations Hazard Awareness training • At a minimum a markup is required (as per UWPC)

PART E: NOTICE OF PROJECT (must be submitted by constructor prior to commencing any work on the project)

☒ Submitted by Contractor	☐ Submitted by THESL

PART F: CONTRACTOR MONITORING

Person Responsible to Monitor (Name)	Frequency of Monitoring
Toronto Hydro: Ken Abram	As required
Contractor: Dustin Hutton (Valard)	Daily
Auditor: Elham Zarepour (WSP)	Daily, as per the crew roster

PART G: EXCESS SOIL MANAGEMENT

The contractor (operator) will carry out the tasks of the Project Leader and operator as set out in O.Reg 406/19 and associated Soil Rules including, without limitation, the following:

- ✓ Determine applicability of the Regulation, as a whole or in part, to the project;
- ✓ File Notice(s) and update such Notice(s), when required, in the Excess Soil Registry, if required
- ✓ Before filing any Notice
  - Design, develop and implement a secure and effective tracking system containing required information
  - Prepare an assessment of past uses, sampling and analysis plan, characterization report and a destination assessment report
- ✓ Develop a soil management plan and procedures, including for stockpiling, storing, handling, loading, transporting and disposal
- ✓ Appropriately carry out any required soil sampling and analysis through accredited laboratory, in accordance with plans/procedures
- ✓ Comply with soil storage rules and processing rules in the Regulation
- ✓ Ensure transportation and disposal of all Excess Soil is to the selected and approved sites
- ✓ Retain all approvals, permits, tracking, hauling records, manifests and other documents related to soil management, including bills of lading

☐ n/a Contractor (operator) confirms all required documentation will be submitted prior to soil excavation and legislation will be followed during the course of the project.

PART H: CONSTRUCTOR SIGN-OFF

For construction projects, where THESL is <u>not</u> the constructor, hazards unique to the project will be discussed with constructor and the constructor will be responsible for implementing control measures for these and all other identified hazards.

Constructor (Contractor Name): Dustin Hutton Constructor Sign Off: _____

PART I: PROJECT HAZARDS

Review unique known hazards to the project (e.g. PCBs, flammable materials, site access, building specific issues etc.). It is the responsibility of the contractor to identify any additional hazards and implement controls measures for all hazards identified. Known hazards include:

Safe limits of approach	PCB Transformer transportation
Traffic & pedestrian control	
Working in proximity to energized cables	
Material handling	
Working close to other utilities	
Fall protection	

PART J. ACKNOWLEDGEMENT

Contractor acknowledges that all contractor staff working on THESL property and/or assets will be required to fulfill the requirements outlined in the respective THESL Contract. Contractor agrees (and guarantees) that only qualified employees will be used to execute the contract and further agrees that the information and responsibilities contained in this Health & Safety Pre-Job Meeting Form has been adequately and clearly communicated to them. By signing this form, I acknowledge as the Authorized Representative of the Contractor, that all hazard mitigation responsibilities assigned to me will be addressed, and that every precaution reasonable in the circumstances will be taken to protect employees, subcontractors and visitors, from workplace hazards.

Contractor Representative

Name	Company	Signature	Date
Dustin Hutton	Valard	DocuSigned by: 340D4F6B0C19472...	Feb 14, 2023 | 05:19 EST

Contract Administrator

Name	Company	Signature	Date
Francine Xu	THESL	Francine Xu Digitally signed by Francine Xu DN: cn=Francine Xu, email=fxu@torontohydro.com Date: 2023.02.21 17:32:10 -05'00'	

AtkinsRéalis	Design-Build Projects Final Audit Report	Revision		Page
		No.	Date	
	672824-P-220271-WD161000-30ZA-0001	00	2024-03-12	1

CLIENT: TORONTO HYDRO-ELECTRIC SYSTEM LIMITED

DEPARTMENT: CPW

		SIGNATURE	DATE
PREPARED BY :	Y. Ulusow		2024-03-12
REVIEWED BY :	O. Rodriguez		2024-03-12
APPROVED BY:	T. Bateman		2024-03-14

Toronto Hydro-Electric System Limited
EB-2023-0195
JT3.1
Appendix F
REDACTED
FILED: April 22, 2024
(53 Pages)

ISSUE/REVISION INDEX

Issue Code	Revision					Revision Details
	No.	By	Rev'd.	App.	Date	
RI	00	YU	OR	TB	2024-03-12	Submitted to TH for Project Close-Out

Issue Codes: RC = Released for Construction, RD = Released for Design, RF = Released for Fabrication, RI = Released for Information, RP = Released for Purchase, RQ = Released for Quotation, RR = Released for Review and Comments.

TABLE OF CONTENTS

1.0 PURPOSE

This finalization report summarizes the audit work completed on the UG PCBs BR-F2/BR-F3/BR-F1/TA-F4 P.1 project number P-220271-WD161000.

2.0 BACKGROUND

The UG PCBs BR-F2/BR-F3/BR-F1/TA-F4 P.1 project involved Installation of vault transformers, OH switch fuse upgrade at the 190, 100 Carrier Dr and 20 Humberline Dr in the Etobicoke area. The design and construction were executed by Entera Utility Contractors.

The project construction start date was June 27th, 2023, and the attainment date was January 25th, 2024.

The Toronto Hydro Electric-System Limited (THESL) Contract Administrator (CA) on this project was Francis Szto and the THESL Field Support (FA) was Kenneth Abram. The main AtkinsRéalis (ATRL) Field Auditor was Yusuf Ulusow, and the back-up was Stephen Farrar.

3.0 WORK SUMMARY

AtkinsRéalis auditors completed the following audit work on this project: pre-construction support, site visits to verify in-construction activities, verification of material and work units, safety verification, quality assurance, verification of scope changes, recognizing deficiencies, and project close-out audit.

4.0 FINDINGS

The following table summarizes the audit tasks performed on this project and lists the appendix in which audit findings are reported.

AUDIT COMPONENT	NUMBER / DATE / COMMENT	APPENDIX REFERENCE
Pre-Job Meeting	2023-05-31	A
Site Visits	3	B
Audit Photographs	Available upon request	C
Asset Installation Checklists	Included	D
Critical Tasks	N/A	E
Non-Compliance Reports (Rs)	QUA-5647 Open	F

Final Billing Verification (JIS)	2024-01-31	G
Change Orders	1 CO issued and finalized	H
Material Verification Excess Unreturned Material (NR) (Total $ value):	$3,684.97	I
Final Walk-Down *(Includes any incomplete work tickets)*	2024-03-06 outstanding deficiencies transferred to QUA-5647 Open.	J
Certificate of Substantial Performance	2024-01-21	K
Contractor Close-Out GCF Verification Checklist Score (%)	97%	L
THESL Department Requisition Form / Job Order Form	Included	M
Third-Party Transfer Form (TPTF)	N/A	N

5.0 CONCLUSION, COMMENTS AND LESSONS LEARNED

Missing Items in the GCF that prevented contractor from achieving a perfect score on the GCF return Checklist:

1. Missing after photos of KIC and MBF specification plates for each new installed TX. Entera was unable to provide.

Outstanding Items at Project Closeout:

1. Qty and description of excess unreturned material (NR):

WO#	Stock ID	Stock Item Name	Amount	Quantity
1000535670	7105160	WIRE 2/0 19 STR CU SD AS PER ASTM B8	$3,684.97	254m

2. Open NCRs and short description:
   QUA-5647: Deficiencies on site to be corrected. Please refer to Deficiency register list.

6.0 APPENDICES

Appendix A up to and including Appendix N – refer to TH File Transfer site (https://transfer.torontohydro.com/).

PRE-JOB MEETING AGENDA AND MINUTES

Project Name:	UG PCBs BR-F2/BR-F3/BR-F1/TA-F4 P.1	**Project Number:**	P-220271-WD161000
Constructor:	**Toronto Hydro (Specify for MEP projects)**	**Contractor:**	
Minutes Prepared by:	Yusuf Ulusow	**Minutes Revision:**	Rev.0
Meeting date:	2023-05-31	**Time/ location:**	13:30 / on Line via Webex
Attendees:	See item no. 1 & signatures on the last page	**Absent:**	

Note: *For outstanding Action Items, describe the action in the "Minutes" column and write the responsible person in the "Action By" column.*

These Meeting Minutes and ***Action Items are to be forwarded to the TH DRP and PA for addition to Contractor's bi-weekly meeting agenda.***

ITEM NO.	AGENDA	MINUTES	ACTION BY
1	**INTRODUCTION OF PROJECT TEAM** *(Please sign last page for attendance)*		**ALL**
a	TH Contract Administrator (CA)	Francis Szto	
b	TH Field Administrator (FA)	Ken Abram	
c	TH Project Analyst (PA)	Joseph Michel	
d	TH Corporate Communication (CC)	Shannon Jackson	
e	Designer – TH or Contractor	Mathew Huestis - Entera	
f	Contractor Supervisor	John Wood	
g	Contractor Foreman	Justin Gillespie	
h	SNC-Lavalin Field Auditor	Yusuf Ulusow	
i	SNC-Lavalin Field Auditor	Sheldon Klassen	
j			
k			

PRE-JOB MEETING AGENDA AND MINUTES

2	**SAFETY MOMENT**		**ALL**
a	Discussion of a brief safety moment	Please make sure to stay hydrated when working in the heat. Make sure to take the time to drink some water when suitable.	
b	Has the TH Contractor EH&S pre job meeting form (FRM-1810-100, Revision 4) been filled out?	Yes, has been completed	
3	**PROJECT SCOPE**		**TH CA**
a	Discussion of project scope and purpose as well as background information on project	To replace three PCB three phase vaultroom transformers from three different locations and install new fault indicators and elbows.	
b	Has the project been assigned to SNCL as the Auditor firm in the NCRDatabase with the TCSAO ID?	Yes	Contractor action item
c	Is the Job Instruction Sheet (JIS) accurate? *Justification for Custom units with verification method* *Anticipated change orders*	Yes, JIS has been completed	
d	Take-Off sheets available? Pass on to SNCL Auditors	Yes, attached to the GCF	
e	Third Party Transfer Form (TPTF) verification:	N/A	
(i)	Are TPTFs required?	N/A	
(ii)	If TPTFs are required, are they present in the GCF?	N/A	
4	**DESIGN**		**DESIGNER**
a	Project Design by TH or DB Contractor?	Entera - Contractor	
b	Presentation of project design and key points of consideration/potential third-party conflicts during construction	To replace three PCB three phase vaultroom transformers from three different locations and install new fault indicators and elbows.	
c	Digitization of drawings complete?	Yes, has been completed	

PRE-JOB MEETING AGENDA AND MINUTES

d	GEAR QA/QC & Posting of drawings complete?	Yes, has been completed.	
e	Confirm DGO (Distribution Grid Operations) construction package approval. If not, provide timeline for completion?	Waiting for control approval for DGO	
f	Construction Standards listed on drawings are up to date?	Yes, rev 60 was used for the drawing	
g	[redacted]	Yes, rev 61	
h		N/A	
i		N/A	
j		N/A	
k		N/A	
l		Yes, all TX has been confirmed to be PCB and needs to be removed	
m		N/A	
n		N/A	
o		N/A	

PRE-JOB MEETING AGENDA AND MINUTES

17 p	[redacted]	N/A	
17 q		N/A	
5	**MATERIAL STATUS**		**TH / CONT**
a	Material purchased by TH or DB Contractor?	TH	
b	Has material been released?	Yes, all have been released except for the transformers. Expected date of arrival is Nov 2023	
c	Material expected delivery date?	9 transformers are to be deliveried in Nov 2023	
d	Has all nomenclature been provided with the material?	Yes	
e	Does Contractor have temporary Material Lay-down Area? *If yes, provide address so inspections can be made*	N/A	
f	Does contractor have permit for the lay-down area? (Ensure lay-down area is safe or fenced off if necessary)	N/A	
6	**CRITICAL TASKS** *(Critical Tasks Checklist to be pre-filled by Designer, put in GCF and brought to Pre-Job meeting)*		**DESIGNER**
a	"Critical Tasks Checklist" document reviewed and marked-up as needed? *Ensure there are steps to deal with each of the identified Critical Tasks*	Yes, has been reviewed	
b	Final photographs (as per Asset Installation Checklist photo requirements) sent to Auditor for verification within 24 hours of energization	Yes, has been reviewed	
7	**PERMITS**		**CONT/TH**

PRE-JOB MEETING AGENDA AND MINUTES

a	[redacted]	N/A	
b	Notice of Project Validity. To be valid through the life of the project	Start Date: 2022-08-30 End Date:2023-12-31 Notice of project # 22eN674162	
c	Will tunneling & boring be required? If yes, ensure this is identified on IFC drawings and Notice for Tunnels (#0068) is on the NOP	*N/A*	
8	**CUSTOMER COMMUNICATIONS & NOTIFICATIONS**		**CONT / CC**

PRE-JOB MEETING AGENDA AND MINUTES

a	Have all the following Customer Letters been issued by either Toronto Hydro or Contractors? 1. Customer General Letter (Civil) – Toronto Hydro Issued 2. Customer Equipment Letters (Civil) – Toronto Hydro Issued ▪ Padmount Transformers ▪ Submersible Transformers ▪ Switch Gear ▪ Sight Line ▪ Splice Boxes ▪ Tap Boxes ▪ Poles Relocation and New Pole Location – As outlined in the Customer List submitted by the designer ○ Property with Pre-Existing Pole - New Pole installed greater than one meter on the same property ○ Property without Pre-Existing Pole has pole installed 3. Customer Week Before Letter (Civil – Underground & Overhead) – Contractor Issued (Posted to Toronto Hydro FTP Site) 4. Customer Outage Letter (Electrical) – Contractor Issued (Posted to Toronto Hydro FTP Site)	1. N/A 2. N/A 3. N/A 4. Contractor to contact the customer 48hrs prior to working in the area. Contractor TH if can not reach the customer.	
b	Life support identified in project area? COCO to confirm the designation is still applicable/required.	*N/A*	
9	**PROJECT PHOTOGRAPHS** *(SNCL auditors will ask contractor for photographs of items not witnessed in order to approve monthly JIS)*		**TH CA**
a	"Contractor Close-Out GCF Photographs Requirements" document reviewed?	Yes, has been reviewed	

PRE-JOB MEETING AGENDA AND MINUTES

b	Photographs must be provided for the installation of 100mm triple mix topsoil prior to laying sod. (With measuring tape showing depth of backfill) Confirm this is understood?	N/A	
c	Any additional photos requested by CA?	N/A	
10	**ADDITIONAL ITEMS**		**CONT / CA**
a	[redacted]	N/A	
b		N/A	
c		Yes, outage will be required. If failure happens, replace the new equipment with the existing equipment	
11	**REVIEW OF CONTRACTOR SAFETY PLAN**		**CONT**
a	Contractor's project specific safety plan included in GCF?	Yes	
b	Summarize the Safety plan presented by Contractor highlighting all hazards (electrical, fall potential, controlled substances, excavations, etc), and mitigation plan(s) (e.g. barriers, elimination, etc).	Wearing rubber glues, PPE, Lighting, fall arrest & spotter.	

PRE-JOB MEETING AGENDA AND MINUTES

c	**Incident Reporting Requirements:** Toronto Hydro Incident Notification Protocol to be followed. **Immediately** notify project CA, FA and 3rd party Auditor via direct phone call followed by an email, Cc to psoadmin@torontohydro.com.	Yes, reviewed	
12	**CONSTRUCTION READINESS**		**CONT**
a	What is the construction schedule? Start / End dates	Start Date: Nov 2023 End Date: Jan 2024	
b	Any premium hours needed? Managerial pre-authorization needed.	Based on customer required, incremental premium hours may be needed.	
c	Pre-job Meeting Minutes to be included to GCF? Crew Leader on site to review and sign off?	Yes, it will be sent out	
d	Have all subcontractors filled out a "Form 1000"? Ensure they all sign on to main tailboard. Also, ensure to include all subcontractors on daily emailed crew lists.	N/A	
e	Multiple contractor on-site coordination required? Coordination required by Contractor or THESL	*N/A*	
f	Traffic Control/Pedestrian Control Paid Duty required? Justification for Paid Duty: ☐ Enforcement or Authority ☐ 30m within intersection with traffic signals ☐ More than one lane or direction of traffic ☐ MCR Traffic Control (Transportation Services Requirement)	N/A	
g	Have potential tree-trimming conflicts been identified?	N/A	
h (i)	Toronto Hydro Worksite Signage Required? (Minimum duration= over 3 months)	YES NO	
(ii)	If Yes – How Many? Location(s):	N/A	
i	Is Pre-Construction Site meeting scheduled? Anticipated date	N/A	

PRE-JOB MEETING AGENDA AND MINUTES

	Ensure to invite all required attendees (City, Police, other utilities, SNCL Auditor, etc.)		
j	RODAR (Road Occupancy) Permit anticipated?	N/A	
k	Any other questions to be answered prior to the site meeting / construction start?	None	
13	**TO BE NOTED**		**ALL**

- Safety is of paramount concern when executing this project.
- All construction work is to be compliant with Ont. Reg. 22/04 and CV-CON-1.
- Any Deviations from the design are to be dealt with as per Construction Standard 34-1000.
- Any scope change requires the written approval of the Field Administrator (FA) and/or Contract Administrator (CA) and sign-off by the contractor DRP and the SNC-Lavalin auditor.
- Contractor to consult and co-ordinate with the FA concerning any field issues encountered during the execution of this project.
- Contractor to co-ordinate with SNC-Lavalin to ensure SNC-Lavalin is on-site regularly to inspect (safety, quality) the execution of this project.

PRE-JOB MEETING AGENDA AND MINUTES

14	PRE-JOB MEETING ATTENDANCE SIGN-OFF	ALL

Project Name / Number:

Company	Name	Signature
SNC-Lavalin	Yusuf Ulusow	yusuf
	Uzair Zaman	
Toronto Hydro	Joseph Michel	
	Francis Szto	Francis Szto Digitally signed by Francis Szto DN: cn=Francis Szto, email=FSzto@TorontoHydro.com Date: 2023.05.31 14:45:35 -04'00'
	Ken Abram	
	Curtis Ross	
	Shannon Jackson	

Contractor Attestation upon signing:

☑ All items discussed in this meeting will be communicated to all contractor crews and sub-contractor crews working on this project.

Contractor: EATON (see Att. Above)		
	Nima Eslami	
	Kristen Iwanczyk	
	Ted Giesbrecht	
	Tony Antinucci	
	TONY WOOD	

Title	Creation Date	Contract Area	Project Number
55WD161000-2024-01-21-Electrical	22/01/2024	A01 - Design-Buil	672824
55WD161000-2023-12-07-Electrical	07/12/2023	A01 - Design-Buil	672824
55WD161000-2023-06-27-Electrical	05/07/2023	A01 - Design-Buil	672824

SLI Sub-Project Number	TH Department	TH Project Number	Project Description	SNCL Auditor	TH DRP/CA
55WD161000	CPW	P-220271-WD161000	UG PCBs BR-F2/BR-F	Ulusow, Yusuf	Francis Szto
55WD161000	CPW	P-220271-WD161000	UG PCBs BR-F2/BR-F	Zambrano, Carlos	Francis Szto
55WD161000	CPW	P-220271-WD161000	UG PCBs BR-F2/BR-F	Zambrano, Carlos	Francis Szto

Address / Loca	Work Type Audited	Contractor	Audit Date	Time In	Inclement Wea	Crew on site at time of
119 Carrier Dr	Electrical	Entera	2024-01-21T00:00:00	2024-01-21T10:38:00	False	True
190 Carrier Dr	Electrical	Entera	2023-12-07T00:00:00	2023-12-07T11:00:00	False	False
20 Humberline	Electrical	Entera	2023-06-27T00:00:00	2023-06-27T12:30:00	False	True

Duration of visit (in minutes)	NCR Issued	NCR Number	Work Planned	Work in Progress During Site Visit
20	False		Crew's plan fo	Crew had completed replacing the vaultroc
30	False		No crew was found on site. Auditor tried to contact the fo	
60	False		Crew planned	Crew was installing new ground wire and th

Areas of Concern	Civil Completion	Electrical Completior	Overall Completion
Pedestrians, Isolation from vault BIA	0	61	30.5
Pedestrians, Isolation from vault BIA	0	60	30
Pedestrians, Isolation from vault BIA	0	60	30

Walk-in Vault Transformer Installation Audit Checklist

(Customer Building Vaults Containing Toronto Hydro Owned Equipment)

Prepared By: Y.Ulusow	Design/Build Contractor: Entera	Audit Date: 2024-03-06
Project Name: UG PCBs BR-F2/BR-F3/BR-F1/TA-F4 P.1	Project Number: P-220271-WD161000	Drawing Number: 2022-019891, 2022-019892, 2022-019893, 2022-019894
Location / Asset Number: Vault CLI	Street Name: 100 Carrier Dr	
Primary Voltage: 13.8/8kV	Secondary Voltage: 347/600V	Transformer kVA Rating: 3-167kVA

STD = THESL Construction Standard

Standards listed on this checklist are a guideline only; auditors are to use the standards listed on approved construction drawings for each specific asset.

	ELECTRICAL INSPECTION				
	Walk-in Vault Installation Type:	**Above Grade☑**		**Below Grade☐**	
#	**Requirements**	**Yes**	**No**	**N/A**	**Comments**
1	Proper nomenclature on front of vault door as per STD 21-4700	☐	☐	☑	
2	Danger sign on front of vault door as per STD 21-4700	☐	☐	☑	
3	Proper nomenclature on inside wall of vault and on equipment as per STD 21-3000.	☐	☐	☑	
4	[redacted]	☑	☐	☐	
5		☐	☐	☑	
6		☑	☐	☐	
7		☑	☐	☐	
8		☑	☐	☐	
9		☐	☐	☑	
10		☑	☐	☐	
11		☐	☐	☑	
12	Grounds are installed as per STD 18-1000 and 18-5300	☑	☐	☐	

13	[redacted]	☑	☐	☐	
14		☐	☐	☑	
15		☑	☐	☐	
16		☐	☐	☑	
17		☑	☐	☐	
18		☑	☐	☐	
19		☐	☐	☑	

NOTES: - Digital photograph(s) are required for all items on the checklist.

- Any deviations or missing items will be identified on a Quality NCR issued to the Design/Build contractor as soon as possible.

Walk-in Vault Transformer Installation Audit Checklist

(Customer Building Vaults Containing Toronto Hydro Owned Equipment)

Prepared By: Y.Ulusow	Design/Build Contractor: Entera	Audit Date: 2024-03-06
Project Name: UG PCBs BR-F2/BR-F3/BR-F1/TA-F4 P.1	Project Number: P-220271-WD161000	Drawing Number: 2022-019891, 2022-019892, 2022-019893, 2022-019894
Location / Asset Number: Vault KIC	Street Name: 20 Humberline Dr	
Primary Voltage: 13.8/8kV	Secondary Voltage: 416/240V	Transformer kVA Rating: 3-167kVA

STD = THESL Construction Standard

Standards listed on this checklist are a guideline only; auditors are to use the standards listed on approved construction drawings for each specific asset.

ELECTRICAL INSPECTION

Walk-in Vault Installation Type: Above Grade☑ Below Grade☐

#	Requirements	Yes	No	N/A	Comments
1	Proper nomenclature on front of vault door as per STD 21-4700	☐	☐	☑	
2	Danger sign on front of vault door as per STD 21-4700	☐	☐	☑	
3	Proper nomenclature on inside wall of vault and on equipment as per STD 21-3000.	☐	☐	☑	
4	[redacted]	☑	☐	☐	
5		☐	☐	☑	
6		☑	☐	☐	
7		☐	☐	☑	
8		☑	☐	☐	
9		☐	☐	☑	
10		☑	☐	☐	
11		☐	☐	☑	
12	Grounds are installed as per STD 18-1000 and 18-5300	☑	☐	☐	

13	[redacted]	☑	☐	☐	
14		☐	☐	☑	
15		☑	☐	☐	
16		☐	☐	☑	
17		☑	☐	☐	
18		☑	☐	☐	
19		☐	☐	☑	

NOTES: - Digital photograph(s) are required for all items on the checklist.

- Any deviations or missing items will be identified on a Quality NCR issued to the Design/Build contractor as soon as possible.

Walk-in Vault Transformer Installation Audit Checklist

(Customer Building Vaults Containing Toronto Hydro Owned Equipment)

Prepared By: Y.Ulusow	Design/Build Contractor: Entera	Audit Date: 2024-03-06
Project Name: UG PCBs BR-F2/BR-F3/BR-F1/TA-F4 P.1	Project Number: P-220271-WD161000	Drawing Number: 2022-019891, 2022-019892, 2022-019893, 2022-019894
Location / Asset Number: Vault MBF	Street Name: 190 Carrier Dr	
Primary Voltage: 13.8/8kV	Secondary Voltage: 347/600V	Transformer kVA Rating: 3-167kVA

STD = THESL Construction Standard

Standards listed on this checklist are a guideline only; auditors are to use the standards listed on approved construction drawings for each specific asset.

	ELECTRICAL INSPECTION				
	Walk-in Vault Installation Type:	**Above Grade☑**		**Below Grade☐**	
#	**Requirements**	**Yes**	**No**	**N/A**	**Comments**
1	Proper nomenclature on front of vault door as per STD 21-4700	☐	☐	☑	
2	Danger sign on front of vault door as per STD 21-4700	☐	☐	☑	
3	Proper nomenclature on inside wall of vault and on equipment as per STD 21-3000.	☐	☐	☑	
4	[redacted]	☑	☐	☐	
5		☐	☐	☑	
6		☑	☐	☐	
7		☑	☐	☐	
8		☑	☐	☐	
9		☐	☐	☑	
10		☑	☐	☐	
11		☐	☐	☑	
12	Grounds are installed as per STD 18-1000 and 18-5300	☑	☐	☐	

13	[redacted]	☑	☐	☐	
14		☐	☐	☑	
15		☑	☐	☐	
16		☐	☐	☑	
17		☑	☐	☐	
18		☑	☐	☐	
19		☐	☐	☑	

NOTES: - Digital photograph(s) are required for all items on the checklist.

- Any deviations or missing items will be identified on a Quality NCR issued to the Design/Build contractor as soon as possible.

NON-COMPLIANCE (NCR) DATABASE

Home | Track NCR's | Contact Us

NCR TRACKING

NCR ID: QUA-5647 Search NCR

Comments:
Limit of 800 characters

Root Cause Analysis of Non Compliance:
(To be completed by NCR Recipient)

Actions: Update Incident With Comments

Upload any pictures or PDF files associated with this incident
(file extensions PDF, GIF & JPG)

Upload file: Choose File No file chosen

File Description: Upload File

*All serious safety NCR's require completion of a "Risk Assessment". This should be uploaded as a PDF with the file description "Safety NCR ID-Risk Assessment" ex: SFA-1000-Risk Assessment

Print

QUALITY-NCR

Project Name: P-220271-WD161000 - UG PCBs BR-F2/BR-F3/BR-F1/TA-F
Project Number: P-220271-W
Address: Multiple Locations
Contractor: Entera
Violation Date: 14/03/2024
Incident#: QUA-5647
Created / Issued By: Yusuf Ulusow
Did an incident occur? NA
Department: PROGRAM SUPPORT OFFICE-W
NCR Type: QUALITY

Description of Non Compliance:
After completed the final walkdown of the project, auditor found the following deficiency in the project: Metal cable clamps were used to train the cable in Vaultroom KIC instead of the thermoplastics clamps that are required in Standard 13-7050.

Root Cause Analysis of Non Compliance:

Corrective & immediate actions taken (comments from issuer):

Yusuf Ulusow On 03-14-24 :Please return to site and install the thermoplastics clamps as required in Standard 13-7050. Please upload pictures of the completed work when updating the NCR.

Identified NCR Categories

Category	Type
Not built to a TH Standard	Other

Keep Informed

Full Name
Francis Szto
Terry Bateman

Crew Members Involved

Preventative Action (Contractor Comments):

Closure of Non Compliance issued by AtkinsRealis :
Current Status: OPEN
Created Date: 14/03/2024
Closed Date:
Last Updated: 14/03/2024

Uploaded Documents

File Description	Added By	Date
Deficiency Register	Yusuf Ulusow	14-Mar-2024
Example of the Deficiency	Yusuf Ulusow	14-Mar-2024

26-E261 Final Billing.

Job Instruction Sheet

Order No.: 1000535672

TORONTO HYDRO

WBS Element: P-220271-WD161000

PO NO. :

Issued By : JOSEPH MICHEL

Award Date :

Start Date : 01-MAR-23

Finish Date : 31-AUG-23

Project Name: UG PCBs BR-F2/BR-F3/BR-F1/TA-F4 P.1

Location :

No. of items in this job : 9

Contractor Name : ENTERA UTILITY CONTRACTORS

Contract Admin. Approval : Francis Szto

Digitally signed by Francis Szto
DN: cn=Francis Szto, email=FSzto@TorontoHydro.com
Date: 2023.02.22 13:22:34 -05'00'

Date :

Contractor Signature : Type text here

Date : 2023-02-22

No.	Service#	Unit	Description	Estim. Quant	Actual Quantities: Aug. 2023	Dec. 2023	Final Billing
Others							
1	3012806 ELE_HS_ 13-7050	each	312830859 - Electrical : 13-7050 : Installation of electrical equipment for 27.6kV or 13.8kV Distribution 3-1Ø Transformer Vault (any voltage or kVA size). Includes all grounding, racking, vault lighting equipment, and attachment and connecting of all cables. 13-7050 13-7060 : Price : UNDERGROUND TRANSFORMERS & SWITCHGEARS [per Vault]	3.000	1/1	1/2	1/3
2	3019893 ELE_HS_ 13-9001	each	312830874 - Electrical : 13-9001 : Remove all electrical equipment and any portion of cables within 3Ø Radial transformer/switching vault. : Price : UNDERGROUND TRANSFORMERS & SWITCHGEARS [per Vault]	3.000	1/1	1/2	1/3
3	3008772 ELE_HS_ 16-4060	each	313131050 - Electrical : 16-4060 : Install 15kV 1 Conductor Cu./Al. Primary TRXLPE Cable Indoor Termination (Cold Shrink Method). 16-4060 : Price : UNDERGROUND CABLE, TERMINATIONS, JOINTS and CONNECTORS [per Terminator]	3.000	0/0	3/3	0/3

Yusuf Ulusow - SNC Lavalin - 416-346-4883 yu

Toronto Hydro and the Contractor acknowledges that the Work described in this Job Instruction Sheet shall be priced and paid according to the Schedule of Unit Prices for the rate year (identified in the Job # listed in the top right corner of this Job Instruction Sheet) in which the Work pursuant to this Job Instruction Sheet relates, notwithstanding that the Work may carry over into subsequent calendar years.

Olivia Brown - Entera yu yu yu

Wednesday , February 22 2023

Job Instruction Sheet

Order No.: 1000535672

No.	Service#	Unit	Description	Estim. Quant	Actual Quantities Aug. 2023	Dec. 2023	Final Billing			
4	3012026	each		21.000	9/9	3/12	9/21			
	ELE_HS_ 16-4220									
	313131060 - Electrical : 16-4220 : Install 15kV 1 Conductor Cu./Al. 200A Primary TRXLPE Cable Loadbreak Elbow Termination. 16-4220 16-4180 : Price : UNDERGROUND CABLE, TERMINATIONS, JOINTS and CONNECTORS [per Elbow]									
5	3003457	each		9.000	3/3	3/6	3/9			
	ELE_HS_ 16-7001									
	313131082 - Electrical : 16-7001 : Install 2 or more underground Fault Indicators to existing terminators/splices/ elbows, at same chamber, vault, splice box or pad location. 20-3400 20-3450 20-3500 20-3600 20-3700 : Price : UNDERGROUND CABLE, TERMINATIONS, JOINTS and CONNECTORS [per Indicator]									
6	3004493	Hours		4.000	2/2	0/2	2/4			
	ELE_HS_ TE-0101 Reg Rate Mon-Fri 6A-7P									
	313631108 - Electrical : TE-0101 : Foreperson/Certified Crew Leader : Regular Rate Mon - Fri 6:00am - 7:00pm : LABOUR RATES [/ hour]									
7	3008769	Hours		8.000	4/4	0/4	4/8			
	ELE_HS_ TE-0102 Reg Rate Mon-Fri 6A-7P									
	313631109 - Electrical : TE-0102 : MEA Journey Person : Regular Rate Mon - Fri 6:00am - 7:00pm : LABOUR RATES [/ hour]									
8	3019030	Hours		4.000	2/2	0/2	2/4			
	ELE_HS_ TE-0301									
	314431131 - Electrical : TE-0301 : Pickup truck. : Price : EQUIPMENT RATES [/hour]									

CB CB CB

Toronto Hydro and the Contractor acknowledges that the Work described in this Job Instruction Sheet shall be priced and paid according to the Schedule of Unit Prices for the rate year (identified in the Job # listed in the top right corner of this Job Instruction Sheet) in which the Work pursuant to this Job Instruction Sheet relates, notwithstanding that the Work may carry over into subsequent calendar years.

gu gu gu

Job Instruction Sheet

Order No.: 1000535672

No.	Service#	Unit	Description	Estim. Quant	Actual Quantities Aug. 2023	Dec. 2023	Final Billing			
9	3012966 ELE_HS_ TE-0323	Hours		4.000	2/2	0/2	2/4			

314431153 - Electrical : TE-0323 : Bucket truck (double for up to 65 feet). : Price : EQUIPMENT RATES [/hour]

Remarks :

CB CB. CB.
gu gu gu

Toronto Hydro and the Contractor acknowledges that the Work described in this Job Instruction Sheet shall be priced and paid according to the Schedule of Unit Prices for the rate year (identified in the Job # listed in the top right corner of this Job Instruction Sheet) in which the Work pursuant to this Job Instruction Sheet relates, notwithstanding that the Work may carry over into subsequent calendar years.

Job Instruction Sheet (Additional Items) Job # : 26-E261

TORONTO HYDRO

Project No : P-220271-WD161000 Project Name : UG PCB's BR-F2/BR-F3/BR-F1/TA-F4 P.1

P.O. No : Location :

No.	Item #	Unit	Description	CO#	Est. Qty	Actual Quantites / Dates					
						Final					
1	TE-0101	per Hour	Foreperson/Certified Crew Leader **Incremental Premium RateWith Contract Item Sun & Stat Holidays6:00am - 7:00pm**	1	10	10/10					
2	TE-0102	per Hour	MEA Journey Person **Incremental Premium RateWith Contract Item Sun & Stat Holidays6:00am - 7:00pm**	1	20	20/20					
3	TE-0123	per Hour	Apprentice Line Person - 3rd Year **Incremental Premium RateWith Contract Item Sun & Stat Holidays6:00am - 7:00pm**	1	10	10/10					
4	TE-0124	per Hour	Apprentice Line Person - 1st or 2nd Year **Incremental Premium RateWith Contract Item Sun & Stat Holidays6:00am - 7:00pm**	1	10	10/10					
5											
6											
7											
8											
9											

CHANGE ORDER

Date: 24 Jan 2024 Construction Related

Purchase Order: **UPCMS Job#:** 2023-Horseshoe

Project Title: P-220271-WD161000 UG PCBs BR-F2/BR-F3/BR-F1/TA-F4 P.1

Contractor: Entera **Change Order#:** 1

The following changes are contemplated to the above project. Unless indicated otherwise, this is not an authorization to proceed. All changes, which affect the final unit price, shall only proceed under the authority of an executed Change Order.To minimize delays to the contractor, approval can occur via email with the contractor submitting a Change Order within 48 hrs.

Change Order Issues:

Sunday work to complete transformer replacement at 100 Carrier Drive.

Location/Drawing/Sketch:

100 Carrier Drive

Detailed Description of Requirements:

Sunday work to complete transformer replacement at 100 Carrier Drive.

Item Description	Exist	E-Qty	A-Qty
Type: Electrical Series: TE-0100-ELECTRICAL Description: Incremental Premium RateWith Contract Item Sun & Stat Holidays6:00am - 7:00pm TE-0101-Foreperson/Certified Crew Leader | UOM: / hour | Short Text: ELE_HS_ TE-0101 IPR W/ CI Sun&Stat 6A-7P | SAP ID: 3004492	NO	10.00	10
Type: Electrical Series: TE-0100-ELECTRICAL Description: Incremental Premium RateWith Contract Item Sun & Stat Holidays6:00am - 7:00pm TE-0102-MEA Journey Person | UOM: / hour | Short Text: ELE_HS_ TE-0102 IPR W/ CI Sun&Stat 6A-7P | SAP ID: 3002999	NO	20.00	20
Type: Electrical Series: TE-0100-ELECTRICAL Description: Incremental Premium RateWith Contract Item Sun & Stat Holidays6:00am - 7:00pm TE-0123-Apprentice Line Person - 3rd Year | UOM: / hour | Short Text: ELE_HS_ TE-0123 IPR W/ CI Sun&Stat 6A-7P | SAP ID: 3006964	NO	10.00	10
Type: Electrical Series: TE-0100-ELECTRICAL Description: Incremental Premium RateWith Contract Item Sun & Stat Holidays6:00am - 7:00pm TE-0124-Apprentice Line Person - 1st or 2nd Year | UOM: / hour | Short Text: ELE_HS_ TE-0124 IPR W/ CI Sun&Stat 6A-7P | SAP ID: 3005835	NO	10.00	10
Total Change Order: **) Final Change Order Value:**			

A: Requested By: Olivia Brown Company: Entera

B: Inspector/ Auditor Name: Yusuf Ulusow | Dated: Jan-25-2024 | Accepted by Auditor: YES

Comments: Accepted. After reviewing the attached documents, the requested units have been confirmed to be valid and can be processed.

C: Design Supervisor Name: Francis Szto | Dated: Jan-25-2024 | Approved by THESL: YES

Comments: Approved for incremental premium

CHANGE ORDER

D: Approved Change Audited by THESL / External Audit Firm Inspector Name: Yusuf Ulusow | Dated: Jan29 -2024
YES : Change Order process as per RFP - followed by Contractor & PSO
YES: Approved work under Change Order has been completed

Comments: Accepted. Actual quantities have been correctly updated.

Date	Proj#	Project Description	Reason	PO#	UPCMS#	CONO	Status
1/24/2024	P-220271-WD161000	UG PCBs BR-F2/BR-F3/BR-F1/TA-F4 P.1	Sunday work to complete transformer replacement at		2023-Horseshoe	1	CLOSED

CHANGE ORDERS

Welcome **obrown@entera.ca**! [Log Out]

Home | Create CO | Dashboard | Change Order Log | Add Project | Contact Us

APPROVE/REJECT CHANGE ORDERS

Select ▾ Submit

Comments:

Optional: Upload files or pictures related to this change order (file extension can only be jpg, gif or pdf)
Caution: Do not upload confidential information, send via email and quote final CO Ref# in email subject

1. **File Description:**
2. **Select File (one file at a time):** Choose File No file chosen
3. **Upload file:** Upload File

CHANGE ORDER

Date: 1/24/2024
Change Order #: 1
Purchase Order:
UPCMS Job#: 2023-Horseshoe
Project Title: UG PCBs BR-F2/BR-F3/BR-F1/TA-F4 P.1
Project#: P-220271-WD161000
Contractor: Entera
CO Status: 5-SNC-Accepted
Change: Construction Related

The following changes are contemplated to the above project. Unless indicated otherwise, this is not an authorization to proceed. All changes, which affect the final unit price, shall only proceed under the authority of an executed Change Order.To minimize delays to the contractor, approval can occur via email with the contractor submitting a Change Order within 48 hrs.

Change Order Issue:

Sunday work to complete transformer replacement at 100 Carrier Drive.

Location/Drawing/Sketch:

100 Carrier Drive

Detailed Description of Requirements:

Sunday work to complete transformer replacement at 100 Carrier Drive.

Exist: Does this item exist on the UPCMS of the project?

R_ID	Item Description	*Exist	E-Qty	A-Qty	Price	
102438	Type: Electrical Series: TE-0100-ELECTRICAL Description: Incremental Premium RateWith Contract Item Sun & Stat Holidays6:00am - 7:00pm TE-0101-Foreperson/Certified Crew Leader | UOM: / hour | Short Text: ELE_HS_ TE-0101 IPR W/ CI Sun&Stat 6A-7P | SAP ID: 3004492	NO	10	10	0	Edit
102439	Type: Electrical Series: TE-0100-ELECTRICAL Description: Incremental Premium RateWith Contract Item Sun & Stat Holidays6:00am - 7:00pm TE-0102-MEA Journey Person | UOM: / hour | Short Text: ELE_HS_ TE-0102 IPR W/ CI Sun&Stat 6A-7P | SAP ID: 3002999	NO	20	20	0	Edit
102440	Type: Electrical Series: TE-0100-ELECTRICAL Description: Incremental Premium RateWith Contract Item Sun & Stat Holidays6:00am - 7:00pm TE-0123-Apprentice Line Person - 3rd Year | UOM: / hour | Short Text: ELE_HS_ TE-0123 IPR W/ CI Sun&Stat 6A-7P | SAP ID: 3006964	NO	10	10	0	Edit
102441	Type: Electrical Series: TE-0100-ELECTRICAL Description: Incremental Premium RateWith Contract Item Sun & Stat Holidays6:00am - 7:00pm TE-0124-Apprentice Line Person - 1st or 2nd Year | UOM: / hour | Short Text: ELE_HS_ TE-0124 IPR W/ CI Sun&Stat 6A-7P | SAP ID: 3005835	NO	10	10	0	Edit

Total Estimated Value: | Total Actual Value:

Step 1(A)

Requested By:Olivia Brown Contractor: Entera

Step 2(B) Inspector: Yusuf Ulusow Backup Inspector: SNC General Mailbox

Authorized By Inspector: Yusuf Ulusow on Thursday, January 25, 2024 | Approved: YES

Comments:

Accepted. After reviewing the attached documents, the requested units have been confirmed to be valid and can be processed.

Step 3(C) Design Supervisor: Francis Szto

Authorized By Design Supervisor: Francis Szto on Thursday, January 25, 2024 | Approved: YES

Comments:

Approved for incremental premium

Paid Under Progress Billing#: Dated:

Step 4(D) Actuals Updated By: Olivia Brown on Monday, January 29, 2024

Comments:

Actuals updated.

Step 5(E) Inspector: Yusuf Ulusow Backup Inspector: SNC General Mailbox

Verified By Inspector: Yusuf Ulusow on Monday, January 29, 2024

Comments:

Accepted. Actual quantities have been correctly updated.

☑ Change Order process-as per RFP-followed by Contractor & PSO

☑ Approved work under Change Order has been completed

File Description	Added By	Date
Timesheet	Olivia Brown	24-Jan-2024
Approval	Olivia Brown	24-Jan-2024

Timesheet ID:	28475																Date:	2024-01-21		
Foreman:	417183	Brady Davidson				Approved by GF/Super:				120676	Justin Gillespie			Approved by Manager:						
		JOB#1				JOB#2				JOB#3				JOB#4						
		26261-2																		
																	TOTAL HOURS			
Employee ID	Employee Name	Straight	Night Premi	Time &Half	Double	Straight	Night Premi	Time &Half	Double	Straight	Night Premi	Time &Half	Double	Straight	Night Premi	Time &Half	Double	Straight	Night Premi	Time &Half	Double	Comments/Notes
417183	Brady Davidson				11																11	Loa
16138	Brendan Johnson				11																11	
16303	Kyle Parsons				11																11	Loa
20837	James Groves				11																11	
20894	Dave Maxwell				11																11	Loa
UNIT#	DESCRIPTION																TOTAL HOURS					Comments/Notes
2-241	2024 GMC Sierra 2500 Electrical foreman				11				0				0				0				11	
3-62	2019 Freightliner M2-106				11				0				0				0				11	
3-70	2020 Freightliner M2-106 Altec AN50E-OC S/N 0120FK2425				11				0				0				0				11	
224830	International 4300 Digger Derrick				11				0				0				0				11	
2-82	2012 Ford F550 Super Duty (gas)				11				0				0				0				11	

From: Francis Szto
To: Justin Gillespie; Olivia Brown
Subject: RE: 100 Carrier drive power outage.
Date: January 9, 2024 3:43:12 PM

Justin:
Please proceed.
Regards,

From: Justin Gillespie <jgillespie@entera.ca>
Sent: January-09-24 1:29 PM
To: Francis Szto <FSzto@TorontoHydro.com>; Olivia Brown <obrown@entera.ca>
Subject: [EXTERNAL] : RE: 100 Carrier drive power outage.

Hi Francis,

Happy New year!!!

The customer is good with us completing this job on Sunday Jan 21st as long as you are good with the ot still. Will need 1 foreman, 4 journeymen and 1 4th year apprentice to complete this vault.

Thank you

From: Justin Gillespie
Sent: Tuesday, November 28, 2023 2:48 PM
To: Francis Szto <FSzto@TorontoHydro.com>; Olivia Brown <obrown@entera.ca>
Subject: RE: 100 Carrier drive power outage.

Sounds good. I will set something up for early Jan.

Thank you

From: Francis Szto <FSzto@TorontoHydro.com>
Sent: Tuesday, November 28, 2023 2:12 PM
To: Justin Gillespie <jgillespie@entera.ca>; Olivia Brown <obrown@entera.ca>
Subject: RE: 100 Carrier drive power outage.

Justin:
This is good enough and I will keep this in file as part of the Change order approval supporting documentation.
Regards,

From: Justin Gillespie <jgillespie@entera.ca>
Sent: November-28-23 2:00 PM
To: Francis Szto <FSzto@TorontoHydro.com>; Olivia Brown <obrown@entera.ca>
Subject: [EXTERNAL] : FW: 100 Carrier drive power outage.

See below from the customer. Let me know if that is enough?

Thank you

From: Tony Balasingham <Tony@xcella.ca>
Sent: Thursday, June 15, 2023 9:24 AM
To: Justin Gillespie <jgillespie@entera.ca>
Cc: shipping@xcella.ca; Olivia Brown <obrown@entera.ca>; Taran | Xcella.CA <taran@xcella.ca>
Subject: Re: 100 Carrier drive power outage.

Hi Justin

further to our discussion this morning,

we will not be able to shut down our operation on weekdays due customers visiting showroom , delivery as well as pick ups

however as discussed , we could have one of our staff open the premises on Sunday or Saturday to accommodate you to carry out the work

Thank you for your understanding

Tony
416 891 0927

On Thu, Jun 15, 2023 at 8:50 AM Justin Gillespie <jgillespie@entera.ca> wrote:

> Good morning Tony,

Could you please pick the date that works best for you ? I know this is inconvenient but the equipment does need to be replaced to keep it working well.

Give me a call if you need to discuss further. 416 660 1746.

Thank you

From: Justin Gillespie <jgillespie@entera.ca>
Sent: Tuesday, June 13, 2023 11:31 AM
To: Tony Balasingham <tony@xcella.ca>
Cc: shipping@xcella.ca; Olivia Brown <obrown@entera.ca>; Taran | Xcella.CA <taran@xcella.ca>
Subject: Re: 100 Carrier drive power outage.

Hi tony,

Unfortunately we will have to keep this between the hours of 8 am and 3pm. That is when our crews work.

We are giving lots of notice if you need to move some things around. This is only for 1 day. Please let me know 1 of the days that i provided that works best.

Thank you

Sent from my Bell Samsung device over Canada's largest network.

From: Tony Balasingham <tony@xcella.ca>
Sent: Tuesday, June 13, 2023 10:54:47 AM
To: Justin Gillespie <jgillespie@entera.ca>
Cc: shipping@xcella.ca <shipping@xcella.ca>; Olivia Brown <obrown@entera.ca>; Taran | Xcella.CA <taran@xcella.ca>
Subject: Re: 100 Carrier drive power outage.

Hi Justin

Further to your request for work to be done on June 27 or 28th - 8AM to 3 PM

We have operations and showroom open during this time and it is not possible to close down .

However we could accommodate you from say 4 PM till you complete the job. Hope there is no work to be done inside the building

Pl get back to us.

Thank you
Tony
416 891 0927

Sent from my iPhone

> On Jun 13, 2023, at 7:53 AM, Justin Gillespie <jgillespie@entera.ca> wrote:
>
> Good morning,
>
> I was out to your building a couple months ago to discuss a power outage to replace the equipment in the Toronto hydro vault room. This will impact the power to the building for the day. I have 2 dates that we can pick from Tuesday June 27 and Wednesday June 28th 8am to 3pm. Let me know which of those 2 dates works best for you and I will put in the schedule.
>
> Thank you

SNC·LAVALIN

FINAL WALK DOWN DEFICIENCY REGISTER

PROJECT NAME:	TH Project number (WBS):	SLI AUDITOR:	DATE OF FINAL WALK DOWN:
UG PCBs BR-F2/BR-F3/BR-F1/TA-F4 P.1	P-220271-WD161000	Yusuf Ulusow	2024-03-06
☐ **24 hrs notice was given to Contractor prior to final walk-down** ☐ **Contractor attended final walk-down**	CONTRACTOR & REP NAME: Entera	SITE ADDRESS / INTERSECTIONS: Multiple Locations	

A Final Walk-Down of the construction site has been performed using the Construction Drawings. The following observations have been made:

☐ *No deficiencies were found. Work was completed as per drawings and:*

- *site was left clear of any equipment, material or undue hazards*
- *all temporary and permanent restorations completed as per MCR including the application of THs Utility Cut Identifier*
- *all signage has been removed from site*
- *customer property has been restored*

☑ *Deficiencies were found, contractor to see deficiencies listed in table below and address all items by the date indicated. Contractor is to notify SLI auditor once all deficiencies have been cleared.*

NCR(s) Issued: QUA-5647

Comments:

DEFICIENCY NO.	DATE ISSUED	DESCRIPTION OF DEFICIENCY	REQUIRED CLOSE OUT DATE	ACTUAL CLOSE OUT DATE
1		Metal cable clamps were used to train the cable in Vaultroom KIC instead of the thermoplastics clamps that are required in Standard 13-7050		

FORM 9
CERTIFICATE OF SUBSTANTIAL PERFORMANCE OF THE CONTRACT UNDER SECTION 32 OF THE ACT

Construction Act

City of Toronto ,
(County/District/Regional Municipality/Town/City in which premises are situated)

190, 100 Carrier Dr and 20 Humberline Dr , Etobicoke, ON ,
(street address and city, town, etc., or, if there is no street address, the location of the premises)

This is to certify that the contract for the following improvement:

UG PCBs BR-F2/BR-F3/BR-F1/TA-F4 P.1 - P-220271-WD161000
(short description of the improvement)

to the above premises was substantially performed on **2024-01-21** .
(date substantially performed)

Date certificate signed:

(payment certifier where there is one)

(owner and contractor, where there is no payment certifier)

Name of owner: **Toronto Hydro-Electric System**

Address for service: **14 Carlton Street, Toronto, ON M5B 1K5**

Name of contractor: **Entera Utility Contractors**

Address for service: **1530 Birchmount Road, Scarborough, ON M1P 2H2**

Name of payment certifier (where applicable): **AtkinsRéalis Canada Inc.**

Address: **191 The West Mall, Toronto, ON M9C 5K8**

(Use A or B, whichever is appropriate)

☐ A. Identification of premises for preservation of liens:

(if a lien attaches to the premises, a legal description of the premises, including all property identifier numbers and addresses for the premises)

☒ B. Office to which claim for lien must be given to preserve lien:

Toronto Hydro Head Office, 14 Carlton Street, Toronto, ON M5B 1K5
(if the lien does not attach to the premises, a concise description of the premises, including addresses, and the name and address of the person or body to whom the claim for lien must be given)

TORONTO HYDRO

Contractor Close-Out GCF Verification Check List

Contractor Sign-Off		Audit Firm Sign-Off
Project Name: UG PCB BR-F2/BR-F3/BR-F1/TA-F4 P.1	Construction Contractor - Completed By (Print Name): Olivia Brown	Audit Firm - Date GCF Received from Contractor: ATRL 2024-02-12
Project Number: P-220271-WD161000	Date & Signature: OliviaBrown Jan.30/24	Audit Firm – Completed By (Print Name): ATRL Slawomir Domurat
Project Construction Attainment Date: January 2024.	Construction Contractor Manager Attestation (Print Name): John Wood	Audit Firm – Date & Signature: ATRL 2024-02-20 Slawomir Domurat
Construction Contractor Firm: Entera Utility Contractors	Date & Signature: Jan. 31/24	Audit Firm – Field Auditor: Main: Yusef Ulusow Backup: Stephan Farrar

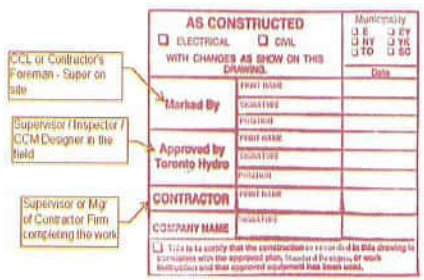
Contractor to fill out their part of this checklist (left side) completely.

****GCFs will not be accepted by Audit Firm unless all items listed in Sections A, B, and C are included in the GCF, and this checklist is properly signed off in the header above.****

Refer to notes at the end of the checklist for importance of each section.

VT = Verification Type:
A = Administrative F = Field

		Contractor Check Off			Audit Firm Verification				
Item #	Section A: Regulatory	Yes	N/A	Comments	Yes	N/A	# of pts.	VT	Comments
1	Number of GCFs returned matches the number originally issued. (This can be seen from Department Requisition)	☑	☐		☑	☐	1	A	
a	If Civil GCF was issued, all documents in the Civil GCF pertaining to this checklist are included in the Electrical GCF as ONE package	☐	☑		☐	☑	1	A	
2	GCF Checklist Title Block is completed and signed	☑	☐		☑	☐	1	A	
3	Latest version of GCF Checklist used	☑	☐		☑	☐	2	A	
4	Back of **folder** is completed correctly as per below.								
a	Constructor signed and dated sections 1 to 7. (Refer to "GCF Rear Sign-Off" Visual Guide, and below in b and c)	☑	☐		☑	☐	1	A & F	
b	Section 4 filled out accordingly with name of qualified staff member, their position & signature. "Partial Certificate" and/or "Final Certificate" boxes checked off according with Ontario Reg 22/04. ➢ *Qualification of staff member to be checked against the contractor's ESA Ont. Reg.22/04 training records.* ➢ *Civil Folder – Final Certificate box* ➢ *Electrical Folder – Final Certificate box; and Partial Certificate (if partial energization has occurred-i.e. partial certificate stamps on dwgs.)*	☑	☐		☑	☐	3	A & F	
c	Section 6 has two parts. 1. Material Closure signed by CCL. 2. Excess Material and Recovered Material checkboxes checked off accordingly. (*These are only needed for Electrical folder*)	☑	☐		☑	☐	1	A & F	

5	**Department requisition** is signed and dated. ("Date Work Completed", "Completed By", and "Supervisor Signature" are all filled in at bottom right of page) This must be done for each of the folders (ie: one for electrical and a separate one for civil).	☑	☐		✓	☐	1	A	
6	**As-Built Drawings** are all returned and properly stamped and signed as per below:								
a	Same number of drawings returned as issued out. (This can be seen on the Department Requisition).	☑	☐		✓	☐	1	A	
b	Drawings returned are the latest revision issued to the constructor and have proper P.Eng. and PSO stamps on them. (The stamps are only needed for externally [non THESL] designed projects). 	☑	☐		✓	☐	1	A	
c	All changes are marked-up on the as-built drawings.	☑	☐		✓	☐	10	F	
d	All mark-ups on the as-built drawings are clear and legible.	☑	☐		✓	☐	4	F	
e	All drawings are stamped "**As Constructed**" and stamp is signed and dated by competent persons as described in diagram below: *(Civil and Electrical As-Builts are signed by Civil and Electrical Foreman, respectively)* 	☑	☐		✓	☐	4	F	
f	All check boxes on the "As Constructed" stamp have been checked off accordingly. (Electrical or Civil check box, Municipality check box, and bottom "as per design" checkbox)	☑	☐		✓	☐	3	F	
g	"Primary Schematic" on As- Built drawings are complying with the latest DGO approved Feeder Print(s), and both are included in the retuned GCF	☐	☑		☐	✓	3	F	

h	**All Electrical drawings** are stamped with a "**Partial Certificate**" stamp next to all items that have been energized. This stamp was placed and dated at the time of the energization. Stamp fully completed and signed by competent person at site (CCL or Contractor's Foreman – Super on site).  Partial Certificate Name Position Signature Date ☐ This is to certify that the construction as recorded in this drawing is consistent with the approved plan, Standard Designs, or work instruction and that approved equipment has been used. ➢ *Qualification of competent person to be checked against the contractor's ESA Ont. Reg.22/04 training records.*	☑	☐		☑	☐	10	F	
i	All Technical Deviations (refer to Std. 34-1000) have been approved by the Designer or Standards department. Revised drawings (signed by a P.Eng or designer) submitted for any deviation from approved standard or drawing, respectively	☐	☑		☐	☑	10	F	
j	As-Built drawing mark-ups are in compliance with CSA Standard S250	☑	☐		☑	☐	10	A & F	
k	As-Constructed Road Cut stamp is filled out on title page	☐	☑		☐	☑	3	A & F	
l	**If UG Primary Cable Testing** is required, then the Cable Testing Report must be submitted as part of GCF Return package	☐	☑		☐	☑	4	A & F	
m	If a project falls under **Excess Soil Regulations**, then the following documents must be be submitted as part of GCF Return package: -The filed notice on registry -Assessment of Past uses (or a Phase One ESA if that has been completed in the last 18 months) **-Sampling and Analysis Plan** **-Soil Characterization Report** **-Excess Soil Destination Assessment Report**	☐	☑		☐	☑	15	A & F	
n	All Disconnected Unused Lines 750V or more:	☐	☑		☐	☑			
l-1	Shall be removed completely and mark the lines as "REMOVED" on as-built drawings	☐	☑		☐	☑	15	A & F	
l-2	If removal is such line is not feasible or practical, each end of line should be cut off and grounded. Mark the lines as "GROUNDED" on as-built drawings	☐	☑		☐	☑	15	A & F	
l-3	If k-1 and k2 are not feasible or practical, field assessment to be signed off by Standards Engineer. A signed off report by P Eng should be filed to ESA. Mark the lines as "UNGROUNDED" on as-built drawings	☐	☑		☐	☑	15	A & F	
7	A signed & stamped, (by Auditor), **Certificate of Substantial Completion** is included in the GCF.	☐	☑		☐	☐	1	A	
Item #	**Section B: Corporate Records / Asset Management**	**Yes**	**N/A**	**Comments**	**Yes**	**N/A**	**# of pts.**	**VT**	**Comments**
8	**Asset Checklist** completed and included in the GCF. *(This checklist should be used in conjunction with items #9, 10, and 11 below as a check for all asset forms and photographs.)*	☑	☐		☑	☐	1	A & F	
A	All electrical assets shown on the As-Built drawings to be removed or installed are included on the asset checklist.	☑	☐		☑	☐	1	A & F	

B	All electrical assets shown on the JIS to be removed or installed are included on the asset checklist. *(These assets should be same as those on as-builts; report/fix any discrepancies, if found).*	☑	☐		☑	☐	0	A & F	
c	Equipment Change-Out Form (ECF) column is filled in as a YES for all assets of the following Equipment type: **Pole, Transformer, Switch.**	☑	☐		☑	☐	1	A	
d	Assets marked with a YES in the ECF column are labelled correctly as installed, removed or both. *(Check the As-Built drawings / JIS to see if the location specified an asset to have been installed or removed or both.)*	☑	☐		☑	☐	1	A	
e	Nomenclature Form column is filled in as a YES for the following asset types: Transformer, Switch, Vault, CC, Customer Location/Equipment, Tapbox.	☑	☐		☑	☐	1	A	
9	**Equipment Change Out forms** (ECFs) included in the GCF. *(If ECFs are checked off as N/A on this project, review JIS and As-Builts to ensure this is correct.)*	☑	☐		☑	☐	1	A & F	
a	There is a completed ECF for each asset specified with a YES in the ECF column on the Asset Document Checklist. *(This is in conjunction with item #8 above.)*	☑	☐		☑	☐	1	A	For OS41537 installation section was not filled in entirely. Entera confirmed Only fuses were upgraded.
b	The "Installation" and "Removal" sections of the ECF are filled out as required per the ECF column on the Asset Document Checklist. *(This is in conjunction with item #8 above.)*	☑	☐		☑	☐	10	A	
c	The asset number / location number, serial number, stock code, and equipment number on the ECF matches those seen on at least one of the photographs for each asset installed/removed. (Asset Removed = Before picture, Asset Installed = After picture) *(This is in conjunction with item #8 above and item #11 below.)*	☑	☐		☑	☐	1	A	
d	Technical details such as feeder, kVA, phase and voltage are completed and accurate on each ECF.	☑	☐		☑	☐	3	A & F	
e	A completed ECF Summary Form is included and filled out accordingly for all major assets (poles, transformers, and switches). *Assets are counted per individual item, not per location (e.g. 3-ph inline switches are counted as 3 assets)* - *Justification must be provided for any variance between planned and actual quantities*	☑	☐		☑	☐	15	A & F	
10	**Nomenclature** Labelling Reports included in the GCF.	☐	☑		☐	☑	1	A	
a	There is a completed Nomenclature Labelling Report for each of the assets specified with a YES in the Nomenclature Form column on the Asset Document Checklist. *(This is in conjunction with item #8 above.)*	☐	☑		☐	☑	1	A	
b	The asset number / location number on the Nomenclature form can be seen in at least one of the "After" photographs for each asset. *(This is in conjunction with item #8 above and item #11 below.)*	☐	☑		☐	☑	1	A	
c	Nomenclature Labelling Reports are fully completed and accurate.	☐	☑		☐	☑	1	A & F	

11	"Before" and "After" **photographs** are saved in digital format and included in the close-out GCF on an electronic disk.	☑	☐		☑	☐	10	A	
a	"Before" and "After" photographs are included for all assets listed on the Asset Document Checklist. *(This is in conjunction with item #8 above.)*	☑	☐		☑	☐	10	A	
b	Photographs are named/filed as per the "Contractors Close-Out GCF Photograph Requirements" document.	☑	☐		☑	☐	5	A	
c	Contents of the Before/After Photographs include all requirements as per the "Contractors Close-Out GCF Photograph Requirements" document.	☑	☐		☑	☐	5	A & F	After pictures of serial#, equip#, Stock codes for KIC and MBF locations were not provided by Entera
12	**Investment Recovery Forms** included in the GCF.	☑	☐		☑	☐	1	A	
a	Investment recovery forms are included for each asset that was removed of the following type:								
	Transformer	☑	☐		☑	☐	2	A	
	Switch	☐	☑		☐	☑	1	A	
	Pole	☐	☑		☐	☑	1	A	
	Removed Cable	☐	☑		☐	☑	1	A	
b	Investment recovery forms completed and "Received By" portion is signed and dated.	☑	☐		☑	☐	1	A	
13	**Material Return Forms** included in the GCF.	☐	☑		☐	☑	1	A	
a	Material Return forms are included for returnable items. *(e.g. empty cable reel, transformer skid, kit box, etc.)*	☐	☑		☐	☑	1	A	
b	Material Return forms are included for all unused material that was issued for the project. This includes the following:								
	Poles	☐	☑		☐	☑	1	A	
	Transformers	☐	☑		☐	☑	1	A	
	Switches	☐	☑		☐	☑	1	A	
	Cable	☐	☑		☐	☑	5	A	
	Termination / Splice Kit	☐	☑		☐	☑	1	A	
c	Material Return forms completed and "Received By" portion is signed and dated.	☐	☑		☐	☑	1	A	
14	**Street Light** Change forms included in the GCF.	☐	☑		☐	☑	1	A	
a	Number of street lights added or deleted matches the number indicated on the As-Built drawings and/or the Final JIS.	☐	☑		☐	☑	1	A & F	
15	**TPTF (Third Party Transfer Forms)** included in the GCF as follows:								
a	Updated TPTF is submitted with accurate markups	☐	☑		☐	☑	10	A & F	
b	Updated TPTF is provided in both excel and PDF format	☐	☑		☐	☑	10	A & F	
c	Updated TPTF is signed off by Auditor with total deferred pole count	☐	☑		☐	☑	5	A & F	

16	Concrete 7 day and 28 day compress strength tests included in the GCF for:								
	Cable Chambers	☐	☑		☐	☑	1	A & F	
	Vaults	☐	☑		☐	☑	1	A & F	
17	Concrete delivery tickets included for each batch (chambers, sidewalk, etc.)	☐	☑		☐	☑	2	A & F	
18	**Network Automation**								
a	Complete the Network Condition Monitoring and Control Commissioning Checklist	☐	☑		☐	☑	1	A & F	
b	Complete the Network Automation VCB Installation Checklist & Consult Job Aid	☐	☑		☐	☑	1	A & F	
c	Number of Network Automation forms from section 18a/b should match number of VCB's installed in the project.	☐	☑		☐	☑	2	A & F	
d	Fill out Network Automation forms from section 18a/b. Provide proof that forms were sent to System Planning Core (CPlanning@TorontoHydro.com).	☐	☑		☐	☑	1	A	
Item #	Section C: Financial Records	Yes	N/A	Comments	Yes	N/A	# of pts.	VT	Comments
19	Final Job Instruction Sheet (JIS) included in the GCF.	☑	☐		☑	☐	10	A	
a	JIS has been filled out as per instructions (refer to JIS tracking sheet example).	☑	☐		☑	☐	5	A & F	
b	Actual quantities are filled in one column per billing period (month).	☑	☐		☑	☐	1	A & F	
c	JIS is labelled "Final" on first page and is initialed by Contractor & Auditor on every page.	☑	☐		☑	☐	5	A & F	
d	All items on JIS that have quantities over or under the estimate are referenced to a Change Order in that billing period column.	☑	☐		☑	☐	5	A & F	
e	All items on JIS that have zero (0) as the claimed quantity have been verified as work that was not required.	☑	☐		☑	☐	1	A & F	
20	**Change Orders** are included in the GCF.	☑	☐		☑	☐	10	A & F	
a	There is a change order for all items that were not included in the original estimate on the JIS.	☑	☐		☑	☐	4	A & F	
b	Each change order has all 5 stages completed and the finalized CO is printed out and included in the GCF	☑	☐		☑	☐	5	A & F	
c	Supporting documents are included in the GCF (paper/electronic copy) for each change order.	☑	☐		☑	☐	8	A & F	
d	Additional Units Sheet is included for all items not included in the original JIS estimate and is initialed at the bottom of the page.	☑	☐		☑	☐	5	A & F	
e	Change Order Log is included and up to date.	☑	☐		☑	☐	3	A & F	
21	**Paid Duty** Invoices are included in the GCF.	☐	☑		☐	☑	5	A	
a	Total paid duty hours are the same as those in the Final JIS.	☐	☑		☐	☑	5	A	

22	**ESA Certificates** are included in the GCF.	☐	☑		☐	☑	1	A	
a	Number of certificates corresponds with the Final JIS quantities.	☐	☑		☐	☑	1	A & F	
Item #	**Section D: Other Project Records**	**Yes**	**N/A**	**Comments**	**Yes**	**N/A**	**# of pts.**	**VT**	**Comments**
23	**Materials** Requisition, packing list, and print-out of electrical material installed spreadsheet are included in the GCF.	☑	☐		☑	☐	1	A	
24	**Notice of Project** included in folder and signed. (Only needed for projects >= $50 000)	☑	☐		☑	☐	1	A	
25	All completed **OTO's Work Requests** are included in the GCF.	☑	☐		☑	☐	1	A & F	
26	All **Record "ON"** forms are included in the GCF.	☐	☑		☐	☑	1	A	
27	All **Cut Permits** are included in the GCF.	☐	☑		☐	☑	1	A	
28	**Request for Attainment** form included in GCF	☑	☐		☑	☐	1	A & F	
29	Following documents were submitted to 3rd Party Audit Firm within **15 calendar days of construction attainment:**								
a	Green Construction Folders	☑	☐		☑	☐	5	A	
b	Final JIS with approved change orders	☑	☐		☑	☐	20	A	
c	Updated Third Party Transfer Forms (both Excel and PDF version)	☐	☑		☐	☑	20	A	
d	Material Return Forms	☐	☑		☐	☑	30	A	
e	Permanent restoration unit estimate	☐	☑		☐	☑	20	A	

Table 1: Close-Out GCF organized into sections as per importance and risk to Toronto Hydro, along with total close-out GCF Score

Section	Area Affected	Importance of accurate information / Risk to Toronto Hydro	Subtotal		Score	N/A total	Net total [Subtotal - N/A]
Section A Regulatory	**ESA Reg. 22/04 Compliance**	**Cannot energize system without Reg. 22/04 Certification**	135		53	82	53
Section B Corporate Records	**Management of Assets** **Operation of Assets**	**Need accurate records for life cycle asset management** **Need accurate records for safe operation of system**	125		64	55	70
Section C Financial Records	**Needed for Capital Closure**	**OEB Rates Risk** **Project Financial Close-out is required for inclusion of project capital cost in rate base**	74		62	12	62
Section D Other Project Records	**Project Records**	**Additional Items for project retention**	101		29	72	29
Grand total			435		208	221	214

97%

DEPARTMENT REQUISITION

DATE: 21/02/2023

WBS L2 #: P-220271-WD161000

TO:	Jen Grado, Director - Capital Projects West - RC 3620		
DRP (CA):	Francis Szto - Supv Design CPW Contract Administrator x23754		
Supv (FA):	Kenneth Abram - CPW Field Administrator x27833 c416-903-9289		
Attn.:	THESL O/H CPLP CREW	**Issued to:**	
Attn.:	THESL O/H POLE CREW	**Issued to:**	
Attn.:	THESL U/G CPCP CREW	**Issued to:**	
Attn.:	THESL U/G CABLE CREW	**Issued to:**	
Attn.:	THESL STATION CREW(FDR Decommissioning)	**Issued to:**	
Attn.:	THESL STATION CREW(SCADA)	**Issued to:**	
Attn.:	THESL METER CREW	**Issued to:**	
Attn.:	CIVIL CONTRACTOR	**Issued to:**	
Attn.:	ELECTRICAL CONTRACTOR	**Issued to:**	Entera
Attn.:	INSPECTOR CIVIL & ELECTRICAL	**Issued to:**	SNC-Lavalin-

UG PCBs BR-F2/BR-F3 /BR-F1/TA-F4 P.1

NOTICE OF PROJECT #:	22eN674162		**Proposed Start Date:**	**End Date (Commissioning):**
PERMIT NUMBERS:	INCLUDED		March 1, 2023	August 31, 2023

WORK DESCRIPTION:

PLEASE SEE THE FOLLOWING DRAWINGS FOR DETAILS OF PROPOSED WORK:

DWG#	2022-019891 - Title Sheet	**DWG#**	
DWG#	2022-019892 - Primary Schematic	**DWG#**	
DWG#	2022-019893 - Electrical U/G Installations	**DWG#**	
DWG#	2022-019894 - Electrical U/G Removals	**DWG#**	
DWG#		**DWG#**	
DWG#		**DWG#**	
DWG#		**DWG#**	
DWG#		**DWG#**	
DWG#		**DWG#**	
DWG#		**DWG#**	

DESIGNER: Matthew Huestis

SUPERVISOR: Nima Eslami

Lily Dai Digitally signed by Lily Dai DN: cn=Lily Dai, email=ldai@torontohydro.com Date: 2023.05.11 15:04:29 -04'00'

for Sandro Nasso, Director Enterprise Program Mgmt

THESL RESOURCE REQUIREMENTS IN WORK DAYS

CPLP CREW	0
CPCP CREW	0
CABLE CREW	0
STATIONS CREW	0
METERING CREW	0

NOTES:

PLEASE SEE ATTACHED GANTT CHART FOR SCHEDULED RESOURCES AND ACTIVE WORK ORDERS APPLIED TO THIS PROJECT.

PLEASE REFER TO THE ATTACHED MATERIAL PRINTOUT FROM THE APPROVED ESTIMATE.

TEN BUSINESS DAYS PRIOR TO THE PLANNED START DATE OF THE WORK ORDER, THERE IS VISIBILITY OF THE MATERIAL USING THE "PICKING SLIP."
TEN BUSINESS DAYS PRIOR TO THE PLANNED START DATE OF THE WORK ORDER, THERE IS VISIBILITY OF THE MATERIAL USING THE "PICKING SLIP."

	ISSUED # OF CONST. FOLDERS
O/H THESL SUPV & CPLP CREW	0
O/H THESL SUPV & POLE CREW	0
U/G THESL SUPV & CPCP CREW	0
U/G THESL CABLE CREW	0
THESL SUPV METERING	0
CIVIL CONSTRUCTION BY THESL	0
THESL STATIONS CREW(FDR Decomm.)	0
THESL STATIONS CREW(SCADA)	0
CIVIL CONTRACTOR CREW	0
ELEC. CONTRACTOR CREW	1
INSPECTOR	1
TOTAL CONST. FOLDERS ISSUED	2

DATE WORK COMPLETED: 2024-01-21

COMPLETED BY: Yusuf Ulusow

SUPERVISOR SIGNATURE: yusuf

Rev 73 Jan.04, 2023

ENTERA #: 26-E261

TORONTO HYDRO

CONSTRUCTION FOLDER AND FORM(S)

Project Name/Location	UG PCBs BR-F2/BR-F3 /BR-F1/TA-F4 P.1		CAPEX
Project #	P-220271-WD161000	W.O. #	OPEX
Work Request #			DB
Construction DRP	John Wood		CLAIMS
Work #	416-746-9914	Mobile #	416-908-3524
Design Supervisor	Nima Eslami		
Work #	416-446-6493 ext. 423	Mobile #	416-892-8972
Design Technician	Matthew Huestis		
Work #	416-575-6506	Mobile #	

Feeders Associated with Project:	Type of Work Location(s):	Project Management Date of Issue:
BR-F1, BR-F2, BR-F3	U/G Electrical	PROGRAM MGMT.
Notice of Project #:	Scheduled Completion Date	DATE ISSUED _____ OF _____
22eN674162	August 31, 2023	

EMERGENCY PROCEDURES

EMERGENCY CONTACT INFORMATION

1. For any emergency, follow the emergency plan on the tailboard document (May-Day Procedure)

2. For serious safety or environmental accidents (individual spills) call the **THESL EHS Spill Hotline; Phone 416-235-9995**. Anytime 24/7

3. For accident reporting of critical injury, or other, the Ministry of Labour field office contact info is as follows;

Ministry of Labour Contact Centre - Toronto Area
Phone: 1-877-202-0008 or
416-325-3000 (after hours), Fax: 905-577-1316
Address of District Offices:

Ministry of Labour - West Toronto
Location: 1340 Central Parkway West, 4th Floor
Mississauga, Ontario, L5C 4R3

REQUIRED BY

Ministry of Labour - Central Toronto
Location: 5001 Yonge Street, Suite 1600
North York, Ontario, M7A 0A3

Ministry of Labour - East Toronto
Location: 2275 Midland Ave., Unit #1
Scarborough, Ontario, M1P 3E7

When complete, please return:

PMC: _____

Location:

Form M966-1040 (05/17)

Project Name/Location

Project #

W.O. #

TORONTO HYDRO - JOB PLANNING PROCESS

Process	Responsibility (Signature)	Date	Product
1.	John Wood **Construction DRP / Contractor**	2023/02/22	
	Nima Eslami **Design Supervisor/ Administrator**	2023/02/22	
	Matthew Huestis **Design Technician**	2023/02/22	
2. Pre-Construction Meeting	Yusuf Ulusow **Field Supervisor/CCL** (Control Authority/Tech. if required)	2024-02-20	Issue Project W.O. and Planning Document to CCL, sketches and/or notes, if required
3. Initial Site Visit With Crew	**Certified Crew Leader / Foreman**		Review steps and conditions, tailboard planning & W.O. dwgs.

4. This is to certify that the construction as recorded in this drawing(s) is consistent with the approved plan, Standard Designs, or Work Instruction, and that approved equipment has been used. Deviations in the drawing(s) present “no undue hazard" as defined in the ESA Technical Guidelines for Ontario Regulation 22/04.
CCL- Please mark changes on the drawings: indicate changes, additions, deviations revisions & include specific notes to explain red circles

☑ **Partial Certificate** **Name:** Yusuf Ulusow **Position:** Field Auditor

☑ **Final Certificate** **Date:** 2024-02-20 **Signature:** yusuf

5. Project Sign-off	yusuf **Construction DRP / Contractor**	2024-02-20 **Date**	Review material variance Complete construction project package

6. Material Closure _____ CCL
Excess material returned to Warehouse for restocking. Recovered Items returned to reclaim area at TH Work Centre, Return forms sent with item.

Excess Material	Recovered Material
☐ Returned	☐ Returned
☐ None	☐ None

7. Project Review/Closure	yusuf **Design Supervisor/ Administrator**	2024-02-20 **Date**	Assess job cost vs plan, as built, drawing, project closure, variance analysis Hold project closure meeting

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ONTARIO ENERGY BOARD STAFF

UNDERTAKING NO. JT3.2:

Reference(s): 2B-AMPCO-29

Provide the list of distribution capital projects that are greater than $5 million and those that show a variance of either +20% or -15% (relating to distribution capital).

RESPONSE:

Of the planned distribution capital projects identified in 2B-AMPCO-29, there was one project was greater than $5 million with a variance of either +20% or -15%. Please see Table 1 below for a description of the project and summary of the variance.

Table 1: Planned Distribution Capital Projects greater than $5 million with +20% / -15% Variance

Project Description	Portfolio / Project Overview	Project Variance Summary	Design Estimate	Actual Costs	Variance	
Load Demand P-180695-ZZ129001 Phase 2-P18 Transfer A256DN from A5-6DN to A5-6W TOA256DN	To maintain the Dufferin A5-6DN bus loading within firm capacity and provide capacity for conversion of 4kV Dupont feeders, new cables & load transfer.	The original design estimate did not account for all required contractor costs. Additional civil and electrical work was also required due to unforeseen site conditions found during execution (increasing material and labour costs).	$3.5M	$5.2M	$1.6M	+65%

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO SCHOOL ENERGY COALITION

UNDERTAKING NO. JT3.3:

Reference(s): 2A-Staff-109, Appendices A and C

To verify the depreciation rates in the RGCRP models for both the HONI and the ES for 2023 going forward

RESPONSE:

The Hydro One Contributions in the RGCRP models have a useful life of 25 years.[1] This is consistent with the useful life used in Toronto Hydro's last rebasing application which remains unchanged as a result of the Concentric Depreciation study.

Energy Storage uses a simple average useful life of 15 years based on the assets provided in Table 1 below. Toronto Hydro notes that the useful lives of the assets in the table remain unchanged as a result of the study.

Table 1: Useful Life for Energy Storage

Asset Class Description		**Useful Life in 2-FB**
Energy Storage System Battery	A	10
Energy Storage Inverter	B	20
Simple Average	**(A+B)/2**	**15**

[1] EB-2018-0165, Interrogatory Response 2A-Staff-54 part (a)

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ONTARIO ENERGY BOARD STAFF

UNDERTAKING NO. JT3.4:

Reference(s): n/a

To provide a summary table for those unit costs for 2025 or that were used for the estimates of the forecast period.

RESPONSE:

Please see Appendix A to this response for Toronto Hydro's unit cost estimates used in developing the 2025-2029 expenditure plan. These unit cost estimates are unadjusted costs, i.e., without any inflation and other allocations. Additional allocations are layered on a program basis and not at the asset class level.

The methodology used to develop these unit costs can vary from one program to another. For example, the Stations Renewal program utilizes cost estimates that are specific to the project along with historical project actuals and material cost increases to determine the forecasted expenditure plan as asset specific details may already be known for the forecast period. Whereas for other renewal programs where the project-specific details have yet to be determined, an estimate is used based on historical average values. For each program and corresponding asset class, additional details on the assumptions used to generate the unit cost estimate are provided as part of Appendix A.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ONTARIO ENERGY BOARD STAFF

UNDERTAKING NO. JT3.5:

Reference(s): 4-Staff-293

Referring to 4-Staff-293, corrective maintenance for Delta-Wye work, to provide the portion or percentage of the total impacted services that have been addressed already.

RESPONSE:

As of 2023 year-end, Toronto Hydro has addressed approximately 77 percent of the total impacted services.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO SCHOOL ENERGY COALITION

UNDERTAKING NO. JT3.6:

Reference(s): **2-Staff-263(b)**
Exhibit 4, Tab 1, Schedule 1

Re: 2-Staff-263B, for 2020-2029, to show actual and forecasted spend, and the calculation.

RESPONSE:

Table 1 below outlines Toronto Hydro's actual costs from 2020 to 2023 and the bridge cost for 2024 for cloud computing implementation. For 2025 to 2029 cloud computing costs please refer to Toronto Hydro's response to interrogatory response 2B-Staff-263(a).

Table 1: 2020-2024 Cloud Computing Implementation Costs ($ Million)

	Actual				Bridge
	2020	**2021**	**2022**	**2023**	**2024**
Cloud Implementation (OM&A)	1.0	3.5	3.4	3.4	-
Cloud Subscription Fees (OM&A)	1.9	2.5	3.2	3.6	4.1
Cloud Implementation Deferral Account (Note 1)				0.5	3.5

Note 1: The OEB set the effective date for the Cloud Implementation Deferral Account as of December 1, 2023,[1] and therefore, the costs recorded for 2023 only cover actual costs

[1] Ontario Energy Board, Accounting Order (003-2023) for the Establishment of a Deferral Account to Record Incremental Cloud Computing Arrangement Implementation Costs, November 2, 2023.

incurred between December 1, 2023 and December 31, 2023. The 2024 forecast is for the full calendar year.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO SCHOOL ENERGY COALITION

UNDERTAKING NO. JT3.7:

Reference(s): 4-SEC-106

Ref 4-SEC-106, to provide the percentage of customers on E-billing for 2020 and 2021, and Table 2 as well.

RESPONSE:

Table 1: Percent of Customers on ebills

Year	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Percent of customers on ebills	40.7%	44.7%	48.3%	50.9%	53.5%	55.2%	56.7%	57.8%	59.2%	60.1%

Table 2: Estimated Annual Savings per Customer on ebills

Year	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Estimated annual savings per customer on ebills	$10.67	$11.09	$11.58	$11.17	$11.53	$11.86	$12.22	$12.58	$12.94	$13.30

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO SCHOOL ENERGY COALITION

UNDERTAKING NO. JT3.8:

Reference(s): 2B-SEC-39

Referring to 2B-SEC-39, to the extent it is possible, to provide the three most recent reports and notes or decision logs; if deemed not relevant, to set out the rationale.

RESPONSE:

As noted in the interrogatory response 2B-AMPCO-29(c), executive oversight of the capital program occurs through the monthly Investment & Operations Planning ("IOP") management review, which centers around a monthly meeting with senior leaders responsible for the planning and execution of the capital and operations work program. The company's oversight of the execution of its capital plan is comprised of numerous organizational processes and detailed work activities that feed into the monthly IOP review.

The agendas for IOP meetings are similar month over month, starting with a review of any open actions, presentation materials related the program status, and any new business that may be added monthly as required. The presentation materials can vary from month to month based on identified needs and requirements. Materials typically contain summary level visual information which is presented and discussed at the meeting using a round table approach. Deliberations, reviews and decisions may continue beyond IOP and be completed through follow-up meetings, reviews and discussions.

The requested documents enable the oversight functions that take place at the IOP. Without the full context of the discussions and presentations that occur at the IOP meeting, these documents are not relevant to evaluate the execution of the 2020-2024 plan.

The relevant evidence to evaluate the execution 2020-2024 plan has been provided across 39 capital and operational programs comprised of 87 unique segments which are detailed in Exhibits 2B and 4. In addition, Toronto Hydro has led the following evidence to help parties understand the utility's planning and execution processes and key decisions and consideration with respect to managing the execution of the 2020-2024 plan:

- Exhibit 2B, Section D1: Asset Management Process, including the investment planning and portfolio reporting process (p 7-23), scope and project development (p. 24-25), program management and execution (p. 25-26) and performance measurement (p. 27-29).
- Exhibit 2B, Section E4: Capital Expenditure Summary, including variances in forecast expenditures from the 2020-2024 capital plan versus actual expenditures over the 2020-2024 rate period (p. 2-14).
- Exhibit 1B, Tab 3, Schedule 2: Historical Performance Results, including the 2020-2022 custom measure performance asset management measures (p. 31-34) and cost control measures (p. 35-35).
- Exhibit 1B, Tab 3, Schedule 3: Productivity and Benchmarking, including 2020-2024 execution constraints (p. 9-15).
- Exhibit 4, Tab 2, Schedule 9: Asset and Program Management Program, including the Program Management and Support segment (p. 26-32)
- Relevant interrogatory responses such as:

- 1B-AMPCO-10, which describes, and provides evidentiary references to, the utility's Asset Management Process and Investment Planning & Portfolio Reporting ("IPPR") processes;
- 2B-AMPCO-27, which describes project and portfolio governance in the context of the IPPR process;
- 2B-AMPCO-28, which describes capital project prioritization and the iterative governance process of the Execution Work Program ("EWP");
- 2B-AMPCO-29, which describes the process for executive oversight of the capital program and provides illustrative materials such as a flowchart of the project planning process and a template for project variance analyses;
- 2B-SEC-34, which details the changes Toronto Hydro has made to move closer to meeting ISO55001 requirements with respect to its asset management and capital planning processes;
- 2B-SEC-41, which explains how the utility is implementing new inputs to enhance its risk-based project valuation and portfolio optimization processes;
- 2B-SEC-55, which describes how the utility determines the appropriate resourcing mix for its capital and maintenance programs;
- 2B-Staff-166, which showcases how the utility applies the IPPR process with respect to managing reliability outcomes;
- 4-Staff-294, which describes Toronto Hydro's process for acceptance of assets constructed or repaired, including how Toronto Hydro addresses correction of non-conformances and the volume of non-conformances;
- 4-Staff-297, which describes Toronto Hydro's processes for project closure and asset acceptance;
- 4-VECC-62, which describes oversight responsibilities with respect to projects assigned to external contractor crews;

- Relevant Technical Conference undertaking responses such as JT3.1 and JT4.12, which provide third-party reports and summarize internal audit findings and management action plans with respect to the effectiveness of distribution capital and maintenance planning and execution processes;
- Relevant testimony by Toronto Hydro's witnesses, such as:
    - Day 3, page 44, line 18 to page 45, line 19;
    - Day 3, page 28, lines 12-23;
    - Day 3, page 32, line 28 to page 33, line 8;
    - Day 3, page 70, lines 6-8.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO SCHOOL ENERGY COALITION

UNDERTAKING NO. JT3.9:

Reference(s): 2B-SEC-64(e)

Reference: 2B-SEC-64E, to provide the total cost of the AMI program regardless of rate period, if it flows into the next rate period.

RESPONSE:

Please refer to undertaking response JT3.10.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO SCHOOL ENERGY COALITION

UNDERTAKING NO. JT3.10:

Reference(s): 2B-SEC-64(e)

To provide updated program costs, 2024-2029, based upon the new metering costs.

RESPONSE:

Table 1 below provides the most current forecast of the costs for the life of the AMI 2.0 project, as compared to the original figures included in evidence. The original forecasts for capital costs reflect the Residential and Small C&I Meter Replacement costs captured in Exhibit 2B, Section E5.4; specifically, the subsets of 2020-2024 actual and bridge costs on page 16 in Table 5 and 2025-2029 forecast costs on page 17 in Table 6 associated with the AMI 2.0 project. The original forecasts for OM&A costs reflect costs included under the Metering Services segment of the Preventative and Predictive Overhead Line Maintenance program in Exhibit 4, Tab 2, Schedule 1.

Tables 2 and 3 below break down the total costs of the AMI 2.0 project in Table 1 between the 2020-2024 and 2025-2029 rate periods, respectively. The project is scheduled to be completed in 2028.

The most current forecast as of March 31, 2024 includes updated meter hardware costs as a result of the finalized competitive procurement process. Toronto Hydro has begun a competitive process to procure the field installation contractor(s) and the system integrator, however, this process has not yet been completed and updated costs for these significant components of the project are pending. As such, Toronto Hydro's forecasts for

the Metering capital program and Preventative and Predictive Overhead Line Maintenance have not changed.

Table 1: Summary of full AMI 2.0 project costs encompassing all years of the project ($ Millions)

AMI 2.0 Program Costs	Forecast at time of pre-filed evidence	Current forecast, as at March 31, 2024
Capital costs	248.7	229.0
OM&A costs	3.3	3.3
Total Project costs	252.0	232.3

Table 2: Summary of AMI 2.0 project costs, 2020-2024 ($ Millions)

AMI 2.0 Program Costs	Forecast at time of pre-filed evidence	Current forecast, as at March 31, 2024
Capital costs	47.0	41.4
OM&A costs	1.3	1.3
Total Project costs	48.3	42.7

Table 3: Summary of AMI 2.0 project costs, 2025-2029 ($ Millions)

AMI 2.0 Program Costs	Forecast at time of pre-filed evidence	Current forecast, as at March 31, 2024
Capital costs	201.6	187.6
OM&A costs	2.0	2.0
Total Project costs	203.6	189.6

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO SCHOOL ENERGY COALITION

UNDERTAKING NO. JT3.11:

Reference(s): 2B-SEC-52

Referring to 2B-SEC-52c, the Gartner IT Cost Benchmarking Study, to provide the information with respect to the custom peer group but not the ITKMD group.

RESPONSE (PREPARED BY TORONTO HYDRO):

In reviewing the transcript, Toronto Hydro notes that this undertaking does not capture the request by SEC. The scope of the undertaking is to provide a breakdown of the ITKMD peer group.

RESPONSE (PREPARED BY GARTNER):

Providing the breakdown for the 123 organizations in the IT Key Metrics Data – Utilities group would take a significant amount of time, as the composition of business operations within the organizations is not a data point captured. It would require Gartner to research each company individually to determine their mix of operations. This would not be practical given the time available, and moreover, it would not provide added value, as the primary point of comparison for the benchmark analysis is the Custom Peer Group.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO SCHOOL ENERGY COALITION

UNDERTAKING NO. JT3.12:

Reference(s): 2B-SEC-52(f); Gartner Report

Referring to 2B-SEC-52f, to provide descriptions for each maturity level.

RESPONSE (FROM GARTNER):

"Scores" refers to the Maturity Levels for the IT Domains / Functional Activities that were in scope for the assessment. Gartner has a proprietary maturity model for each IT domain that uses a 5-point scale, with 1 being the lowest maturity level and 5 being the highest.

Gartner has shared the requested maturity definitions for maturity level 1 through 5 for each IT Domain / Functional Activity, see attachment titled "Gartner IT Maturity Definitions (Confidential)". The IT maturity level definitions are proprietary to Gartner. The definitions are custom classifications created by Gartner as elements of the proprietary methodology used by Gartner to assess and evaluate an organization's maturity level. Having this information enter the public domain or shared more broadly would put Gartner at a competitive disadvantage. As such, the maturity level definitions should be treated as confidential.

RESPONSE (FROM TORONTO HYDRO):

Toronto Hydro is filing the "Gartner IT Maturity Definitions (Confidential)" document in Appendix A to this undertaking response confidentially, as Gartner has advised that it contains proprietary information.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO SCHOOL ENERGY COALITION

UNDERTAKING NO. JT3.13:

Reference(s): Exhibit 2B, Section E8.1

To provide cost estimate for cloud computing EDC option.

RESPONSE:

Toronto Hydro considered the costs of implementing a cloud-based enterprise data centre ("EDC") at a high level but did not engage in a more detailed analysis because this option would involve the greatest drawbacks out of all possible alternatives, for the reasons the utility noted in its options analysis in Exhibit 2B, Section E8.1, at pages 25-26, as well as the following:

- Cloud-based data centres do not meet Toronto Hydro's technical requirements for critical IT/OT systems, such as low-latency and controllable communication between field devices and systems hosted in the EDC. Therefore, implementing a cloud-based data centre would require the utility to retain a significant portion of on-premises infrastructure, negating any potential benefits.
- Given the critical nature of IT/OT systems that are reliant upon Toronto Hydro's EDC, a high degree of service reliability is required. A cloud-based data centre would increase Toronto Hydro's operational risks because the utility would become dependent on vendor(s) to manage the reliability of the data centre environment, as noted in interrogatory response 2B-Staff-263(c).
- Toronto Hydro's communications costs are currently nil between on-network enterprise data centres and work centres, thanks to the utility's in-house fibre optic network. A cloud-based data centre would not allow the use of the existing

fibre optic network and would require the reconfiguration of existing facilities and/or the construction of new fibre-optic connections to sites beyond the utility's existing footprint, introducing duplicate efforts and costs.

Because of the above factors, Toronto Hydro does not consider a cloud-based data centre to be a feasible option. The utility's primary criterion for the evaluation of EDC technology solutions is operational resilience.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO SCHOOL ENERGY COALITION

UNDERTAKING NO. JT3.14:

Reference(s): 2B-Staff-273

To provide regulatory compliance costs included in the 2020 to 2024 budget in the last application.

RESPONSE:

The table below indicates the planned budget for regulatory compliance initiatives under the IT Software segment of the Information Technology and Operational Technology Systems capital program for 2020 to 2024, from Toronto Hydro's rate application for the same period.[1]

	2020-2024 Planned
	Cost ($ Millions)
Regulatory Compliance	9.3

[1] EB-2018-0165, Exhibit 2B, Section E8.4, at page 22.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO SCHOOL ENERGY COALITION

UNDERTAKING NO. JT3.15:

Reference(s): 1B-SEC-28

Using forecast information, to respond to 1B-SEC-28.

RESPONSE:

As noted in its response to 1B-SEC-28 part (e), Toronto Hydro is unable to provide forecast unit costs. Toronto Hydro develops baseline unit costs for both benchmarking and programmatic cost estimating purposes based on relevant historical data.[1] However, Toronto Hydro does not create a forecast for how these unit costs will change in future years. Rather, planners develop cost forecasts using the appropriate baseline unit costs, after which inflation and allocation assumptions are applied to the overall program cost.[2]

[1] Note that program-specific unit costs are not necessarily the same as the unit costs provided to UMS, as the UMS unit cost study addresses asset classes more broadly.
[2] Note that the exact approach to cost estimating varies depending on the program. For details on the program specific unit cost estimates and their corresponding assumptions, please refer to Toronto Hydro's response to undertaking JT3.4.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ASSOCIATION OF MAJOR POWER CONSUMERS IN ONTARIO

UNDERTAKING NO. JT3.16:

Reference(s): 2B-AMPCO-23

To provide the data in Table 1 and Table 2 on a dollar basis.

RESPONSE:

Please see Table 1 and Table 2 below which reflects the dollar amounts used to calculate the response to 2B-AMPCO-23 for 2020-2024.

Table 1: 2020-2024 Capital Costs ($ Million)

	Actual				Bridge
	2020	**2021**	**2022**	**2023**	**2024**
Internal Costs (Labour)	101.0	92.3	90.2	105.3	120.1
Internal Costs (Vehicle)	4.0	6.0	6.2	5.1	6.1
External Costs (including civil materials)	325.4	377.7	414.7	400.8	453.1
Other Costs	163.5	157.2	202.7	236.8	224.1
Total Costs	**593.9**	**633.3**	**713.7**	**747.9**	**803.4**

Table 2: 2020-2024 Maintenance Costs ($ Millions)

	Actual				Bridge
	2020	**2021**	**2022**	**2023**	**2024**
Internal Costs (Labour)	12.2	11.7	9.9	11.1	11.4
Internal Costs (Vehicle)	1.5	2.0	1.9	1.8	2.3
External Costs (Including civil materials)	23.6	27.1	26.5	29.4	30.1
Other Costs	2.6	2.8	2.3	2.7	2.9
Total Costs	**39.9**	**43.7**	**40.5**	**45.0**	**46.7**

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ASSOCIATION OF MAJOR POWER CONSUMERS IN ONTARIO INTERROGATORIES

UNDERTAKING NO. JT3.17:

Reference(s): 2B-AMPCO-23

To provide the two tables for capital programs and maintenance programs showing 2025-2029.

RESPONSE:

Please see Table 1 and Table 2 below which reflects the dollar amounts used to calculate the response to 2B-AMPCO-23 for 2025-2029.

Table 1: 2025-2029 Capital Costs ($ Million)

	Forecast				
	2025	**2026**	**2027**	**2028**	**2029**
Internal Costs (Labour)	164.1	170.2	175.5	167.4	162.2
Internal Costs (Vehicle)	6.8	7.2	7.5	7.9	8.1
External Costs (including civil materials)	508.2	510.4	535.3	553.9	537.8
Other Costs	213.2	219.6	236.8	241.7	251.6
Total Costs	**892.2**	**907.4**	**955.2**	**970.9**	**959.7**

Table 2: 2025-2029 Maintenance Costs ($ Millions)

	Forecast				
	2025	**2026**	**2027**	**2028**	**2029**
Internal Costs (Labour)	13.6	14.4	15.2	16.2	17.2
Internal Costs (Vehicle)	2.6	2.6	2.7	2.8	2.9
External Costs (Including civil materials)	33.8	34.1	33.6	34.6	35.2
Other Costs	3.2	3.3	3.4	3.5	3.6
Total Costs	**53.2**	**54.4**	**54.8**	**57.1**	**58.9**

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ASSOCIATION OF MAJOR POWER CONSUMERS IN ONTARIO

UNDERTAKING NO. JT3.18:

Reference(s): 2B-AMPCO-29

For each of the years 2020 to 2024, to provide copies of the project variance reports for projects greater than $1 million, where the cost variance is 30 percent or greater, including if there were multiple reports for a project, so a multiyear project that has individual project variance reports; to advise which of the project variance reports provided required approval from senior management and executive team, due to the change in cost.

RESPONSE:

In reviewing the transcript, Toronto Hydro notes that this undertaking does not accurately capture the scope of the request. The scope of the undertaking was to provide the requested information for the years 2020-2023.

As shown in the tables below, Toronto Hydro executes hundreds of planned distribution capital projects each year as part of its execution work plan (EWP). Project variances are commonly attributable to the following types of execution challenges and complexities associated with doing work in Toronto Hydro's dense urban service territory:

- Additional work zone coordination requirements from the City of Toronto, including additional traffic control, coordination for CafeTO, work after hours and on weekends
- Unforeseen site conditions, including infrastructure conflicts with other entities, water in cable chambers, shale requiring increased depth due to soil conditions,

clearing duct bank blockages, new duct banks required for alternative routes, duct rebuilds, duct rerouting, contaminated soil, asbestos removal

- Additional scope transferred from other project (projects combined or consolidated, customer delays and changes in requirements)
- Change in standards since original design
- Additional costs required when working with legacy assets or systems such as box construction and paper-insulated lead-covered ("PILC") due to complexity and safety considerations
- Additional costs due to COVID-related work restrictions including extra vehicle and labour hour costs due to social distancing requirements (see Exhibit 1B, Tab 3, Schedule 3 at pages 9-11 for more details).
- Additional costs due to inflationary pressures, including rising costs of materials as described in Exhibit 1B, Tab 3, Schedule 3 at pages 11-13 and as shown in Exhibit 2B, Section D2 at page 14.

Tables 1 and 2 below summarize the completed projects from 2020 to 2023 with a value greater than $1 million and where the cost variance between the initial design estimate and the final project cost was +30% or greater. For additional context, Table 3 provides the total value of the cost variances relative to the total value of the work program for each year from 2020 to 2023. The project costs shown in the tables below are for the full life of the individual projects completed each year and the costs span multiple years for both design and construction.

Together, the tables below demonstrate Toronto Hydro successfully managed and executed its 2020-2023 distribution capital execution work program within very reasonable margins of variance.

Table 1: Distribution Capital Projects Greater than $1M with +30% Variance

Year	# of Projects Completed	# Projects > $1M and variance of +30%	% Projects > $1M and variance of +30%
2020	274	7	2.6%
2021	286	9	3.1%
2022	286	7	2.4%
2023	314	4	1.3%
2020-2023	**1160**	**27**	**2.3%**

Table 2: Distribution Capital Projects Greater than $1M with +30% Variance ($ Millions)

Year	$ Value of Projects Completed (Estimate)	Total $ Variances for Projects Greater than $1M with +30% Variance	$ Variance for Projects Greater than $1M with +30% as a % of Total Value of Projects Completed
2020	$195.5	$8.3	4.2%
2021	$206.6	$8.4	4.1%
2022	$238.2	$9.2	3.9%
2023	$193.0	$4.1	2.1%
2020-2023	**$833.2**	**$29.9**	**3.6%**

Table 3: Distribution Capital Execution Work Program Annual Variances ($ Millions)

Year	$ Value of Projects Completed (Estimate)	$ Value of Total Projects Actuals	Variance	% Variance
2020	$195.5	$212.1	$16.6	8.5%
2021	$206.6	$208.8	$2.3	1.1%
2022	$238.2	$234.2	-$4.0	-1.7%
2023	$193.0	$200.3	$7.3	3.8%
2020-2023	**$833.2**	**$855.3**	**$22.1**	**2.7%**

In reviewing the information above it is important to note that in the last rate application (EB-2018-0165) Toronto Hydro put forward a five-year capital plan for 2020-2024 that based on a programmatic approach, and did not include project level details except for major capital projects like Copeland Phase 2. It is also key to note that the funding approved by the OEB to enable the execution of the five-year capital plan reflects an approved capital envelope, within which Toronto Hydro has the flexibility to implement its plan and to respond to changes as needed.[1] As such, the project-level variances summarized in the tables should not be interpreted as variances between OEB-approved and actual capital expenditures; that information is summarized in Exhibit 2B, Section E4 and detailed in the programmatic evidence in Exhibit 2B, Section E5, E6 and E7. For this reason, Toronto Hydro respectfully declines to disclose the project variance reports as the information is not relevant to assessing variances between OEB-approved and actual capital expenditures. From a work execution perspective, the information above demonstrates that over the last four years (2020-2023), Toronto Hydro successfully managed the execution work challenges and considerations (discussed in Exhibit 1B, Tab 3, Schedule 3 at pages 2-15 and summarized above) and delivered over 1100 projects within very reasonable margins of variance.

[1] EB-2018-0165, Decision and Order (December 19, 2019) at page 59.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ASSOCIATION OF MAJOR POWER CONSUMERS IN ONTARIO

UNDERTAKING NO. JT3.19:

Reference(s): 2B-AMPCO-48

To provide a breakdown of EV vehicles, 2020-2024, including actual purchase cost.

RESPONSE:

During the 2020 to 2024 rate period, Toronto Hydro purchased 19 fully electric vehicle units at a cost of $2.8 million, shown in Table 1 below. This figure excludes hybrid vehicles.

Table 1: Number and Cost ($ Millions) of Electric Vehicles Purchased in 2020-2024

Description	2020		2021		2022		2023		2024		Total Cost
	No.	Cost	No.	Cost	No.	Cost	No.	Cost	No.	Cost	
Pickup Truck	0	0	0	0	0	0	0	0	7	0.7	**0.7**
Full Size Van - Cargo	0	0	0	0	0	0	1	0.1	5	0.7	**0.8**
Car	5	0.3	0	0	0	0	0	0	0	0	**0.3**
Single Bucket Truck	0	0	0	0	0	0	1	1.0	0	0	**1**
Total	**5**	**0.3**	**0**	**0**	**0**	**0**	**2**	**1.1**	**12**	**1.4**	**2.8**

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO CONSUMERS COUNCIL OF CANADA

UNDERTAKING NO. JT3.20:

Reference(s): **Exhibit 2B, Section E8.3**
2B-AMPCO-65
2B-SEC-77

To reconcile the evidence at 2B, E8.3, Table 4 on Page 11, and Table 5 on page 12, compared to 2B-AMPCO-65, Part A, and 2B-SEC-77.

RESPONSE:

As noted in interrogatory response 2B-SEC-77(c), the original Table 4 and Table 5 provided in Exhibit 2B, Section E8.3 at pages 11 and 12 contained summation errors with respect to annual columns and the breakdown of costs across vehicle and equipment categories. The tables provided in 2B-SEC-77(c) and 2B-AMPCO-65(b) for 2025-2029 have corrected these errors and reflect the most current breakdown of units and costs for that rate period. These errors did not affect the aggregate program cost forecast of $43.7 million for 2025-2029.

The tables for 2020-2024 in 2B-SEC-77(c) and 2B-AMPCO-65(a) are different because they provide two distinct sets of data. 2B-SEC-77(c) shows historical actual or near-term annual capital expenditures, whereas the table in 2B-AMPCO-65(a) reflects of the number of vehicle units and their costs when the units are put into service.

As purchases are completed and actual data is collected, these two views will not always match, as some vehicles drive capital expenditures that may be realized in years other than when the vehicle is put in service. For example, many heavy-duty units have several

milestone payments over the course of the purchasing project (e.g. when the chassis is delivered, when the body is installed and when the aerial package is delivered). These lag effects may cause some purchases to drive capital expenditures in certain years such as 2022 and 2023, but not become part of in-service additions until another year, such as 2024.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO CONSUMERS COUNCIL OF CANADA

UNDERTAKING NO. JT3.21:

Reference(s): 1B-CCC-49

To provide a chart similar to the one at Exhibit 4, Tab 2, Schedule 9, Page 12 for 2020-2024.

RESPONSE:

Table 2: On-going Customer Engagement

Program /Segment	Description of Activities	Annual Costs ($ Millions)				
		2020	2021	2022	2023	2024
Customer Operations – Key Accounts Segment (Exhibit 4, Tab 2, Schedule 8 at Page 22)	Proactive and responsive engagement activities with Key Account customers. Please refer to for more information.	0	0.5	0.8	0.9	1.2
Customer Operations – Customer Connections Segment (Exhibit 4, Tab 2, Schedule 8 at Page 16)	Communications with customers relating to connection and upgrade requests, from intake through the completion process, and general inquiries.	3.7	1.6	1.6	3.2	3.6
Customer Care - Customer Relationship Management Segment (Exhibit 4, Tab 2, Schedule 14 at Page 34)	Communications across various channels to provide customers information in relation to service offerings and the utility's operations.	11.4	11.4	12.1	14.4	15.1
Customer Care - Collections Segment (LEAP) (Exhibit 4, Tab 2, Schedule 14 at page 26).	Application of financial assistance programs such as the Low-Income Energy Assistance Program ("LEAP") and Ontario Energy Support Program ("OESP").	24.9	9.0	7.8	9.6	10.2

Program /Segment	Description of Activities	Annual Costs ($ Millions)				
		2020	2021	2022	2023	2024
Public, Legal and Regulatory Affairs – Communications and Public Affairs Segment (Exhibit 4, Tab 2, Schedule 18 at page 28)	Includes channels that facilitate two way communication with customers such as costs for surveys, focus groups, and the Customer Advisory Panel. This also includes town halls and other communications with customers regarding planned capital work.	3.6	4.1	4.1	5.5	6.4
Asset and Program Management – System Planning Segment (Exhibit 4, Tab 2, Schedule 9 at Page 12)	The utility uses the City of Toronto's development pipeline to engage large customers and developers with upcoming projects to understand their needs, determine their load requirements and timelines, provide technical guidance, explore innovation opportunities, and provide support in understanding the connection process. For more information, about development planning please see coordinate planning Exhibit 2B, Section B.	5.6	6.1	7.5	8.1	8.1
	Toronto Hydro participates in the Regional Planning process which includes community and stakeholder engagement, including webinars, led by the IESO.					

1

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO VULNERABLE ENERGY CONSUMERS COALITION

UNDERTAKING NO. JT3.22:

Reference(s): 4-Staff-296

To take Table 1 at 4-Staff-296 and recast that table to include 2020, 2021, and 2022.

RESPONSE:

Table 1: 2020-2025 Actual and Forecast Locate Costs and Volumes

	Actual	Actual	Actual	Forecast	Actual	Forecast	
	2020	2021	2022	2023	2023	2024	2025
Volumes	147,710	134,805	120,234	122,400	133,520	110,400	105,000
Cost ($ millions)	$4.7	$4.4	$5.4	$7.3	$6.9	$6.8	$10.4
Cost Data Source	Table 6	Table 6	Table 6	Table 6	4-SEC-89 (c) and (d)	Table 6	Table 7

Cost data source tables 6 and 7 are from Exhibit 4, Tab 2, Schedule 8.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO VULNERABLE ENERGY CONSUMERS COALITION

UNDERTAKING NO. JT3.23:

Reference(s): 1B-VECC-09

To produce the last year's 12 months worth of reports showing data about customer feedback.

RESPONSE:

Table 1 provides the pre-defined categories as coded by Toronto Hydro's Contact Centre staff upon the conclusion of a call and the major call drivers within each category. Table 2 below reflects the total volume of customer calls by major call category for the most recent 12-month period, in a monthly view.

Table 1: Major call drivers within each Call Category

Major Call Category	Most common call reasons within the category
Accounts	- Account balance and due date requests - Authorized access authorization and changes - Mailing address updates
Billing (Commercial Customers)	- Bill explanations - Security deposit inquiries - Higher than expected bill concerns
Billing (Residential Customers)	- Bill explanations - Higher than expected bill concerns - Bill not yet received inquiries
Conservation Demand Management (CDM) *(category removed Feb. 2024)*	- Inquiries regarding CDM programs

Major Call Category	Most common call reasons within the category
Collections	- Late payment notices or auto-dialler calls received - Making a payment - Setting up an arrears payment agreement or other payment plan
Environmental Inquiries *(added in Feb. 2024)*	- Electric Vehicles - DERs
Flat Rate Water Heater Calls	- Water heater conversion inquiries
General Inquiries	- Non-account holder requests - Transfers to other departments - Payment option inquiries
Moves	- Move in/move out - Move confirmations - Customer moves to another address
Online Tools	- Residential self-serve portal inquiries - Commercial self-serve portal inquiries - eBills enrollment or inquiries
Premise	- Meter inquiries - Inquiries related to the customer property
Remittance	- Payment options inquiries - Pre-authorized debit enrollments - Security deposit or credit balance refunds

1

1 **Table 2: Major Call Categories and Volume of Calls for April 2023 - March 2024**

Call Categories	Apr-23	May-23	Jun-23	Jul-23	Aug-23	Sep-23	Oct-23	Nov-23	Dec-23	Jan-24	Feb-24	Mar-24	TOTAL	% of TOTAL
Accounts	3,066	3,496	3,243	3,072	3,225	2,622	3,266	3,300	2,727	3,129	2,718	2,819	**36,683**	**11%**
Billing Commercial	419	434	508	496	525	496	489	430	360	639	517	462	**5,775**	**2%**
Billing Residential	2,030	2,675	2,540	2,317	2,963	2,825	2,282	2,176	2,115	2,652	2,378	2,198	**29,151**	**9%**
Conservation Demand Management	-	-	-	2	-	-	-	2	-	-	n/a	n/a	**4**	**0%**
Collections	5,664	9,870	7,943	6,505	8,722	8,093	8,223	5,440	3,729	4,983	5,011	5,780	**79,963**	**24%**
Environmental Inquiries	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	3	5	**8**	**0%**
Flat Rate Water Heaters	8	6	-	4	5	9	6	9	2	5	4	4	**62**	**0%**
General Inquiries	6,203	8,886	7,837	6,994	7,454	7,574	8,155	7,422	5,042	6,132	5,456	6,049	**83,204**	**25%**
Moves	4,271	5,599	6,075	5,961	6,955	5,285	4,897	4,836	3,740	4,861	4,722	4,934	**62,136**	**18%**
Online Tools	1,215	1,293	1,312	1,149	1,279	1,181	1,193	1,119	866	1,303	1,033	1,118	**14,061**	**4%**
Premise	285	380	430	319	448	341	350	192	91	127	131	127	**3,221**	**1%**
Remittance	1,981	2,003	1,971	1,843	2,120	1,782	1,931	1,812	1,690	2,105	1,832	2,053	**23,123**	**7%**
TOTAL	**25,142**	**34,642**	**31,859**	**28,662**	**33,696**	**30,208**	**30,792**	**26,738**	**20,362**	**25,936**	**23,805**	**25,549**	**337,391**	**100%**

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO VULNERABLE ENERGY CONSUMERS COALITION

UNDERTAKING NO. JT3.24:

Reference(s): N/A

To describe the communication protocol between Toronto Hydro and the customer with respect to scheduled outages.

RESPONSE:

Toronto Hydro issues its customers communications for planned (scheduled) outages in accordance with section 4.4.7 of the Distribution System Code and section 2.3.2.5 of the utility's Conditions of Service.

Toronto Hydro's Community Relations team[1] communicates with customers and various stakeholders regarding planned capital construction projects. Depending upon the particular circumstances of each communication, such as scope, audience, complexity, or other factors, the utility uses multiple channels, including email, letter, telephone, auto-dialler, face-to-face meetings, newsletters, community meetings, and notices on Toronto Hydro's website. Regardless of the channel, these communications are issued a minimum of 48 hours in advance of the planned outage date.

[1] For more information about this function, please refer to evidence on the Communications and Public Affairs segment of the Public, Legal and Regulatory Affairs program, specifically pages 36-38 of Exhibit 4, Tab 2, Schedule 18.

Once prepared, outage notifications are reviewed by construction crews for accuracy and confirmation of the date and time. Once confirmed, the notifications are scheduled for delivery and released to the target audience.

Appendix A of this undertaking response provides a template of the most commonly used planned outage notice that Toronto Hydro uses to notify impacted customers, with information about the outage date and duration, contact information for customer inquiries, and links to additional resources.

Planned Power Outage

Toronto Hydro-Electric System Limited
EB-2023-0195
Technical Conference
Schedule JT3.24
Appendix A
FILED: April 22, 2024
(1 Page)

HAND-DELIVERED

June 12, 2023

In order for our crews to safely perform maintenance on our equipment, a power outage is required and has been scheduled for **Monday, June 19, 2023.**

THIS POWER OUTAGE IMPACTS ONLY THOSE WHO RECEIVE THIS NOTICE

POWER OUTAGE

OUTAGE DATE[1]	LOCATION
Monday, June 19, 2023	**[Address]**
TIME[2]	**DURATION[2]**
9 a.m. – 12 p.m.	**3 hours**
REASON FOR OUTAGE	
Equipment maintenance	

[1] Should unexpected circumstances arise (inclement weather, equipment failure, etc.), the power outage will be rescheduled to **Tuesday, June 20, 2023** for the same time and duration.
[2] Approximate

IMPORTANT TIPS

- Consider removing your vehicle(s) from your garage if you have an electric garage door opener
- Charge mobile devices prior to the power outage
- Consider charging any electric vehicle prior to the power outage
- Ensure your electric cooktop, stove and other sensitive equipment are turned off prior to the power outage
- Advise your security or fire alarm monitoring agency (if applicable) of the power outage
- Provide unobstructed access to workers at all times and exercise caution around construction areas
- Reset electrical clocks, automatic timers and alarms upon power restoration

QUESTIONS?

COMMUNITY RELATIONS REPRESENTATIVE	PHONE	EMAIL
[Staff name]	**416-542–3366**	**outages@torontohydro.com**

For questions about the outage, please contact the representative listed above. If power is not restored on the day of the outage after the above-noted time period, please call our Power Outage Hotline during regular business hours at **416-542-8000 (press 1).**

Thank you for your patience, cooperation and understanding.

To learn more, scan the code to visit
torontohydro.com/constructionmap

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ONTARIO ENERGY BOARD STAFF

UNDERTAKING NO. JT3.25:

Reference(s): Exhibit 4, Tab 2, Schedule 1

To provide the number of suite meters installed by year of installation, and the number of units that require seal extensions, 2020-2029.

RESPONSE:

Table 1: Number of Installed Suite Meters 2020-2029

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Suite Meters	4,924	2,974	2,559	3,576	2,581	2,623	2,363	2,131	1,924	1,740

Table 2: Number of Suite Meters Requiring Seal Extensions

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Suite Meters	13,188	4,834	8,208	9,821	11,472	8,977	11,395	13,773	14,402	10,684

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ONTARIO ENERGY BOARD STAFF

UNDERTAKING NO. JT3.26:

Reference(s): Exhibit 2B, Section E8.3

To provide a fleet asset condition assessment, for the vehicles within a two-year window of replacement, relative to the LCA; to include the vehicle numbers that haven't been included in that assessment.

RESPONSE:

Please refer to Appendix A to this undertaking response, in which column F shows the current condition assessment rating of fleet vehicles within scope of this undertaking and column G shows a description of the relevant condition assessment. The number of vehicles that are not included in this table and make up the balance of Toronto Hydro's current vehicle fleet is 292.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO ONTARIO ENERGY BOARD STAFF

UNDERTAKING NO. JT3.27:

Reference(s): Exhibit 2B, Section E8.3

To show the calculation of the 6.4 years under deterioration in Table 8.

RESPONSE:

In reviewing the transcript, Toronto Hydro notes that this undertaking does not capture the request made by OEB Staff. The scope of the undertaking is to show the calculation of the average fleet age of 6.7 years under the deterioration option in Table 8.

Table 1 below provides shows the estimated average age of vehicles per vehicle category under a managed deterioration approach by 2029, inclusive of the effects of any vehicles replaced between now and 2029 under this scenario. The regular average (mean) of the age of all 451 units that would comprise Toronto Hydro's fleet by 2029 is 6.7 years.

Table 1: Estimated Average Age per Vehicle Category (Managed Deterioration)

	Average Age of M-2029 (Years)
Crane Truck	4.8
Cube Van	3.9
Digger Derrick	4.9
Double Bucket	7.6
Dump Truck	4.0
Line Truck	8.2
Single Bucket	9.1
Single Bucket-Van Mount	6.0
Car	4.3

Cargo Minivan	5.0
Fullsize Van	6.1
Passenger Minivan	4.8
Pick-Up	6.1
SUV	6.7
Equipment	11.0
Trailer	14.6
Total Average Vehicle Age	**6.7**

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO SCHOOL ENERGY COALITION

UNDERTAKING NO. JT3.28:

Reference(s): **4-SEC-89**
Exhibit 1, Tab 3, Schedule 1

For the table in 4-SEC-89, to show at a high-level changes for 2023 and 2024.

RESPONSE:

In reviewing the transcript, Toronto Hydro notes that this undertaking does not capture the request made by School Energy Coalition. The scope of the undertaking is to provide the information only for 2023.

Figure 1 below shows high-level changes from 2023 Bridge to 2023 Actuals.

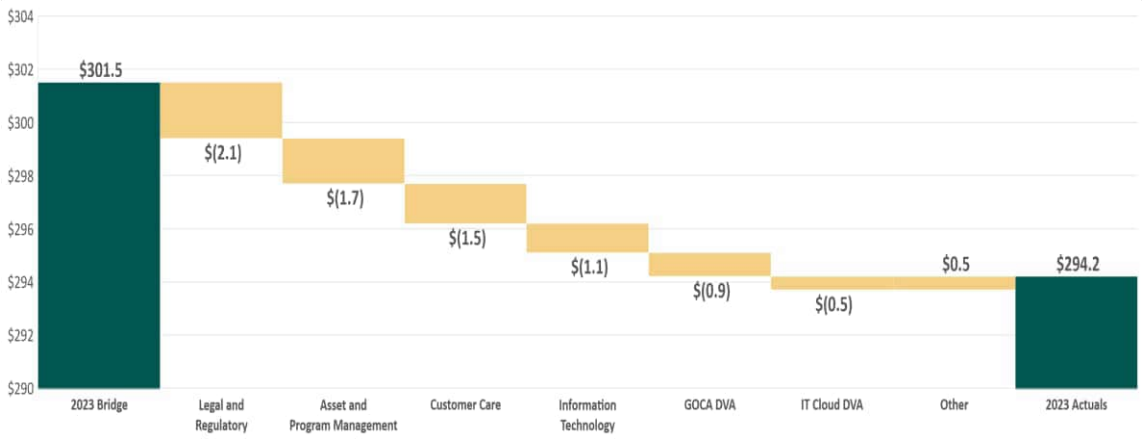


Figure 1: OM&A Causal 2023 Bridge to 2023 Actual

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO SCHOOL ENERGY COALITION

UNDERTAKING NO. JT3.29:

Reference(s): **Exhibit 4, Tab 1, Schedule 1**

To explain how the dollar figures related to customer growth were calculated based on the growth in customers for figures 14 and 15, B-1-1.

RESPONSE:

Toronto Hydro noted a classification error in the split between inflation increase and customer growth in Figure 14 (Exhibit 4, Tab 1, Schedule 1). The summation of increase between inflation and customer growth remains unchanged. The split between inflation and customer growth is corrected in Figure 1 below.

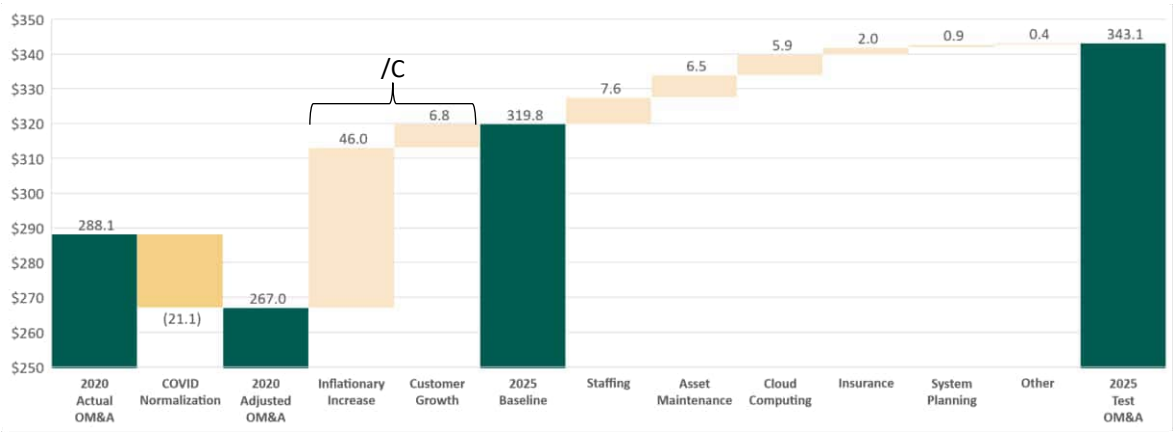


Figure 1: OM&A Causal Track Analysis 2020 Test versus 2025 Test ($ Million)

The following tables set out the calculation of the "customer growth" element of the referenced figures.

Table 1: Customer Growth Calculation 2021-2025 ($ Millions)[1]

	Actual		Bridge		Test	Total Increase
	2021	**2022**	**2023**	**2024**	**2025**	
Inflation (a)	2.2%	3.3%	3.7%	4.8%	2.0%	***N/A***
Customer Growth (b) – *Note 1*	0.6%	0.6%	0.4%	0.4%	0.4%	***N/A***
Combined Escalation (a + b)	**2.8%**	**3.9%**	**4.1%**	**5.2%**	**2.4%**	***N/A***
Opening OM&A (Adjusted for COVID) (c)	**267.0**	**274.5**	**285.2**	**296.9**	**312.4**	***N/A***
Inflation Increase (d = a x c)	5.9	9.1	10.6	14.3	6.2	**46.0**
Customer Growth Increase (e = b x c)	1.7	1.6	1.2	1.2	1.2	**6.8**
Ending OM&A (c + d + e)	**274.5**	**285.2**	**296.9**	**312.4**	**319.8**	**$52.8**

[1]*Numbers may not sum due to rounding*

Table 2: Customer Growth Calculation 2025-2029 ($ Millions)[2]

	Actual	Bridge		Test	Total Increase
	2026	**2027**	**2028**	**2029**	
Inflation (a)	2.0%	2.0%	2.0%	2.0%	*N/A*
Customer Growth (b) – *Note 1*	0.4%	0.3%	0.3%	0.3%	*N/A*
Combined Escalation (a + b)	**2.4%**	**2.3%**	**2.3%**	**2.3%**	***N/A***
Opening OM&A (Adjusted for COVID) (c)	**343.0**	**351.1**	**359.3**	**367.7**	***N/A***
Inflation Increase (d = a x c)	6.9	7.0	7.2	7.3	28.4
Customer Growth Increase (e = b x c)	1.3	1.2	1.2	1.2	4.9
Ending OM&A (c + d + e)	**351.1**	**359.3**	**367.7**	**376.2**	**$33.2**

[2]*Numbers may not sum due to rounding*

Note 1: Please see Table 3 below which shows the calculation of the customer growth rate using the data from OEB Appendix 2-L.

Table 3: Customer Growth Rate Calculation 2021 – 2029

Year	Number of Customers	Growth Rate (%)
2020 Actual	781,374	-
2021 Actual	786,258	0.6%
2022 Actual	790,699	0.6%
2023 Bridge	794,025	0.4%
2024 Bridge	797,318	0.4%
2025 Test	800,374	0.4%
2026 Forecast	803,334	0.4%
2027 Forecast	806,017	0.3%
2028 Forecast	808,731	0.3%
2029 Forecast	811,245	0.3%

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO SCHOOL ENERGY COALITION

UNDERTAKING NO. JT3.30:

Reference(s): 1B-CCC-14

To provide the underlying data and calculations for Figure 1 in 1B-CCC-14

RESPONSE:

Below tables 1 to 3 below which provides underlying data that supports the information in Exhibit 4, Tab 1, Schedule 1, Figure 1 for 2015-2019, 2020-2024 and 2025-2029 rate application periods.

Table 1: 2015-2019 FTE per $1 million CAPEX

	Actual				
	2015	**2016**	**2017**	**2018**	**2019**
FTEs (a) – (Note 1)	**1,483**	**1,484**	**1,473**	**1,425**	**1,386**
Net CAPEX (b) – (Note 2)	491.4	511.6	497.8	435.6	443.0
OEB Inflation Factor (c) – (Note 3)	1.60%	2.10%	1.90%	1.20%	1.50%
2023 Index (d)	0.84	0.86	0.87	0.88	0.90
Inflation Adjusted CAPEX to 2023 (e = b – b * (d – 1))	**571.0**	**585.5**	**561.6**	**486.9**	**489.3**
FTE per $1 Million CAPEX (a / e)	**2.60**	**2.53**	**2.62**	**2.93**	**2.83**

Table 2: 2020-2024 FTE per $1 million CAPEX

	Actual			Bridge	
	2020	**2021**	**2022**	**2023**	**2024**
FTEs (a) – (Note 1)	**1,321**	**1,203**	**1,227**	**1,307**	**1,463**
Net CAPEX (b) – (Note 2)	448.1	533.2	597.9	582.9	625.3
OEB Inflation Factor (c) – (Note 3)	2.00%	2.20%	3.30%	3.70%	4.80%
2023 Index (d)	0.91	0.93	0.96	1.00	1.05
Inflation Adjusted CAPEX to 2023 (e = b – b * (d – 1))	**486.9**	**568.6**	**619.2**	**582.9**	**595.2**
FTE per $1 Million CAPEX (a / e)	**2.71**	**2.12**	**1.98**	**2.24**	**2.46**

Table 3: 2025-2029 FTE per $1 million CAPEX

	Forecast				
	2025	**2026**	**2027**	**2028**	**2029**
FTEs (a) – (Note 1)	**1,531**	**1,572**	**1,596**	**1,617**	**1,631**
Net CAPEX (b) – (Note 2)	728.2	756.7	814.4	823.7	804.8
OEB Inflation Factor (c) – (Note 3)	2.00%	2.00%	2.00%	2.00%	2.00%
2023 Index (d)	1.07	1.09	1.11	1.13	1.16
Inflation Adjusted CAPEX to 2023 (e = b – b * (d – 1))	**678.0**	**688.3**	**723.1**	**713.0**	**678.4**
FTE per $1 Million CAPEX (a / e)	**2.26**	**2.28**	**2.21**	**2.27**	**2.40**

Note 1:

- 2015-2019 FTEs from EB-2018-0165, Draft Rate Order filed January 21, 2020, Schedule 8, OEB Appendix 2-K with 2019 bridge updated for actuals.
- 2020-2029 FTEs from EB-2023-0195, OEB Appendix 2-K.

Note 2:

- 2015-2019 Net Capex from EB-2018-0165, Draft Rate Order Update filed February 12, 2020, Schedule 4, OEB Appendix 2-AB with 2019 bridge updated for actuals.
- 2020-2029 Net Capex from EB-2023-0195, Appendix 2-AB

Note 3:

- 2015-2024 OEB annual inflation factors applicable to electricity distributors.
- 2026-2029 inflation assumed to be 2% annually.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO SCHOOL ENERGY COALITION

UNDERTAKING NO. JT3.31:

Reference(s): 1B-SEC-01

Provide revised rate base tables for 2025 to 2029, based on the updated 2023/2024 numbers or to provide the reference in the evidence.

RESPONSE:

Please refer to Table 10 at Exhibit 1B, Tab 1, Schedule 3, page 9 filed April 2, 2024. Toronto Hydro also notes that the 2024 Working Capital Allowance presented in 1B-SEC-01 at Table 1 has been updated to reflect the latest information as presented in Table 9 in Exhibit 1B, Tab 1, Schedule 3, page 9 filed on April 2, 2024.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO SCHOOL ENERGY COALITION

UNDERTAKING NO. JT3.32:

Reference(s): 1B-SEC-3

To provide for 2020-2024 referenced in 1B-SEC-3, the full corporate scorecard that shows the correct weightings, the thresholds, the targets, the stretch targets for each.

RESPONSE:

In reviewing the transcript, Toronto Hydro notes that this undertaking does not capture the request made by School Energy Coalition. The scope of the undertaking is to either provide the following requested information or, if Toronto Hydro is not in a position to or has an objection, to advise: the full corporate scorecard that shows the correct weightings, the thresholds, the targets, the stretch targets for each for 2020-2024 as referenced in 1B-SEC-3.

The tables below provide the weight, threshold, target, stretch and year-end results for 2020 to 2024. Toronto Hydro has not provided the result for 2024 as no year-end results are available.

Table 1: 2020 Corporate Scorecard

Metric	Weight	Threshold	Target	Stretch	Result
New Services Connected on Time[1]	5%	92.2%	97.7%	98.9%	**99.7%**
Estimated Time of Restoration	5%	57.0%	60.0%	62.0%	**89%**
First Contact Resolution	5%	80%	86%	88%	**92%**
Total Recordable Injury Frequency	10%	1.5	1.30	1.25	**0.58**
Employee Engagement	5%	5.0	5.5	6.0	**9.0**
SAIFI (Defective Equipment)	10%	0.61	0.50	0.48	**0.40**
SAIDI (Defective Equipment)	10%	32.20	26.47	25.23	**21.82**
In-Service Assets ($M)[2]	10%	$ 418.1	$ 423.1	$ 428.1	**$438.0**
Consolidated Net Income ($M)[3]	10%	$ 141.9	$ 146.9	$ 151.9	**$156.0**
Cash Flow Management ($M)	30%	$ 1,200.0	$ 1,000.0	$ 950.0	**$360.0**

Table 2: 2021 Corporate Scorecard

Metric	Weight	Threshold	Target	Stretch	Result
New Services Connected on Time[1]	5%	93.0%	98.0%	99.0%	**99.9%**
Estimated Time of Restoration	5%	70%	75%	80%	**90%**
First Contact Resolution	5%	80%	86%	88%	**91%**
Total Recordable Injury Frequency	10%	1.20	1.15	1.10	**0.56**
Employee Engagement	5%	6.5	7.0	7.5	**9.4**
SAIFI (Defective Equipment)	10%	0.61	0.50	0.48	**0.46**
SAIDI (Defective Equipment)	10%	32.20	26.47	25.23	**21.35**
In-Service Assets ($M)[2]	10%	$ 415.8	$ 420.8	$ 425.8	**$ 452.3**

[1] Please note that the trending for this metric included in the business plans provided in response interrogatory 1A-CCC-01 may differ from scorecard results. The trending provide in the business plan are "point in time" results subject to validation/correction.
[2] Refer to Toronto Hydro's response to JTC3.33 for additional details
[3] The scope of the Net Income KPI in 2020-2022 applied certain exclusions and was not necessarily the same as Net Income as per audited financial statements.

Consolidated Net Income ($M)[4]	30%	$ 135.2	$ 140.2	$ 145.2	**$ 156.8**
Cash Flow Management ($M)	10%	$ 514.0	$ 469.0	$ 432.0	**$ 325.0**

Table 3: 2022 Corporate Scorecard

Metric	Weight	Threshold	Target	Stretch	Result
New Services Connected on Time	5%	93.0%	98.0%	99.0%	**99.9%**
Estimated Time of Restoration	5%	80%	85%	90%	**94%**
First Contact Resolution	5%	82%	86%	88%	**92%**
Total Recordable Injury Frequency	10%	1.15	1.10	1.05	**0.47**
Employee Engagement	5%	7.0	7.5	8.0	**10.9**
SAIFI (Defective Equipment)	10%	0.61	0.50	0.48	**0.46**
SAIDI (Defective Equipment)	10%	32.20	26.47	25.23	**20.38**
In-Service Assets ($M)[5]	10%	$ 429.1	$ 434.1	$ 439.1	**$ 450.5**
Consolidated Net Income ($M)	25%	$ 151.0	$ 156.0	$ 161.0	**$ 165.7**
Cash Flow Management ($M)	5%	$ 559.0	$ 532.0	$ 500.0	**$ 655.0**
Fleet Electrification	5%	3%	5%	8%	**9%**
Building Emissions Reduction	5%	2235.7	2213.6	2191.5	**2001.2**

Table 4: 2023 Corporate Scorecard

Metric	Weight	Threshold	Target	Stretch	Result
New Services Connected on Time	5%	93.0%	98.0%	99.0%	**99.9%**
Estimated Time of Restoration	5%	80%	85%	90%	**96%**
First Contact Resolution	5%	82%	86%	88%	**92%**
Total Recordable Injury Frequency	10%	1.05	1.00	0.95	**0.30**
Employee Engagement	5%	7.5	8.0	8.5	**10.5**
SAIFI (Defective Equipment)	10%	0.61	0.50	0.48	**0.33**

[4] The scope of the Net Income KPI in 2020-2022 applied certain exclusions and was not necessarily the same as Net Income as per audited financial statements.
[5] Refer to Toronto Hydro's response to JTC3.33 for additional details

SAIDI (Defective Equipment)	10%	32.20	26.47	25.23	**15.07**
In-Service Assets ($M)[2]	10%	$ 494.7	$ 499.7	$ 504.7	**$ 507.1**
Consolidated Net Income ($M)	30%	$ 128.0	$ 133.0	$ 138.0	**$ 139.9**
Fleet Electrification	5%	11%	13%	15%	**20%**
Building Emissions Reduction	5%	2213.6	2191.5	2145.8	**1657.2**

1

2 **Table 4: 2024 Corporate Scorecard**

Metric	Weight	Threshold	Target	Stretch
New Services Connected on Time	10%	93.0%	98.0%	99.0%
Estimated Time of Restoration	5%	80%	85%	90%
First Contact Resolution	10%	82%	86%	88%
Total Recordable Injury Frequency	10%	1.00	0.95	0.90
Employee Engagement	5%	8.0	8.5	9.0
SAIFI (Defective Equipment Only)	10%	0.61	0.50	0.48
SAIDI (Defective Equipment Only)	10%	30.69	25.23	24.19
In-Service Assets[6]	10%	496.0	501.0	506.0
Consolidated Net Income	30%	100.0	105.0	110.0

[6] Note: The Target for this metric is under review based on 2023 Audited Financials.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO SCHOOL ENERGY COALITION

UNDERTAKING NO. JT3.33:

Reference(s): 1B-SEC-03

To provide what's included in in-service additions for the scorecard, as compared to the OEB-approved numbers and your actual numbers provided in the other tables in the evidence.

RESPONSE:

Please see Table 1 below for the OEB approved in-service additions as well as the actual/bridge in-service additions.

Table 1: In-Service Additions (ISA)[1] ($M)

	2020	2021	2022	2023	2024	
Corporate KPI – ISA Actuals/Target	438.0	452.3	450.5	507.1	501.0	
OEB Approved ISA (annual)	527.4	456.2	565.1	565.8	559.1	
OEB Approved ISA (cumulative)	527.4	983.5	1,548.6	2,114.3	2,673.4	**A**
ISA Custom Scorecard Measure Actual/Bridge (annual)	447.9	485.2	554.4	594.2	619.8	
ISA Custom Scorecard Measure Actual/Bridge (cumulative)	447.9	933.2	1,487.6	2,081.8	2,701.6	**B**
ISA Custom Measure Actual/Bridge (cumulative 5-year plan % attainment)	17%	35%	56%	78%	101%	**B/A**

The corporate ISA KPI excludes one or more of the following programs/projects.

[1] 1B-SEC-01, Appendix A

- **Renewable Enabling Improvement ("REI") Investments,** subject to provincial rate recovery and do not form part of rate base;
- **Externally Driven Capital Projects,** driven by third-party relocation requests;
- **Contributions to Hydro One,** driven by the transmitter
- **Streetlighting Investments,** funded by the City of Toronto
- **Customer Choice Initiative,** funded through a new DVA
- **Customer Connections**, exclusion starting in 2022 due to increased variability in timing of expenditures and additions related to this type of demand-driven work

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO SCHOOL ENERGY COALITION

UNDERTAKING NO. JT3.34:

Reference(s): 1B-CCC-18

To provide the scan of the Key Performance Indicators in other jurisdictions.

RESPONSE:

In reviewing the transcript, Toronto Hydro notes that this undertaking does not accurately capture the request made by the School Energy Coalition ("SEC"). The scope of the undertaking is, with reference to 1B-CCC-18, to provide the scan of KPIs in other jurisdictions grouped into the four categories outlined in the OEB's renewed regulatory framework of customer focused, operational effectiveness, public policy responsiveness and financial performance.

Please see Appendix A for the list of Key Performance Indicators.

OEB Performance Outcome	Performance Category	Description/Examples	HI	WA	MA	NY	UK
Customer Focus	Customer Satisfaction	Survey results (residential, major customer connections)		✓	✓		✓
	Customer Complaints	Complaints lodged		✓			✓
	Customer Engagement	Online data platform use, Bill pay use, mobile app use, text messages, outage map use, hosting capacity map use, marketing impressions made, Green Button etc.	✓		✓		
	Customer Participation	Program participation (DER, DR, etc.), TOU Participation, AMI Opt-Out	✓				
	Customer Service Equity	Language interpretation services, public engagement with vulnerable communities, proportion of vulnerable customers, vulnerable customer satisfaction			✓		✓
	Timeliness	Customers connected on time			✓		
Operations Effectiveness	Reliability & Resilience	SAIDI, SAIFI, CAIDI, CAIFI, MAIFI, unplanned interruptions, planned interruptions, CEMI IEEE Standard, exceptional events, loss of load, total time critical loads are without power, fire and non-fire season outages, worst served customers, physical site security	✓	✓	✓		✓
	Emergency Response Preparedness	Number of employees NIMS certified, number employees that attend Emergency Response Training, Avg Emergency Response Time	✓	✓			
	Peak and Energy Demand	Peak demand and energy demand growth, primary network forecasting accuracy, Peak Demand Reduction, Peak Reduction Target			✓	✓	✓

OEB Performance Outcome	Performance Category	Description/Examples	HI	WA	MA	NY	UK
Operations Effectiveness	Equipment Performance	Overhead equipment failures, transformer utilization, asset resilience (NARM), flexibility procured transformer utilization		✓			✓
	Vegetation and Wildlife Management	Number of trees trimmed, vegetation management completed on time, number of hazard trees removed, miles of wildland urban interface, wildlife guards installed, etc.		✓			
	Infrastructure Upgrades	SCADA upgraded circuit breakers, copper conductors replaced, circuit length added ratio to peak load capacity caused by low carbon tech, transformer capacity released ratio to LCT demand, small copper wire units removed, conductors underground, reclosers installed, # open wire secondary districts removed, # wedge/bail clamps installed, transmission steel replacement poles installed, etc.		✓			✓
	Distributed Energy Resources	DER capability (MW), DER enrolled in grid service programs, DER utilization for grid services, number of users on non-firm connections	✓			✓	✓
	Innovation	To support network innovation that contributes to the achievement of net zero, while delivering real net benefits to network companies and consumers					✓
	Workforce Resilience	Retention, diversity, wellbeing, etc.					✓
Public Policy Responsiveness (Environment)	GHG Emissions	Emissions from: energy delivery systems, plant air emissions, business operations, embodied carbon Types: CO2, SF6	✓	✓	✓		✓

OEB Performance Outcome	Performance Category	Description/Examples	HI	WA	MA	NY	UK
Public Policy Responsiveness (Environment)	Carbon Intensity	Emissions intensity in CO2e per year in grams/kWh	✓	✓			
	Emissions Avoided NWA	Annual utility system CO2e emissions avoided through non-pipe, non-wire alternative programs		✓			
	Days Exceeding Health Levels	Weighted average days exceeding health levels		✓			
	Ratio New Gas to New Elec customers	Ratio of new gas customers to new electric customers		✓			
	Home Heating Wood Use	Metric related to decreased wood use for home heating		✓			
	Fluid Filled Cables	A leakage reduction target (in both percentage and liters)					✓
	Climate and Environment Plan	Sets environmental and climate goals; track, measure and report annually against targets and activities related to climate goals			✓		
	LED Lighting Replacement	Achievement of lighting replacement timelines			✓		
Public Policy Responsiveness	Interconnection Timeliness	Total DER interconnection time, IPP interconnection time, solar installation timeliness	✓		✓		
	Interconnection Cost	Cost overrun, expected vs actual cost to interconnect, study deposit, etc.	✓				
	Producer Satisfaction	Survey results	✓		✓		
	Truck Roll Response Time	response times for meter change outs for DER and non-DER customers	✓				
	Peak Load Reduction	Total DER curtailment, Capable DR peak load reduction, actual DR peak load reduction, Load Factor Improvement		✓		✓	

OEB Performance Outcome	Performance Category	Description/Examples	HI	WA	MA	NY	UK
Public Policy Responsiveness	Electric Vehicle Load Management	% load shift to off-peak due to tariff, % EV load subject to managed charging, %EVSE in DR programs, %EVSE in TOU rates		✓			
	EV Growth	Measured energy load, measured demand load, estimated load, EV count, fleet electrification, number of ride share fueling hubs, etc.	✓			✓	
	Energy Efficiency	Incentives for savings tied either to efficiency achievements or clean energy targets				✓	
	Energy Use	Electric usage intensity				✓	
	NWA Costs	NWA Capital Expenditures		✓			
	% Generation in WA or Avista Connected	% Generation in WA or Avista Connected		✓			
	Price Charged at EVSE	Price Charged at EVSE		✓			
	Types of Electric Transport Technology Supported as % of total TE investments	Types of Electric Transport Technology Supported as % of total TE investments		✓			
	Hosting Capacity Map Usage	Hosting Capacity Map Usage Metric			✓		
Financial Performance	Customer Equity	Low income customer program participation; % energy efficiency, DR, DER, and renewable spending on load income communities, etc.	✓	✓			
	Disconnections & Terminations	Disconnections by customer class, low income terminations	✓	✓	✓		

OEB Performance Outcome	Performance Category	Description/Examples	HI	WA	MA	NY	UK
Financial Performance	Customer Affordability	Average bill, Annual bill as % of low income avg income, Average annual bill as a percentage of income by census tract, arrearages for residential and small commercial customers, % and number of customers with high energy bill burden, etc.	✓	✓			
	Revenue Growth	Rate of annual revenue growth, revenue through riders	✓	✓			
	Payment Arrangements	% of low income customers on bill assistance, % customers in payment arrangements	✓	✓			
	NWA	Avoided T&D investment, NWA total cost	✓				
	Rate Base per Customer	Rate Base per customer	✓	✓			
	O&M per Customer	O&M per customer	✓	✓			
	Credit Rating	Credit rating, annual outlook	✓	✓			
	Costs & Expenses	Incremental spending, Annual sum of Energy Cost Recovery Clause ("ECRC") costs, Purchased Power Adjustment Clause ("PPAC") costs, Major Project Interim Recovery/Exceptional Project Recovery Mechanism ("MPIR" and EPRM") costs	✓	✓			
	Diversity	% Suppliers that are minority, woman, or veteran owned, % of Employees and management who are female, non-binary, person of color		✓			
	ROE	Return on equity		✓			

OEB Performance Outcome	Performance Category	Description/Examples	HI	WA	MA	NY	UK
Financial Performance	EV Infrastructure	% of utility owned EVSE, number of charging stations, miles of transport provided by community based orgs		✓			
	# of Customers	Number of customers served		✓			
	Program Participation	Number of residential appliance and equipment rebates provided, Commercial Customer Program Participation		✓			
	Third-Party Generation	Percentage of third-party generation on system	✓				

Hawaii (HI) Source: Docket No. 2018-0088, Decision and Order No. 37787			
OEB Performance Outcome	**Performance Category**	**Metric**	**Description**
Customer Focus	Customer Participation	Program Participation	Number and percent of customers participating in any of the following programs: CERE projects, DER programs, and DR programs
	Customer Engagement	Green Button Connect My Data	Number and percent of customers that have used Green Button Connect My Data to enable sharing of information
	Customer Engagement	Green Button Download My Data	Number and percent of customers that have used Green Button Download My Data
	Customer Participation	TOU Participation	Number and percent of customers participating in time-varying tariffs, by customer class
	Customer Participation	AMI Opt-Out	Percentage of customers opting out of advanced meters
Operations Effectiveness	Reliability & Resilience	Critical Load	Total amount of time that critical loads are without power in a year
	Emergency Response Preparedness	NIMS Certification	Total number of employees completing National Incident Management System Incident Command System 100, 200, and 300 certifications
	Emergency Response Preparedness	Emergency Response Training	Total number of employees that have attended emergency response training, annually

Hawaii (HI) Source: Docket No. 2018-0088, Decision and Order No. 37787			
OEB Performance Outcome	**Performance Category**	**Metric**	**Description**
Operations Effectiveness	Distributed Energy Resources	DER Grid Services Capability	Percentage and total MW of DER systems capable of providing grid services
	Distributed Energy Resources	DER Grid Services Enrollment	Percentage and total MW of capable DER systems enrolled in grid services programs
	Distributed Energy Resources	DER Grid Services Utilization	Percentage and total MW of DER systems enrolled in grid services programs that are being utilized to provide grid services
	Peak and Energy Demand	DER Curtailment	Total MW and MWh of curtailment from DERs, including partial curtailment or power reductions
Public Policy Responsiveness	GHG Emissions	GHG Emissions	GHG emissions in CO2e emissions per year in metric tons, reflecting emissions that both include and exclude biogenic CO2e
	Carbon Intensity	GHG Intensity	Emissions intensity in CO2e per year in grams/kWh, reflecting emissions that both include and exclude biogenic CO2e. Calculated as absolute emissions/total kWh
	Interconnection Timeliness	Total DER Interconnection Time	The Companies' respective average (mean) total number of calendar days to interconnect DER systems <100 kW in size, in a calendar year
	Producer Satisfaction	IPP Experience	Percentage of IPP surveys sent within six months and results provided in full and in summary to the Commission annually

Hawaii (HI) Source: Docket No. 2018-0088, Decision and Order No. 37787			
OEB Performance Outcome	**Performance Category**	**Metric**	**Description**
Public Policy Responsiveness	Truck Roll Response Time	Truck Roll Response Time	Truck roll-related response times, related to steps within the Companies' control, for meter change-outs for DER and non-DER customers, by individual Company
	Interconnection Cost, Timeliness	IPP Interconnection	For each IPP Project with a Power Purchase Agreement approved by the Commission: Location, Technology, Procurement type, Size (MW), Interconnection voltage; Time to interconnect by step (steps both in and out of the Companies' control, to the extent known); RFP unit cost information; Cost to interconnect (original interconnection requirements study deposit, IRS advanced payments, IRS actual costs, system impact study, taxis, company owned interconnection facilities, estimated interconnection costs, actual interconnection costs, delta between estimated and actual costs, etc.)
	Interconnection Cost	Interconnection Cost Overrun	The percentage of times the cost of interconnection has exceeded the estimated cost of interconnection for utility scale IPP projects.
	EV Growth	Fleet Electrification	Total number of the Companies' light-duty EV miles as a percentage of their total light-duty vehicle ("LDV") fleet miles
	EV Growth	Measured EV Load (Energy)	Measurable energy (kWh) delivered at EV charging stations in approved EV tariffs by time period

Hawaii (HI) Source: Docket No. 2018-0088, Decision and Order No. 37787			
OEB Performance Outcome	**Performance Category**	**Metric**	**Description**
Public Policy Responsiveness	EV Growth	Measured EV Load (Demand)	Average demand (kW) attributable to measured EV charging in approved EV tariffs by hour, to be expanded to include any subsequently approved EV tariffs
	EV Growth	Estimated EV Load	Estimated total EV load (kWh), measured by: Number of registered light-duty EVs and average vehicle miles traveled, Average kWh/mile (expected to be approx. 0.31), and Load (kWh) from e-Buses
	EV Growth	EV Count	Total number of registered light-duty
	EV Growth	Ride Share Fueling Hubs	Number of shared fueling hubs for Ride Share Only (with stored energy capabilities)
Financial Performance	NWA	Avoided T&D Investment	Total value ($) of deferred and/or avoided T&D capital investments due directly to the installation or acquisition of an NWA, reported annually by T&D capital investment with a description of the NWA that enabled the deferral, by service territory.
	NWA	NWA Total Cost	Total cost ($) of NWAs deployed by the utility or acquired through a program or procurement, which are owned or operated by the Companies or third-party that defers or avoids T&D capital investment, reported annually by capital investment and service territory
	Low Income Customer Affordability	LMI Energy Burden	Typical and average annual bill as a percentage of low-income average income. LMI = low to moderate income, 150% of the Hawaii Federal Poverty Limit

Hawaii (HI) Source: Docket No. 2018-0088, Decision and Order No. 37787			
OEB Performance Outcome	**Performance Category**	**Metric**	**Description**
Financial Performance	Payment Arrangements	Payment Arrangement	Percent of customers entered into payment arrangements by zip code
	Disconnections & Terminations	Disconnections	Percent of disconnections for non-payment by customer class by zip code
	Credit Rating	Credit Rating	Credit rating of the Companies and annual outlook, including directionality
	Third Party Gen	Third-Party Generation	Percentage of third-party generation on system (measuring total MWs of generation provided by non-utility entities as a percentage of total generation)
	Costs & Expenses	Annual sum of Energy Cost Recovery Clause ("ECRC") costs	Annual recorded metric compared to base year metric increased at the rate of inflation as measured by GDPPI (i.e., maintaining constant real expense)
	Costs & Expenses	Purchased Power Adjustment Clause ("PPAC") costs	Annual recorded metric compared to base year metric increased at the rate of inflation as measured by GDPPI (i.e., maintaining constant real expense)
	Costs & Expenses	Major Project Interim Recovery/Exceptional Project Recovery Mechanism ("MPIR" and EPRM") costs	Annual recorded metric compared to base year metric increased at the rate of inflation as measured by GDPPI (i.e., maintaining constant real expense)
	Rate Base per Customer	Rate Base per Customer	Total rate base ($) per customer for each Company

Hawaii (HI) Source: Docket No. 2018-0088, Decision and Order No. 37787			
OEB Performance Outcome	**Performance Category**	**Metric**	**Description**
Financial Performance	O&M per Customer	O&M cost per Customer	Total utility Operations & Maintenance costs ($) per residential customer for each Company
	Revenue Growth	Annual Revenue Growth	Rate of annual growth for overall authorized revenues compared to inflation, shown as historical record of revenues with GDPPI trend line and showing annual percentage change
	Customer Equity	LMI Program Participation	Number of LMI (low to moderate income) customers participating in each of the following programs, and percentage of program participants in each of the following programs that are LMI: CBRE projects, TOU, DR, and DER

Washington Source: Avista Washington PBR Metrics, https://www.myavista.com/about-us/our-rates-and-tariffs/washington-pbr-metrics			
OEB Performance Outcome	**Performance Category**	**Metric**	**Description**
Customer Focus	Customer Satisfaction	Telephone Service Customer Satisfaction	Customer satisfaction, by class, with telephone service provided by customer service representatives (residential only)
	Customer Satisfaction	Field Service Representative Customer Satisfaction	Customer satisfaction, by class, with Avista's field service representatives (residential only)
	Customer Complaints	Customer Complaints	Customer Complaints, by class, made to the Commission

Washington Source: Avista Washington PBR Metrics, https://www.myavista.com/about-us/our-rates-and-tariffs/washington-pbr-metrics			
OEB Performance Outcome	**Performance Category**	**Metric**	**Description**
Customer Focus	Customer Satisfaction	% of Customer Calls Answered	Percentage of customers call answered live by a customer service representative within 60 seconds
	Customer Engagement	Number of Outreach Contracts	
	Customer Engagement	Number of Marketing Impressions	
Operations Effectiveness	Reliability & Resilience	SAIDI excluding major events	SAIDI excluding IEEE-defined major events for WA
	Reliability & Resilience	SAIDI all outages	SAIDI all outages for WA
	Reliability & Resilience	SAIFI excluding major events	SAIFI excluding IEEE-defined major events for WA
	Reliability & Resilience	SAIFI all outages	SAIFI all outages for WA
	Reliability & Resilience	CAIDI by feeder classification	CAIDI by feeder classification (rural, suburban, urban)

Washington Source: Avista Washington PBR Metrics, https://www.myavista.com/about-us/our-rates-and-tariffs/washington-pbr-metrics			
OEB Performance Outcome	**Performance Category**	**Metric**	**Description**
Operations Effectiveness	Reliability & Resilience	CAIDI in highly impact communities	CAIDI in highly impacted communities, by census tract
	Reliability & Resilience	CAIFI by feeder classification	CAIFI by feeder classification
	Reliability & Resilience	CAIFI in highly impacted communities, by census tract	CAIFI in highly impacted communities, by census tract
	Reliability & Resilience	CEMI IEEE Standard 1366P-2003, by census track	CEMI IEEE Standard 1366P-2003, by census track
	Reliability & Resilience	CEMI IEEE Standard 1366P-2003 in highly impacted communities	CEMI IEEE Standard 1366P-2003 in highly impacted communities, by census tract
	Emergency Response Preparedness	Avg Emergency Response Time	Average response time to an electric system emergency
	Reliability & Resilience	Fire and Non-Fire Season Outages	Number of outages by category during the Fire Season (June 1-Oct. 1) vs No Fire Season
	Equipment Performance	Overhead Equipment Failures	Number of overhead equipment failures by subcategory (arrestors, capacitor, insulator, fuse, conductor, etc.) during Fire Season (June 1-Oct. 1) vs No Fire Season

Washington Source: Avista Washington PBR Metrics, https://www.myavista.com/about-us/our-rates-and-tariffs/washington-pbr-metrics			
OEB Performance Outcome	**Performance Category**	**Metric**	**Description**
Operations Effectiveness	Vegetation and Wildlife Management	Vegetation Inspections and remediation performed on time	Number and percent of planned pre-season vegetation inspections and remediation performed on time. By Distribution and transmission inspections. # of Miles, % inspected on time, % remediated.
	Vegetation and Wildlife Management	Numbers of Trees trimmed	Number of trees trimmed. By distribution, transmission, and total
	Vegetation and Wildlife Management	Numbers of Hazard Trees Removed	Number of hazard trees removed. By distribution, transmission, and total
	Vegetation and Wildlife Management	Number Trees Replaced through Customer Choice Right Tree Right Place Program	Number of trees replaced through the Customer Choice Right Tree Right Place program
	Vegetation and Wildlife Management	Trees Removed by Customer Request	Number of trees removed through customer requests
	Vegetation and Wildlife Management	Trees removed/trimmed from Fuel Reduction Partnerships	Trees and brush removed and trees trimmed from the Fuel Reduction Partnerships
	Infrastructure Upgrades	Reclosers Installed	Number of reclosers installed. By distribution, fire mode ready, and total
	Infrastructure Upgrades	SCADA Upgraded Circuit Breakers	Number of circuit breakers upgraded with supervisory control and data acquisition

Washington Source: Avista Washington PBR Metrics, https://www.myavista.com/about-us/our-rates-and-tariffs/washington-pbr-metrics			
OEB Performance Outcome	**Performance Category**	**Metric**	**Description**
Operations Effectiveness	Vegetation and Wildlife Management	Miles of Wildland Urban Interface	Miles of Wildland Urban Interface
	Infrastructure Upgrades	# and % Distribution Hardening Projects Planned vs completed	Number and percent of distribution grid hardening projects planned vs completed. # Miles Planned, # Miles Completed, % Complete
	Infrastructure Upgrades	Conductors Underground	Miles of conductors underground
	Infrastructure Upgrades	Copper Conductors replaced	Miles of copper conductor replaced
	Infrastructure Upgrades	Small Copper Wire Units Removed	Number of small copper wire units removed
	Vegetation and Wildlife Management	Wildlife Guards Installed	Number of wildlife guards installed
	Infrastructure Upgrades	# open wire secondary districts removed	: Number of open wire secondary districts removed
	Infrastructure Upgrades	# Wedge/Bail Clamps Installed	Number of wedge/bail clamps at hot tap connection points installed

Washington Source: Avista Washington PBR Metrics, https://www.myavista.com/about-us/our-rates-and-tariffs/washington-pbr-metrics			
OEB Performance Outcome	**Performance Category**	**Metric**	**Description**
Operations Effectiveness	Infrastructure Upgrades	Other Wildfire Plan Metrics	Miles of Distribution Satellite – AiDASH Complete, Acres of Transmission Corridor Clearing Complete, Miles of Transmission LiDAR Complete, Miles of Overhead Distribution Conductor Installed/Replaced, # Steel Poles Installed, # of Fiberglass Distribution Crossarms Installed, # of Distribution Wood Poles Installed, # of Lightning Arrestors Installed, # of Distribution Fire Resistant Mesh Wrap Installed, # of Transmission Wood Pole Fire Resistant Wraps Installed, # of Failed/Damaged Transmission Replacement Poles Installed, # of Transmission Asset Condition/New Project Poles Installed, # of Transmission Steel Replacement Poles Installed: Wildfire Only
Public Policy Responsiveness (Environment)	Carbon Intensity	Carbon Intensity	Carbon intensity CO2e/MWh; CO2e/MW*, CO2e/customer (E & G)
	GHG Emissions	Total Emissions from Energy Delivery Systems	Total CO2 emissions from energy delivery systems, including customer direct use
	Emissions Avoided NWA	Annual CO2 Emissions Avoided NWA	Annual utility system CO2e emissions avoided through non-pipe, non-wire alternative programs
	Days Exceeding Health Levels	Days Exceeding Health Levels	Weighted average days exceeding health levels
	GHG Emissions	Plant Air Emissions	Avista plant air emissions (SO2, Mercury, Nox, VOC)

Washington Source: Avista Washington PBR Metrics, https://www.myavista.com/about-us/our-rates-and-tariffs/washington-pbr-metrics			
OEB Performance Outcome	**Performance Category**	**Metric**	**Description**
Public Policy Responsiveness (Environment)	Ratio New Gas to New Elec customers	Ratio New Gas to New Elect Customers	Ratio of new gas customers to new electric customers
	Home Heating Wood Use	Home Heating Wood Use	Metric related to decreased wood use for home heating
Public Policy Responsiveness	Electric Vehicle Load Management	% Load Shift to Off-Peak due to TE tariff	Percentage of load shifted to off-peak periods attributable to TE tariff (transportation electrification) offerings by use case
	Electric Vehicle Load Management	% EV Load Subject to Managed Charging	% EV Load Subject to Managed Charging
	Electric Vehicle Load Management	% EVSE in DR programs	% EVSE in DR programs
	Electric Vehicle Load Management	% of EVSE in TOU rates	% of EVSE in TOU rates
	Peak Load Reduction	Capable DR Peak Load Reduction	Peak load reduction capability attributable to demand response programs
	Peak Load Reduction	Actual DR Peak Load Reduction	Actual peak load reductions realized through dispatched DR in top 100 hours

Washington Source: Avista Washington PBR Metrics, https://www.myavista.com/about-us/our-rates-and-tariffs/washington-pbr-metrics			
OEB Performance Outcome	**Performance Category**	**Metric**	**Description**
Public Policy Responsiveness	NWA	NWA Capital Expenditures	Annual capital expenditures avoided through non-wires alternative programs
	% Generation in WA or Avista Connected	% Generation in WA or Avista Connected	Percent of generation located in Washington or connected to Avista transmission
	Price Charged at EVSE	Price Charged at EVSE	Price Avista charges at utility-owned and supported EVSE, by use case
	Types of Electric Transport Technology Supported as % of total TE investments	Types of Electric Transport Technology Supported as % of total TE investments	Types of electric transportation technology supported by a utility portfolio as a percent of total TE investments i.e. micro-mobility, transit, etc.
Financial Performance	Customer Affordability	Average annual bill	Calculated using average billing information for each residential rate schedule, by class, by census tract
	Customer Affordability	Average annual bill as a percentage of income	Calculated using average billing information for residential customers compared to average income by census tract. By class, by census tract
	Revenue Growth	Total revenue occurring through riders	Total revenue occurring through riders and associated mechanisms not captured in the MYRP (multi-year rate plan)
	Customer Affordability	Residential arrearages	By month, measured by location and demographic information (zip code/census tract, KLI customers, Vulnerable Populations, Highly Impacted Communities, and for all customers in total)

Washington Source: Avista Washington PBR Metrics, https://www.myavista.com/about-us/our-rates-and-tariffs/washington-pbr-metrics			
OEB Performance Outcome	**Performance Category**	**Metric**	**Description**
Financial Performance	Customer Affordability	Small commercial customer arrearages	by month, for all customers and measured by location in Vulnerable Populations, Highly Impacted Communities
	Rate Base per Customer	Rate base per customer	Rate base per customer
	O&M per Customer	O&M per customer	O&M per customer
	Revenue Growth	Rate of annual revenue growth	Rate of annual revenue growth compared to inflation
	Disconnections & Terminations	Residential Disconnections	Number and percentage of residential electric disconnections for nonpayment by month, measured by location and demographic information (zip code/census tract, KLI customers, Vulnerable Populations, Highly Impacted Communities, and for all customers in total)
	Disconnections & Terminations	Small Commercial Disconnections	Number and percentage of small commercial customer electric disconnections for nonpayment by month, for all customers and measured by location in Vulnerable Populations, Highly Impacted Communities
	Payment Arrangements	Bill Assistance Participation	Percentage of low-income customers who participate in bill assistance programs
	Customer Affordability	% Average bill of income of low income customers	Average bill as a percentage of low-income customers' average income

Washington Source: Avista Washington PBR Metrics, https://www.myavista.com/about-us/our-rates-and-tariffs/washington-pbr-metrics			
OEB Performance Outcome	**Performance Category**	**Metric**	**Description**
Financial Performance	Customer Affordability	Number Customers with High Energy Burden	Number of households with a high-energy burden (>6%), separately identifying known low income and Named Communities. Known low-income customers are included in total of all customers and may also be included in Named Communities customers.
	Customer Affordability	% Customers with High Energy Burden	Percentage of households with a high-energy burden (>6%), separately identifying known low income and Named Communities
	Customer Affordability	Average excess burden per household	This metric is reported on an annual basis for residential customers that have a high energy (>6%). Average excess burden is calculated after taking into consideration energy assistance.
	ROE	ROE	Ratemaking return on common equity
	Credit Rating	Credit Rating	Utility credit ratings
	Customer Equity	Energy Efficiency Program Participation	Percentage of customers, by class, that participate in energy efficiency programs
	Customer Equity	Low Income Customer Program Participation	Percentage of known low-income customers that participate in demand response, distributed energy resources, or renewable energy utility program
	Program Participation	Commercial Customer Program Participation	Percentage of small commercial customers that participate in demand response, distributed energy resources, or renewable energy utility programs

Washington Source: Avista Washington PBR Metrics, https://www.myavista.com/about-us/our-rates-and-tariffs/washington-pbr-metrics			
OEB Performance Outcome	**Performance Category**	**Metric**	**Description**
Financial Performance	Customer Equity	% Energy Efficiency Spending on Vulnerable Communities	Percentage of utility energy efficiency program spending that benefits highly impacted communities and vulnerable populations
	Customer Equity	% DR, DER, and Renewable Program Spending on Vulnerable Communities	: Percentage of utility spending on demand response, distributed energy resources, and renewable that benefits highly impacted communities and on vulnerable populations. Calculation of this metric is based on spending on renewable generation and DERs located in Named Communities. Calculation does not include spending on electric transportation or energy efficiency as those areas have separate metrics.
	Customer Equity	% Low Income Customer Participation in EV Programs	Percentage of known low-income customers that participate in utility electric vehicle programs, by program
	Customer Equity	% EV Program Spending on Vulnerable Communities	Percentage of utility electric vehicle program spending that benefits highly impacted communities and vulnerable populations
	EV Infrastructure	% of utility-owned EVSE by use case located within named communities	Percentage of utility-owned and supported EVSE by use case located within and/or providing direct benefits and servicing named communities
	Diversity	% Suppliers that are minority, woman, or veteran owned	Percentage of Avista suppliers that are minority-owned, women-owned, or veteran owned

Washington Source: Avista Washington PBR Metrics, https://www.myavista.com/about-us/our-rates-and-tariffs/washington-pbr-metrics			
OEB Performance Outcome	**Performance Category**	**Metric**	**Description**
Financial Performance	Diversity	% of Employees and management who are female, non-binary, person of color	Percentage of Avista employees and senior management (separately identifying: a) c-suite employees and b) directors and employees more senior than directors) who identify as: i) female or non-binary; or ii) as a person of color
	EV Infrastructure	Miles of transport provided by Community Based Orgs	Number of annual passenger miles provided by Community Based Organizations for individuals utilizing electric transportation
	EV Infrastructure	Number of Charging Stations	Number of Public Charging Stations located in Named Communities
	Costs & Expenses	Incremental spending	Incremental spending each year in Named Communities
	# of Customers	# Customers and/or CBOs	Number of customers and/or Community based organizations served
	Program Participation	Residential Appliance and Equipment Rebates	Number of residential appliance and equipment rebates provided to customers residing in Named Communities and the number of residential rebates provided to customers residing in rental units
	Customer Service Equity	Translation Services	Percentage of company engagements available with translation services

Massachusetts Source: DPU 22-22, Final Order, 11.3.22			
OEB Performance Outcome	**Performance Category**	**Metric**	**Description**
Customer Focus	Customer Satisfaction	Overall Customer Satisfaction Metric	The Department directs the Company to include annual reporting on its J.D. Power business customer satisfaction survey results. Measures customer satisfaction using: power quality and reliability; price; billing and payment; corporate citizenship; communications; and customer service. Customer responses to these separate segments are compiled into one final index score
	Customer Satisfaction	Transactional Customer Satisfaction Index	customer satisfaction associated with: (1) unplanned outages; (2) planned outages; (3) website satisfaction; and (4) contact center. The proposed index score would be developed by summing the scores of survey responses from customers following each type of transaction and dividing by the sum of all respondents. (But not integrated into the SQ penalty framework)
	Customer Engagement	Use of Outage Map Metric	In prior years, the metric measured the total number of customer views of the outage map during both "blue sky" conditions and when the Company's Emergency Response Plan is triggered. The Company proposes to report only on views during ERP events and to report engagements with the outage map as a percentage of total inbound customer communications during these events. The calculation will be done on a per-ERP event basis and then averaged across all ERP events for the year.
	Customer Engagement	Digital Engagement Metric	Tracks the percentage of total customer engagements that are digital, including bill pay, outage reporting, text message interactions, mobile app interactions, outage status checks, and others. Does not include customer service phone calls and manual payments

Massachusetts Source: DPU 22-22, Final Order, 11.3.22			
OEB Performance Outcome	**Performance Category**	**Metric**	**Description**
Customer Focus	Timeliness	New Customer Connects Metric	The % of new customer connects completed in accordance with Company targets for timeliness of new service connections. Measures the time from the creation of a work order to the point of installation of the customer's meter in number of business days. The % of new customer connects that meet certain performance targets out of the total number of new customer connects. (Not included in SQ penalty framework)
	Customer Service Equity	Equity Framework	An equity framework that would be applied to projects in all Environmental Justice ("EJ") communities. The framework: (1) rigorous EJ mapping; (2) identification of stakeholders and focused outreach to those stakeholders; (3) language translation and live interpretation services; (4) public engagement utilizing a variety of communication channels and in multiple languages, as applicable; and (5) collection of feedback
Operations Effectiveness	Peak and Energy Demand	Peak Demand Reduction Metric	Separately track peak demand reductions from six measures: (1) energy efficiency programs; (2) demand response programs; (3) company-owned storage; (4) company-owned solar; (5) upgrades to standard technologies; and (6) volt/volt-ampere reactive optimization
	Reliability & Resilience	Momentary Average Interruption Frequency Index ("MAIFI")	Reporting will be limited to devices with SCADA visibility until advanced metering infrastructure ("AMI") meters are deployed.
	Reliability & Resilience	SAIFI and SAIDI	Capture all customer interruptions and customer interruption duration without excluding major event days
Public Policy Responsiveness (Environment)	Climate adaption and mitigation plan	Climate Adaptation and Mitigation Plan	Bringing renewable energy to the region and reducing the Company's own emissions. NSTAR Electric proposes continued development of a substation flood vulnerability

Massachusetts Source: DPU 22-22, Final Order, 11.3.22			
OEB Performance Outcome	**Performance Category**	**Metric**	**Description**
			model, evaluation of new equipment to improve performance in flooding conditions, and augmentation of the Company's outage prediction model to include climate impacts . Commission: "While we approve the climate adaption and mitigation plan, we direct the Company in its annual PBR filing to include a demonstration of how the plan is aligned with the objectives of the Commonwealth's decarbonization policies, including applicable sector-specific interim targets and sub-limits"
Public Policy Responsiveness (Environment)	LED Lighting Replacement	LED Lighting Replacement	Timeframes (all Eversource facilities lighting upgraded by end of calendar year, all non-LED S-1 lighting to be phased out in 2 years). In its annual PBR filings, the Company shall report on its compliance with these timelines; if the Company does not meet these timelines, it shall report on the percentage of S-1 lighting categories of (a) LED and (b) non-LED.
Public Policy Responsiveness	Producer Satisfaction	Producer Satisfaction Survey	The producer satisfaction survey will measure producer satisfaction associated with: (1) ease of enrollment; (2) ease of connection; (3) timeliness; and (4) helpfulness and communication during the interconnection process, before and after interconnection. Total satisfaction reported on a scale of one to ten. (Not included in SQ penalty framework)
	Hosting Capacity Map Usage Metric	Hosting Capacity Map Usage Metric	Measure the sum of visits to the Company's DG hosting capacity websites
	Interconnection Timeliness	Solar Development Timeline Metric	Measures the duration in business days from creation of a solar installation work order to completion, and then will calculate the percentage of solar installations meeting certain timeline performance targets by dividing the number of solar installations that meet the targets by the total number of solar installations

Massachusetts Source: DPU 22-22, Final Order, 11.3.22			
OEB Performance Outcome	**Performance Category**	**Metric**	**Description**
Financial Performance	Disconnections & Terminations	Low-Income Terminations Metric	Provide reports on low-income customer service terminations (for nonpayment and for accounts with past due balances at levels eligible for disconnect) by census tract

UK Ofgem Approved Metrics Source: RIIO-ED2 Final Determinations Core Methodology Document, 11.30.22			
OEB Performance Outcome	**Performance Category**	**Metric**	**Description**
Customer Focus	Customer Satisfaction	Customer Satisfaction Survey	Scores based on three weighted surveys: general enquiries survey (20%), connections survey (50%) and supply interruptions survey (30%)
	Customer Complaints	Complaints Metric	Score based on four weighted indicators: complaints unresolved after one day (10%) complaints unresolved in 31 days (30%) repeat complaints (50%) the number of Energy Ombudsman decisions that go against the DNO (as a percentage of total complaints) (10%)
	Customer Service Equity, Customer Equity	Consumer Vulnerability Incentive	To assess companies' performance against our key principles and baseline expectations for consumers in vulnerable situations, and the delivery of their vulnerability strategies. This included using the following five metrics to measure DNO performance: • the proportion of customers registered on a DNO's PSR (priority services register) out of the total eligible customers in its region(s), which we refer to as PSR Reach (weighting in total score: 40%) • the value delivered as a result of DNOs providing fuel poverty support services (20%) • the value delivered as a result of DNOs supporting customers at risk of being left behind in the energy system transition (20%)

UK Ofgem Approved Metrics Source: RIIO-ED2 Final Determinations Core Methodology Document, 11.30.22			
OEB Performance Outcome	**Performance Category**	**Metric**	**Description**
			• the customer satisfaction of customers who have received fuel poverty support services (10%) • the customer satisfaction of customers who have received support to ensure no one is left behind in the energy system transition. (10%)
Customer Focus	Customer Service Equity	Annual Vulnerability Report	Includes: • Performance metrics • Regularly Reported Evidence • Use of Social Value Framework • Strategy commitments delivery progress update • Winter preparedness to support those vulnerable during a loss of supply
	Customer Satisfaction	Major Connections	Major connection customers' overall satisfaction with DNOs in providing connections to their networks
Operational Effectiveness	Innovation	Whole System	Whole system minimum requirements as part of Stage 1 of the BPI. We will retain the focus on whole system solutions in our innovation stimulus, requiring DNOs to consider whole system approaches when formulating their innovation proposals. To support network innovation that contributes to the achievement of net zero, while delivering real net benefits to network companies and consumers
	Peak and Energy Demand	Primary network forecasting accuracy	Compares the accuracy of the forecast maximum demand MW in the Long Term Development Statement (LTDS) with the outturn reported in the Load Index (LI) reporting pack for each primary substation.
	Reliability & Resilience	Network Options Assessment outcomes	Reports the outcomes from the Network Options Assessment for each scheme as a % of the total against standardized categories (e.g. flexibility, reinforcement + flexibility, reinforcement, no action).

UK Ofgem Approved Metrics Source: RIIO-ED2 Final Determinations Core Methodology Document, 11.30.22			
OEB Performance Outcome	**Performance Category**	**Metric**	**Description**
Operational Effectiveness	Distributed Energy Resources	Curtailable connections	Number and capacity (MW) of users on non-firm connections.
	Equipment Performance	Transformer Utilization	Designed to control against sub-optimal reinforcement in transformers. The metric checks that works are occurring within areas of projected 'high' utilization. A tolerance of 10% of capacity additions in 'low' utilization bands will be permitted under the metric to account for situations where it is justified, or necessary for safety reasons, to invest in transformers with a utilization below 100%.
	Infrastructure Upgrades	Transformer capacity released ratio	Checks that transformer capacity additions (broken down by PMTs and GMTs) are proportional to changes in LCT demand, by measuring the ratio of net transformer capacity additions to the increase in peak load capacity for transformers caused by new LCT demand.
	Infrastructure Upgrades	Circuits length added ratio	Checks that the addition of circuit length (broken down by OHL and cables) is proportionate to changes in LCT (low carbon technologies) demand, by measuring the ratio of additions to the increase in peak load capacity caused by new LCT demand.
	Peak and Energy Demand	Peak demand growth and energy growth indices	Measures the change over time in the peak load and energy volume measured at the discrete points where LV monitoring equipment has been installed on the network. The metric monitors whether year on year growth is positive, with an error being produced if it is negative
	Equipment Performance	Flexibility procured transformer utilization metric	is designed to control against sub-optimal procurement of flexibility for deferring investment in PMTs and GMTs. The metric checks that flexibility is being procured for PMTs and GMTs with 'high' projected utilization.
	Reliability & Resilience	Values of Loss of Load	Introduce a single figure for VoLL, updating the RIIO-ED1 figure in line with inflation. Update incentive rates to reflect VoLL and the latest view of average consumption

UK Ofgem Approved Metrics Source: RIIO-ED2 Final Determinations Core Methodology Document, 11.30.22			
OEB Performance Outcome	**Performance Category**	**Metric**	**Description**
			and GB CMLs. Move to an incentive with a cap of 150BPs of RoRE and a collar of 250BPs of RoRE
Operational Effectiveness	Reliability & Resilience	Unplanned Interruptions	Amend the CML (customer minutes lost) target setting methodology to be consistent with the CI (customer interruptions) methodology and apply. Retain improvement factors to ensure DNOs strive to deliver further reliability improvements, applying three levels set relative to DNO benchmarks (0.5%, 2% and 4%).
	Reliability & Resilience	Exceptional Events	Performance under the IIS (interruptions incentive scheme) in these circumstances is discounted to recognize the impact of these events. Severe Weather Exceptional Event (SWEE) threshold and Other Exceptional Event (OEE) eligible events
	Reliability & Resilience	Short Interruptions	DNOs to report agreed SI dataset annually as part of regulatory reporting process
	Equipment Performance	Asset Resilience	As measured through the Network Asset Risk Metric (NARM)
	Workforce Resilience	Workforce Resilience	Requiring each DNO to prepare and report their progress against a workforce resilience strategy will ensure they focus on important issues around diversity and inclusion (gender, ethnicity, disabilities, age ranges); workforce attraction and retention (number of applicants, time to fill, percentage filled internally vs external hires, retirement age, voluntary staff turnover, length of service, reasons for leaving, redundancy, reasons for absenteeism); staff wellbeing and having a future focused workforce (employee participation in upskilling, multiskilling or new skill training)

UK Ofgem Approved Metrics Source: RIIO-ED2 Final Determinations Core Methodology Document, 11.30.22			
OEB Performance Outcome	**Performance Category**	**Metric**	**Description**
Public Policy Responsiveness (Environment)	GHG Emissions	Annual Environmental Report	Track, measure and report annually against targets and activities as set out in their EAPs using methodologies approved by Ofgem. This will include key performance indicators as well as efforts towards a longer-term plan to net zero by 2050. Report on bespoke commitments as it relates to their EAPs. Submit their AER to Ofgem annually as well as publish on their respective websites.
	GHG Emissions	Business Carbon Footprint (BCF)	reducing emissions from building energy use, operational and business transport, carbon offsetting or removal, and temporary generation
	Fluid filled cables	Fluid-filled cables (FFC)	a leakage reduction target (in both percentage and liters) and the number of km of cable expected to be replaced during RIIO-ED2.

New York Approved Metrics Source: Order Adopting a Ratemaking and Utility Revenue Model Policy Framework, Case 14-M-0101, 5.19.2016 Source: Order Adopting Terms of Joint Proposal and Establishing Electric and Gas Rate Plan, Case 20-E-0428, 11.18.2021 Source: 2021 Con Edison Earning Adjustment Mechanism Achievement Report, Case-19-E-0065 and 19-G-0066, 6.30.2022 Source: Order Adopting Terms of Joint Proposal and Establishing Electric and Gas Rate Plan, Case 19-E-0065 and 19-G-0066, 1.16.2020			
OEB Performance Outcome	**Performance Category**	**Metric**	**Description**
Operational Effectiveness	Peak and Energy Demand / Peak Load Reduction	Peak Reduction Target	Incentives for reducing system peaks
Public Policy Responsiveness	Peak Load Reduction	Load Factor Improvement	Incentives for improving (raising) the load factor on the system
	EV Growth	Energy Efficiency Achievements	Incentives for savings tied either to efficiency achievements or clean energy targets
	Energy Efficiency	Energy Efficiency Achievements	Incentives for savings tied either to efficiency achievements or clean energy targets
	Energy Efficiency	Energy Efficiency Achievements	Measures and incentives in place based upon specific programs in place that are under the utility's control
	Energy Use	Electric Usage Intensity	Metric tied to system-wide usage intensity

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO SCHOOL ENERGY COALITION

UNDERTAKING NO. JT3.35:

Reference(s): 1B-SEC-19

Referring to 1B-SEC-19a, to inquire with ScottMadden and provide additional information about the components of the respective rate and regulatory frameworks in their jurisdiction review; to clarify their definition of IRM.

RESPONSE (PREPARED BY TORONTO HYDRO):

In reviewing the transcript, Toronto Hydro notes that this undertaking does not capture the request made by the School Energy Coalition. The scope of the undertaking is to update the chart in 1B-SEC-19, to include information about the general rate framework for each Utility/Jurisdiction.

RESPONSE (PREPARED BY SCOTTMADDEN):

There are four general types of rate frameworks:

A. Rates based on projected/ historical cost of service
B. Rates based on cost of service but supplemented with alternative cost recovery mechanisms, such as trackers or riders
C. Rates based originally on cost of service and adjusted over time to reflect cost forecasts, indexed trends in utility costs, or a combination of the two
D. Rates established based on achieving certain performance metrics

Rate frameworks have evolved over time to be complements to cost-of-service regulation, rather than complete substitutes. Therefore, the regulatory frameworks listed in the table

below represent hybrid approaches that share features of the four general types of rate frameworks listed above.

Utility (Jurisdiction)	Framework Overview
ATCO Electric (Alberta)	**Regulatory Framework:** B,C **ARM:** Formulaic approach linked to average historical capex; indexed O&M **Cost Recovery**: Capital trackers for costs related to extraordinary events or net-zero laws **PIM:** None **Innovation Funding:** None
SDG&E (CA)	**Regulatory Framework:** B,C **ARM:** Uses utility-specific cost index for O&M rather than general inflation; capital investments based on an escalated seven-year historic and forecast average of capital additions **Cost Recovery**: Various two-way balancing accounts and riders, such as AMI balancing account **PIM:** IDER Pilot **Innovation Funding:** Rate Rider (Public Purpose Programs)
PG&E (CA)	**Regulatory Framework:** B,C **ARM:** Uses utility-specific cost index for O&M rather than general inflation; most capital costs escalated using utility specific cost index ; certain capital costs (that are "unique and not appropriately projected with any available index mechanism") forecasted in post-test years **Cost Recovery**: Various two-way balancing accounts and riders **PIM:** IDER Pilot **Innovation Funding:** Rate Rider (Public Purpose Programs)
Hawaiian Electric (HI)	**Regulatory Framework:** B,C,D **ARM:** Annual revenues adjusted using indexed formula **Cost Recovery**: EPRM and various riders **PIM:** 3 reward only performance incentives; 2 symmetrical performance incentives **Innovation Funding:** "Pilot Process" recovers innovative pilot costs through annual target revenues
Ameren (IL)	**Regulatory Framework:** A, D **ARM:** To be determined (MYRP rate case decision pending) **Cost Recovery**: To be determined (MYRP rate case decision pending) **PIM:** 8 symmetrical performance incentives **Innovation Funding:** "Pilot Process" recovers innovative pilot costs through annual target revenues
Central Maine Power (ME)	**Regulatory Framework:** A,D **ARM:** Forecast O&M and capital **Cost Recovery**: No alternative cost recovery mechanisms **PIM:** 6 penalty-only service quality metrics

Utility (Jurisdiction)	Framework Overview
	Innovation Funding: None
Eversource (MA)	**Regulatory Framework:** B,C,D **ARM:** O&M adjusted annually by I-X ; K-bar for supplement capital funding based on average historical capex **Cost Recovery**: 10% variance allowed for forecasted capital budget; Forecast excludes certain capital projects, such as solar investments, meter-related capital, and grid mod, eligible for recovery through other rate mechanisms outside of base rates **PIM:** 7 penalty-only service quality metrics; reward-only energy efficiency metric **Innovation Funding:** None
Xcel (MN)	**Regulatory Framework**: A,B **ARM:** Forecast O&M and capital **Cost Recovery**: Various riders/trackers to recover various pass-through costs, related to energy efficiency, services for specific customer classes, and environmental improvement, among other areas. **PIM:** None (tracking-only metrics) **Innovation Funding:** None
PSE&G (NJ)	**Regulatory Framework:** A,B **ARM:** N/A – no MYRP **Cost Recovery**: Multiple trackers, including Energy Strong **PIM:** None **Innovation Funding:** None
Con Edison (NY)	**Regulatory Framework:** B,C,D **ARM:** Forecast O&M and capital (used in settlements) **Cost Recovery**: Multiple riders, such as the Systems Beneift Charge **PIM:** 7 reward-only incentives (based on 2020 rate case) **Innovation Funding:** Rate Rider for REV demonstration projects
National Grid (NY)	**Regulatory Framework:** B,C,D **ARM:** Forecast O&M and capital (used in settlements) **Cost Recovery**: Multiple riders, such as the Systems Beneift Charge **PIM:** 9 reward-only incentives **Innovation Funding:** Rate Rider for REV demonstration projects
Duke Energy (NC)	**Regulatory Framework:** B,C,D **ARM:** Commission-authorized “step-ups” in revenue requirements for incremental capital spending projects and associated O&M for each year of the MYRP **Cost Recovery**: Multiple riders, such as the Systems Beneift Charge **PIM:** 1 penalty-only metric; 2 reward-only metric **Innovation Funding:** Rate Rider for REV demonstration projects
Nova Scotia Power (NS)	**Regulatory Framework:** A, B **ARM:** Forecast O&M and capital **Cost Recovery**: Various riders

Utility (Jurisdiction)	Framework Overview
	PIM: None **Innovation Funding:** Rate Rider
AEP (OH)	**Regulatory Framework:** A,B **ARM:** N/A – no MYRP **Cost Recovery**: Various riders, such as the Enhanced Service Reliability Rider **PIM:** None **Innovation Funding:** None
PECO (PA)	**Regulatory Framework:** A,B **ARM:** N/A – no MYRP **Cost Recovery**: Various riders, such as the Distribution System Improvement Charge **PIM:** None **Innovation Funding:** None
Rhode Island Energy (RI)	**Regulatory Framework:** B,D **ARM:** Forecast O&M and capital **Cost Recovery**: Various adjustment provisions, such as the Infrastructure, Safety, and Reliability Provision **PIM:** 4 service quality penalty-only metrics; 1 demand reduction reward-only metric **Innovation Funding:** None
UK RIIO	**Regulatory Framework:** B,C,D **ARM:** Forecast O&M and capital (building blocks method) **Cost Recovery**: Uncertainty mechanisms **PIM:** 10 symmetrical performance incentives **Innovation Funding:** Multiple funding mechanisms, including the Strategic Innovation Fund and the Network Innovation Allowance
Green Mountain Power (VT)	**Regulatory Framework:** B,C **ARM:** Hybrid ARM approach with forecasted CAPEX capped over the plan period and OPEX treated in one of three ways: forecasted and capped, capped and tied to an external inflation index, or reforecast annually **Cost Recovery**: Various riders **PIM:** None (tracking-only metrics) **Innovation Funding:** Recovers innovative pilot costs through annual target revenues

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO SCHOOL ENERGY COALITION

UNDERTAKING NO. JT3.36:

Reference(s): 1B-PP-19

Referring to 1-PP-19B, the table showing innovation funds, to in each jurisdiction who within the regulatory process determines what projects or initiative gets funding, and if there's specific approval criteria and, if there are, what are they.

RESPONSE:

Please refer to the table below.

Innovation Fund	Eligibility Criteria	Governing Body
UK RIIO	**Strategic Innovation Fund** 1) Address the Innovation Challenge set by Ofgem; 2) Clearly identify potential to deliver a net benefit to customers; 3) Involve network innovation; 4) Must not undermine the development of competitive markets; 5) Be innovative, novel, and/or risky; 6) Include participation from stakeholders; 7) Provide value for money and be cost competitively; 8) Have a robust methodology to progress in a timely manner **Network Innovation Allowance** 1) Facilitate energy system transition and/or benefit consumers in vulnerable situations; 2) Potential to deliver a net benefit to consumers; 3) Involve research, development, and demonstration; 4) Develop new learnings; 5) Be innovative; 6) Not lead to unnecessary duplication	Ofgem determines project funding for SIF and network innovation allowances (NIA)
New York REV	REV Demonstration Projects should do the following: 1) Include partnerships between utilities and third-party service providers; 2) Identify questions/problems it hopes to answer, and the market should respond with solutions; 3) Delineate how the economic value is divided between the customer, utility, and third-party provider; 4) The market for grid services should be competitive; 5) Propose rules to create competitive markets; 6) Inform pricing and rate modifications; 7) Consider deploying advanced distribution systems; 8) Explore opportunities to work with various types of customers	NY DPS

Nova Scotia	Criteria is justified based on the expectation the projects will provide customer value in some or all of the following areas: 1) Reduce upward pressure on revenue requirement; 2) Provide reliability and grid stability; 3) Support environmental and other government policy compliance; 4) Improve customer experience In addition, innovation capital investments may be justified on the basis that they are reasonably expected to allow for testing before deploying at scale, provide valuable data and learnings, or aid in the development of business cases where applicable	Nova Scotia Utility and Review Board
California EPIC	Projects that support one or more of the following goals: 1) Transportation electrification; 2) Distributed energy resource integration; 3) Building decarbonization; 4) Achievement of 100% net-zero carbon emissions and coordination of the role of natural gas; 5) Climate Adaptation	CPUC

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO SCHOOL ENERGY COALITION

UNDERTAKING NO. JT3.37:

Reference(s): **4-AMPCO-84**
4-SEC-116

To provide a revised version of those tables that show the total number of employees in each of the four categories from the AMPCO-84a management, executive, union and non-union, and the total amounts that are benchmarked; and then the total amount of compensation that was part of the benchmarked amounts in those categories.

RESPONSE (PREPARED BY TORONTO HYDRO):

In reviewing the transcript, Toronto Hydro notes that this undertaking does not capture the request made by the School Energy Coalition. The scope of the undertaking is to provide revised versions of tables 1 and 2 in 4-SEC-116 that show the total number of employees in the categories used in 4-AMPCO-84: management, executive, union and non-union, and the total amounts that are benchmarked. In addition, to provide the total amount of compensation that was part of the benchmarked amounts in those categories.

RESPONSE (PREPARED BY MERCER):

The table below reflects a revised version of the information provided by Mercer, in the response to question A in 4-SEC-116, across Toronto Hydro's defined Non-Executive Management, Union and Non-Union Non-Management categories (consistent with the above categories in response to 4-AMPCO-84(A)). We note that the scope of the Mercer Study only included benchmark jobs in PWU, Society and Non-Union – Executive jobs were not within the scope of the Study.

Employee Group	Total Employees	Total Employees in Benchmarked Jobs
Union	634	529
Non-Executive Management	70	17
Non-Union Non-Management	477	257

Regarding actual total compensation, the Mercer Study captured total remuneration/ compensation which included base salary (reflects Toronto Hydro's salary structure job rates), target short-term incentive, pension and benefits. Actual payments made to employees were not the basis of the Mercer Study, and so Mercer is not able to respond to the request regarding actual total compensation.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO SCHOOL ENERGY COALITION

UNDERTAKING NO. JT3.38:

Reference(s): 4-SEC-116

To respond with more detail to AMPCO-34C, including the methodology and results.

RESPONSE (PREPARED BY TORONTO HYDRO):

In reviewing the transcript, Toronto Hydro notes that this undertaking does not capture the request made by the School Energy Coalition. The scope of the undertaking is, in reference to 4-SEC-116(c), to provide a step-by-step explanation of how estimates were reached and all supporting calculations (including numbers).

RESPONSE (PREPARED BY MERCER):

Below is a detailed description of the steps used to calculate Toronto Hydro's estimated 2022 total dollar difference.

- **Step 1:** Leveraging the findings in the Mercer Study, the dollar difference between Toronto Hydro and the market median for the Energy peer group, for each grade, was determined.
  For illustrative purposes, if Toronto Hydro's total remuneration/compensation for benchmark jobs in grade 5 was $50K and the average market 50th percentile was $45K, then the dollar difference between Toronto Hydro's grade 5 and the market median is $5K.
- **Step 2:** Calculate the total dollar difference for each grade by multiplying by the total number of employees, in each grade, in the Study. Note that,

as outlined in the Mercer Study, Society and PWU were not broken down by grades.

Continuing with the illustration above, if Toronto Hydro has 10 employees in grade 5, the total dollar differential for grade 5 would [$5K x 10] = $50K

- **Step 3:** The total dollar differential for each grade was calculated and summed up to determine Toronto Hydro's estimated total dollar difference for 2022.

The approach for calculating Toronto Hydro's total dollar difference to the market competitive range is similar to the steps outlined above. However, there is a slight difference in approach, as outlined below:

- In Step 1 above, Mercer calculated the upper end of the market competitive range by increasing the market 50th percentile by 5%.
- The upper end of the market competitive range was then used to calculate the total dollar difference, by grade, as outlined in the subsequent steps above.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO SCHOOL ENERGY COALITION

UNDERTAKING NO. JT3.39:

Reference(s): 4-SEC-116

To ask Mercer why they were able to make a compensation study in the JRAP proceeding, and why they can't do a similar compensation study in this case.

RESPONSE (PREPARED BY TORONTO HYDRO):

In reviewing the transcript, Toronto Hydro notes that this undertaking does not fully capture the request made by the School Energy Coalition. The scope of the undertaking is to explain why Mercer was able to provide a similar analysis in the JRAP proceeding (with reference to E-SEC-212 and JT5.10.20), but cannot provide a similar analysis here up to 2029 (as requested in 4-SEC-116).

RESPONSE (PREPARED BY MERCER):

The referenced information for HONI relates to a Mercer Study addendum based on a specific request by the Ontario Energy Board in that case for a forecast Study to assess the utility's likely benchmark positioning as of the end of the future rate period. As such, the addendum Study was separate from the Compensation Review Study and specifically focused on future compensation forecasts. Mercer has not conducted a similar forecast Study for Toronto Hydro, as mentioned in our response to 4-SEC-116. We are therefore unable to provide an estimated dollar difference beyond the current year of the Study. The Mercer Study conducted for Toronto Hydro was not designed to be forward looking – its purpose was to assess the competitive positioning of Toronto Hydro, on an overall basis, as of the time of the study.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO SCHOOL ENERGY COALITION

UNDERTAKING NO. JT3.40:

Reference(s): Exhibit 2B, Tab 4, Schedule 4

To inquire of Mercer, for the PWU positions specifically, the total employees in those positions of Toronto Hydro compared to total employees that are benchmarked for those positions.

RESPONSE (PREPARED BY MERCER):

The table below presents the list of PWU jobs included in the Mercer Study as well as the number of Toronto Hydro employees in each of the jobs:

THESL Position	Union	Total # of Employees
Engineering Technologist Level 1	PWU	56
Engineering Technologist Level 2	PWU	32
Customer Relations Representative	PWU	30
Cert Meter Mechanic - ALL	PWU	8
Programmer/Analyst	PWU	6
Power Line Technician - ALL	PWU	134
Cert Crew Leader, Power Line Tech - ALL	PWU	21
Distribution System Technologist - ALL	PWU	52
Power System Controller - ALL	PWU	52
Fleet Mechanic	PWU	9

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO SCHOOL ENERGY COALITION

UNDERTAKING NO. JT3.41:

Reference(s): 4-CCMBC-20

To ask Mercer to provide a list of the 90 organizations.

RESPONSE (PREPARED BY MERCER):

As outlined in the Mercer study, the General Industry peer group represents organizations within ½ to 2x the size of Toronto Hydro on the basis of annual revenue. Where data was not available, the peer group was expanded to include organizations within 1/3 to 3x the size of Toronto Hydro - this was only done for one of the benchmark jobs. We note that, as outlined in our response to interrogatory 4-CCMBC-20, there were over 90 organizations included in the General Industry peer group. The table below presents the list of 95 organizations within ½ to 2x the size of Toronto Hydro:

General Industry Peer Group	
Aecon Group, Inc.	Kuehne + Nagel - Canada
Agnico Eagle Mines Limited	Labatt Breweries of Canada
Air Canada	Lassonde Industries, Inc.
Alberta Electric System Operator	Ledcor Industries Inc.
Algonquin Power & Utilities Corp.	Linamar Corporation
AltaGas, Ltd.	Lundin Mining Corporation
Americold	Maple Leaf Foods, Inc.
Apotex, Inc.	Mattamy Homes Limited

General Industry Peer Group	
ATB Financial	McDonald's Restaurants of Canada Limited
ATCO, Ltd.	Mercedes-Benz Canada, Inc.
Business Development Bank of Canada	Nestlé Canada
Cadillac Fairview Corporation Limited	Ocado Solutions Canada, Inc.
Canada Post Corporation - Purolator	Oceaneering Canada, Ltd.
Canadelle Limited Partnership	PwC Management Services LP
Capital Power Corporation	Quest Diagnostics
CI Financial Corp.	Resolute Forest Products, Inc.
Coca-Cola Canada Bottling Limited	Rio Tinto Canada Inc.
Colas Canada, Inc.	Samuel, Son & Co., Limited
Crescent Point Energy Corp.	SaskPower
Deschênes Group Inc.	Secure Energy Services, Inc.
Emera, Inc.	Shutterfly, Inc.
ENMAX Corporation	Signature Aviation
EPCOR Utilities, Inc.	Sonepar Canada Inc.
Export Development Canada	Spectrum Brands Holdings, Inc. - Pet Home & Garden
Finning Canada, Inc.	Spectrum Brands Holdings, Inc. - Spectrum Brands Canada, Inc.
Fluor Canada, Ltd.	Spin Master
Fortis, Inc. - FortisBC, Inc.	Sport Chek
Fossil Canada, Inc.	StandardAero Limited
Generac Power Systems	Stantec, Inc.
Giant Tiger Stores Limited	Starbucks Coffee Canada, Inc.
Gildan Activewear	Sysco Canada, Inc.
Gordon Food Service Canada, Ltd.	Tailored Brands Inc.

1

General Industry Peer Group	
Hudbay Minerals Inc	TC Transcontinental
Hydro One, Inc.	The Boyd Group
Hydro-Québec	The Co-operators Group Limited
Hyundai Auto Canada	The Mosaic Company - Potash
IGM Financial Inc.	The Wawanesa Mutual Insurance Company
IKEA Canada	Tourmaline Oil Corp.
Insurance Corporation of British Columbia	TransAlta
Inter Pipeline, Ltd.	TreeHouse Foods, Inc.
Invesco - Invesco Canada	University Health Network
John Deere Canada ULC	Vale Canada Limited
Johnson & Johnson, Inc.	Valero Energy, Inc.
Johnson & Johnson, Inc. - Janssen, Inc.	Vermilion Energy, Inc.
Keyera Corp.	WestJet, An Alberta Partnership
Kinross Gold Corporation	Workers' Compensation Board - Alberta
KPMG, LLP	Yamana Gold, Inc.
Kraft Heinz Canada	

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO SCHOOL ENERGY COALITION

UNDERTAKING NO. JT3.42:

Reference(s): 5-VECC-77

For each of the issuances during this current rate term, so beginning in 2020, so for each of them, the actual administration cost that Toronto Hydro incurred as compared to the impact of the 5 percent basis points that you're collecting.

RESPONSE:

In reviewing the transcript, Toronto Hydro notes that this undertaking does not capture the request made by School Energy Coalition. The scope of the undertaking is to provide the impact of 5 basis point which equates to 0.05 percent.

Table 1 below shows the administration fees related to debt issuances whereas the administration costs related to debt issuances is summarized in Table 2.

Table 1: 2020-2024 Administration Fees for Debt Issuance ($ Millions)[1]

Description	Start Date	Principal	Administration Fees						Total
			Basis Point	Actual				Forecast	
				2020	2021	2022	2023	2024	
2010 Series 6	20-May-10	200.0	0.05%	0.1	0.1	0.1	0.1	0.1	**0.5**
2012 Prom Note #2	1-Jan-12	45.0	N/A	N/A	N/A	N/A	N/A	N/A	**N/A**
2013 Series 9	9-Apr-13	200.0	0.05%	0.1	0.1	0.1	0.1	0.1	**0.5**
2014 Series 10	16-Sep-14	200.0	0.05%	0.1	0.1	0.1	0.1	0.1	**0.5**
2015 Series 11	16-Mar-15	200.0	0.05%	0.1	0.1	0.1	0.1	0.1	**0.5**
2013 Series 9 re-opening	2-Sep-15	45.0	0.05%	0.0	0.0	0.0	0.0	0.0	**0.1**
2016 Series 12	14-Jun-16	200.0	0.05%	0.1	0.1	0.1	0.1	0.1	**0.5**
2017 Series 13	14-Nov-17	200.0	0.05%	0.1	0.1	0.1	0.1	0.1	**0.5**
2019 Series 14	12-Nov-19	200.0	0.05%	0.1	0.1	0.1	0.1	0.1	**0.5**
2019 Series 15	12-Nov-19	200.0	0.05%	0.1	0.1	0.1	0.1	0.1	**0.5**
Subtotal Administration Fees for issuance prior to 2020 (a)				**0.8**	**0.8**	**0.8**	**0.8**	**0.8**	**4.1**
2020 Series 16	15-Oct-20	200.0	0.05%	0.0	0.1	0.1	0.1	0.1	**0.4**
2021 Series 17	18-Oct-21	150.0	0.05%	-	0.0	0.1	0.1	0.1	**0.2**
2021 Series 18	18-Oct-21	200.0	0.05%	-	0.0	0.1	0.1	0.1	**0.3**
2022 Series 19	13-Oct-22	300.0	0.05%	-	-	0.0	0.2	0.2	**0.3**
2023 Series 20	14-Jun-23	250.0	0.05%	-	-	-	0.1	0.1	**0.2**
2023 Series 21	2-Oct-23	200.0	0.05%	-	-	-	0.0	0.1	**0.1**
2024 Series 22	1-Nov-24	200.0	0.05%	-	-	-	-	0.0	**0.0**
Subtotal Administration Fees for issuances 2020-2024 (b)				**0.0**	**0.1**	**0.3**	**0.5**	**0.7**	**1.7**
Total Administration Fees (c = a + b)				**0.8**	**1.0**	**1.1**	**1.3**	**1.5**	**5.8**

[1] Numbers may not sum due to rounding.

Table 2: 2020-2024 Administration Costs for Debt Issuance ($ Millions)[2]

Name of Company		Services Offered	Actual				Forecast	Total
From	To		2020	2021	2022	2023	2024	
THESL	THC	Finance - Debt Administration Costs (a)	0.1	0.2	0.2	0.3	0.3	1.1
THESL	THC	Legal and Regulatory - Debt Administration Costs (b)	0.1	0.1	0.2	0.2	0.3	0.9
Total Debt Administration Costs Allocated from THESL to THC through Shared Services (c = a + b)			**0.2**	**0.3**	**0.4**	**0.5**	**0.6**	**2.0**
Debt Issuance Cost Amortization (3rd party accounting, legal, bank, credit rating and public filing fees) (d)			2.1	2.2	2.2	2.0	2.1	10.7
Debt Administration Costs Incurred in THC (e)			0.1	0.1	0.1	0.1	0.1	0.5
Total Debt Administration costs (f = c + d + e)			**2.4**	**2.6**	**2.7**	**2.6**	**2.8**	**13.2**

[2] Numbers may not sum due to rounding.

Toronto Hydro notes that in the course of preparing this undertaking response, the utility identified an error with respect to how debt issuance cost amortization costs (row d) have been mapped in OM&A through corporate cost allocations. These costs should not form part of the utility's OM&A since they are being recovered through the administrative fee. Toronto is evaluating the impact of this correction and the implications for the forecasts in the application.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO SCHOOL ENERGY COALITION

UNDERTAKING NO. JT3.43:

Reference(s): 9-Staff-344

Referring to 9-Staff-344C: to provide a similar table that shows how you get to the ROE, the adjustment, for 2023, and then provide an explanation of the drivers of the under-earning in 2023.

RESPONSE:

Please refer below for the 2023 ROE calculations using the ESM methodology as approved in EB-2018-0165 with an explanation of drivers when compared to the approved ROE:

Table 1: 2023 ROE breakdown

2023 RRR 2.1.5.6 ROE		**($m)**
Regulatory Net Income from RRR	**A**	**161.3**
Adjustments for non-rate regulated donations and expenses	B	0.7
Deduction for other out-of-period (revenue) / expense	C	-
Interest expense adjustments to deemed interest expense	D	(14.3)
Payments-in-lieu of taxes adjustments	E	(6.9)
Total Adjustment to RRR net Income	**F (B+C+D+E)**	**(20.5)**
2.1.5.6 Adjusted Net Income	G=(A+F)	140.8
2.1.5.6 Adjusted Deemed Equity	H	2,070.7
2.1.5.6 ROE	**I=G/H**	**6.80%**
ROE Approved	J	8.52%
ROE Over (Under)	**I Compared to J**	**(1.72%)**

Table 2: Approved ROE to Achieved ROE for 2023

	%	($m)
ROE Approved	**8.52%**	**173.6**
Decrease due to lower volumes	(0.83%)	(17.1)
Increase due to amounts deferred into specified DVAs	0.08%	1.6
Decrease due to lower other income	(3.12%)	(64.7)
Decrease due to higher operating expense	(0.35%)	(7.3)
Increase due to lower depreciation expense	2.04%	42.3
Increase due to lower payments-in-lieu of taxes	0.68%	14.1
Decrease due to higher deemed interest	(0.08%)	(1.7)
Decrease due to other stretch in approved ROE[i]	(0.14%)	-
ROE Achieved	**6.80%**	**140.8**

[i] This line includes stretch in the approved ROE rate and the impact of variances between the achieved rate base and the approved rate base. Both impact the ROE rate only with no dollar value impact.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO SCHOOL ENERGY COALITION

UNDERTAKING NO. JT3.44:

Reference(s): 6-SEC-120

To provide a revised version of the table in 6-SEC-120 showing deficiency as compared to the 2024 rates at the forecast load.

RESPONSE:

The table below shows the requested information in accordance with the latest revenue requirement and distribution load forecast.

	2020 OEB Approved	2025 Forecast	2026 Forecast	2027 Forecast	2028 Forecast	2029 Forecast
Rate Base	4,514.8	5,899.1	6,279.3	6,703.2	7,162.0	7,590.1
ROE	8.52%	9.36%	9.36%	9.36%	9.36%	9.36%
Debt Rate	3.64%	4.04%	4.04%	4.04%	4.04%	4.04%
DRIVERS OF DEFICIENCY						
OM&A	266.7	343.0	355.4	364.8	377.2	388.2
Depreciation	263.7	290.4	301.7	318.2	336.7	346.9
Deemed Interest Expense	98.5	142.9	151.0	160.1	169.8	178.7
Return on Equity	153.9	220.9	233.4	247.4	262.5	276.2
PILS	9.7	28.9	30.9	20.3	55.4	47.0
Total Service Revenue Requirement	**792.5**	**1,026.0**	**1,072.5**	**1,110.8**	**1,201.7**	**1,237.0**
Distribution Revenue at previous years approved/ 2024 rates	771.4	866.6	867.6	866.9	867.6	864.1
Revenue Offsets	42.3	48.2	48.8	49.4	50.1	50.7
Total Operating Revenue	**813.7**	**914.8**	**916.4**	**916.3**	**917.7**	**914.8**
Total Deficiency		**111.2**	**156.0**	**194.4**	**284.0**	**322.2**

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO SCHOOL ENERGY COALITION

UNDERTAKING NO. JT3.45:

Reference(s): 8-SEC-125

To revisit the response to 8-SEC-125 and to include actual rates.

RESPONSE:

Appendix A shows the rates broken down by customer class.

TECHNICAL CONFERENCE UNDERTAKING RESPONSES TO COALITION OF CONCERNED MANUFACTURERS AND BUSINESSES OF CANADA

UNDERTAKING NO. JT3.46:

Reference(s): 4-CCMBC-20

To ask Mercer whether the compensation and benefits for employees, which is non-executive compensation and benefits for employees, are higher in Alberta than in Ontario or lower in Alberta than in Ontario.

RESPONSE (PREPARED BY MERCER):

The scope of the Mercer Study was to review total remuneration within a General Industry Peer Group and an Energy Peer Group across Canada. As such, the Mercer Study did not review compensation levels for specific geographical locations including Alberta.