EB-2015-0003

Ontario Energy Board

IN THE MATTER OF the *Ontario Energy Board Act, 1998*, S.O. 1998, c. 15, (Schedule B);

AND IN THE MATTER OF an application by PowerStream Inc. order approving just and reasonable rates and other charges for electricity distribution to be effective
January 1, 2016.

VULNERABLE ENERGY CONSUMERS COALITION
(“VECC”)
CROSS-EXAMINATION COMPENDIUM

November 26 2015

TAB 1

Table 17

	Historical					Proposed				
Material Investments	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
System Renewal	**Actual**	**Actual**	**Actual**	**Actual**	**Plan**	**Plan**	**Plan**	**Plan**	**Plan**	**Plan**
UG Lines - Planned Asset Replacement	**($)**	**($)**	**($)**	**($)**	($)	($)	($)	($)	($)	($)
Cable Injection Program	349,694	771,664	4,141,808	5,913,763	4,024,219	4,138,312	4,255,465	4,375,771	4,499,323	4,626,219
Cable Replacement Program	3,917,735	2,219,486	15,417,075	15,036,321	11,718,862	12,538,684	13,607,273	14,288,297	15,085,861	15,340,181
Emerging Cable Replacement Projects	119,989	1,968,435	1,463,874	1,070,775	491,687	520,801	1,050,756	1,081,576	1,113,287	1,145,915
Submersible Transformer Replacement - North	6,451	508,952	1,168,202	856,776	1,040,300	620,000	-	-	-	-
Switchgear Replacement Program	566,295	662,337	990,400	2,138,988	2,003,445	2,327,404	2,462,129	2,533,373	2,606,624	2,681,945
Distribution Lines - Emergency/Reactive Replace										
Storm damage - Replacement of Distribution Equip due to Storm	428,418	482,911	767,149	1,160,050	999,785	1,000,232	1,005,603	1,005,624	1,010,352	1,010,159
Switchgears - Unscheduled Replacement of Failed Switchgear	-	1,381,861	1,663,004	1,495,974	1,420,148	1,431,384	1,420,148	1,421,218	1,400,444	1,140,858
Unscheduled Replacement of Other Failed Distribution Equip	6,525,087	4,878,957	4,791,473	4,890,357	4,904,357	5,107,035	5,206,156	5,358,281	5,455,354	5,305,986
Overhead Lines - Planned Asset Replacement										
Pole Replacement Program	1,638,822	4,111,507	5,045,992	4,872,277	4,645,383	4,933,143	5,570,700	5,870,246	6,241,483	6,244,377
Unforeseen Projects Initiated by PowerStream	1,076,240	1,499,516	4,232,576	2,429,637	1,046,472	1,070,527	1,093,812	1,117,360	1,141,172	1,165,266
Storm Hardening										
Storm Hardening & Rear Lot Supply	-	-	-	-	3,499,998	7,900,017	7,999,752	7,499,834	6,900,540	7,200,072
Stations/P&C - Planned & Emergency										
Planned Circuit Breaker Replacement Markham TS1&2, Lazenby	-	-	-	-	747,766	-	-	1,087,788	1,119,281	-
Station Switchgear Replacement (ACA) 8th Line MS323	-	-	-	-	-	-	412,339	1,106,666	-	-
Station Switchgear Replacement (ACA) Patterson MS336	-	-	-	-	-	-	-	421,896	895,805	-
Total Material Investments System Renewal	**14,628,731**	**18,485,627**	**39,681,553**	**39,864,918**	**36,542,420**	**41,587,538**	**44,084,133**	**47,167,931**	**47,469,526**	**45,860,979**

TAB 2

G-AMPCO-28

REF: Ex. G-Tab 2-Appendix A: Project Investment Summaries

Storm Hardening and Rear Lot Supply – North and South

a) Please provide the number of rear lot locations.

b) Please provide a breakdown of the proposed 2015 to 2020 budget between the three work programs: conversion of rear lot overhead, 4-circuit pole storm guying and in-line guying and relocation of flood sensitive equipment by year.

c) Please provide the number of rear lot conversions planned for each year for the period 2015 to 2020.

d) Please discuss when the conversion of rear lot project is expected to end.

RESPONSE:

a) PowerStream has 4,670 customers that are rear lot supplied. These customers are located in 35 rear lot geographic areas which are divided into 50 projects.

b) The breakdown of the proposed 2015 to 2020 budget between the three work programs: conversion of rear lot overhead, 4-circuit pole storm guying and in-line guying and relocation of flood sensitive equipment by year is shown in the table below.

2015 - 2020 budget breakdown						
Year	2015	2016	2017	2018	2019	2020
Conversion of rear lot overhead	$3,499,998	$6,000,000	$6,000,000	$6,000,000	$6,000,000	$6,000,000
4-circuit pole storm guying and in-line guying	-	$1,650,017	$1,799,752	$1,174,834	$600,540	$1,200,071
Relocation of flood sensitive equipment	-	$250,000	$200,000	$325,000	$300,000	-
Total	$3,499,998	$7,900,017	$7,999,752	$7,499,834	$6,900,540	$7,200,071

c) The number of rear lot conversions planned for each year for the period 2015 to 2020 is shown in the table below.

Conversion projects planned for 2015-2020						
Year	2015	2016	2017	2018	2019	2020
# of Projects	1	4	5	3	3	4
# of Areas	1	2	4	2	3	2

d) It is estimated that the rear lot program will end in 2029.

TAB 3

II-2-Staff-49

Ref: Section III, T1/S1, B-CCC-16 and Section IV, T2, TCQ-2 G-SEC-19, Appendix B, Hardening the Distribution System Against Severe Storms – Final Report

At the first reference, PowerStream states that:

> proposed rear lot conversion investment expenditures for 2016 to 2020 is based on historical expenditures of similar type construction work. The proposed investments are based on estimated construction costs of approximately $12,400 per customer.

a) Please provide detailed justification for the estimate per customer used for Rear Lot project spending.

b) Please reconcile the estimated construction cost per customer with the Project Cost in Appendix D of the CIMA report (second reference).

RESPONSE:

a) The previous estimate of $12,400 per customer is applicable for Option 3 (Hybrid Option). This estimate was calculated using an example area in Markham (Romfield subdivision). The total cost estimate was $2,190,805 involving 177 customers, which results to a unit cost of $12,377 per customer, rounded to $12,400 per customer.

b) PowerStream did not adopt the accelerated schedule that CIMA indicated in CIMA's report Appendix D. It was recognized that PowerStream would not have sufficient capital funds to accelerate the schedule. On the contrary, it is likely that PowerStream will have to spread the schedule into longer period (i.e. more than 15 years).

In the CIMA's report Appendix D, there are two types of cost listed (by CIMA):

- Cost for Hybrid Option; and
- Cost for Underground Option.

The unit cost for Hybrid Option is the same as that from PowerStream's unit cost.

The unit cost for Underground Option was obtained (by CIMA) by multiplying the unit cost for Hybrid Option with a multiplier factor. This multiplier was used to reflect the incremental cost to go from the Hybrid Option to the Underground Option.

Example:

- Unit Cost for Hybrid Option = $12,400 per customer
- Unit Cost for Underground Option = $12,400 x 1.47 = $18,218 per customer

TAB 4

Rear Lot Supply Review

DRAFT

November 21, 2012

Prepared by: System Planning

Quan Tran, P. Eng., Engineer, Asset Condition Assessment
Jordan Nickason, Co-op Student, System Planning

1.0 Executive Summary

This report reviews the existing rear lot supply system at PowerStream. It summarizes the extent, configuration, condition, advantages/disadvantages, and managing options of rear lot supply.

There are disadvantages and operating concerns regarding rear lot supply. However, many of the issues can be mitigated through regular maintenance practices, effective customer communication and customer compliance with the Electrical Safety Code and easement terms.

To facilitate the analysis of managing options, the issue is divided into the following 2 broad scenarios:

- Scenario 1 – One subdivision (many customers)
- Scenario 2 – Individual customer requesting underground service in a rear lot supply area

1.1 Scenario 1 – One Subdivision (Many Customers)

Under Scenario 1, there are 5 managing options being considered as follows:

- Option 1 – Keep existing rear lot until end of life, and then replace with new rear lot overhead
- Option 2 – Replace existing rear lot with new rear lot overhead
- Option 3 – Replace existing rear lot with new front lot overhead
- Option 4 – Hybrid – Primary cable & transformer at front lot underground; pole & secondary at rear lot
- Option 5 – Replace existing rear lot with new front lot underground

An existing rear lot supply area was used, as an example, to calculate and compare costs associated with various options to illustrate that at the overall system level, Option 1 is the preferred option. In addition, a recently reconstructed and converted (8.32 kV to 27.6 kV) rear lot supply area was used to illustrate that Option 2 is technically feasible.

At the overall system level, based on life cycle cost comparison, the report does not recommend a system-wide program to replace all rear lot systems to front lot. Instead, the report recommends that rear lot systems remain as rear lot; and inspection/maintenance be increased to better manage the risk of asset failure.
When the rear lot assets come to end of life and require replacement, conversion to higher voltage and relocation of assets to more accessible locations could be considered. Each project should be evaluated individually; and justification/approval should be done on a case-by-case basis. The criteria for consideration are:

- Cost versus risk
- Asset condition
- Reliability/capacity impact
- Health & safety/operating impact

Should a specific project for conversion of rear lot to front lot be approved, it is proposed that the process as outlined in section 7.0 be followed to create a positive experience for the local residents.

1.2 Scenario 2 – Individual Customer Requesting Underground Service in a Rear Lot Supply Area

Under Scenario 2, there are 4 configurations being considered as follows:

Configuration 1 – One customer, pole line inside customer property
Configuration 2 – One customer, pole line outside customer property
Configuration 3 – One customer and potential future customers, existing underground system nearby
Configuration 4 – One customer and potential future customers, no nearby underground system

At the individual customer request level, the report does not recommend a system-wide “standard” design to convert a rear lot customer to a front lot customer. Instead, the report recommends the scenarios and criteria that can be used to accommodate a specific customer request. The criteria for consideration are:

- Cost versus risk
- Cost sharing between PowerStream and customer
- Reliability/capacity impact

3.0 Extent of Existing Rear Lot Supply System at PowerStream

For the purpose of this report, only residential customer rear lot supply is considered. Cases of rear lot supply to commercial/industrial customers are not discussed since in general, accessibility to overhead plant supplying commercial/industrial customers is not a concern. Cases of overhead pole lines carrying feeders through a neighbourhood without supplying the local residential customers are not discussed since customer request for underground supply is not an issue. Also, cases of underground rear lot supply where PowerStream equipments are located in easily accessible public areas (e.g. parks) are not discussed since accessibility is not critical issue.

3.1 Current PowerStream Rear Lot Demographics

The following table shows locations, number of customers, average asset age, and characteristics of existing rear lot systems.

Rear Lot Supply (North and South)									
Municipality	Intersection	Grid Number	Construction Type	Installation Year	Operating Voltage (kV)	Number of Customers Supplied	Number of Poles	Number of Transformers	Length of Circuit (m)
Barrie	Ottaway Avenue		Overhead	1968	2.4	91	18	5	706
Barrie	Johnathan/Bothwell		Overhead	1974	2.4	36	12	3	468
Barrie	North Park/ParkDale		Overhead	1968	2.4	42	20	4	806
Barrie	Wellington/Oak		Overhead	1955	2.4	68	24	6	977
Barrie	Gunn/Oak/St. Vincent		Overhead	1955	2.4	92	32	4	1,297
Barrie	Marion/Pratt/Shannon		Overhead	1955	2.4	114	30	9	1,214
Barrie	Alexander/Oliver		Overhead	1661	2.4	40	15	3	481
Barrie	Blake/Kempenfelt		Overhead	1955	2.4	18	6	1	186
Barrie	Shirley/Vine		Overhead	1958	2.4	21	13	2	534
Alliston	Regional Rd 15/Victoria		Overhead	1970	8	106	73	11	3,128
Alliston	Queen/Victoria E		Overhead	1950	8	33	27	6	1,080
Alliston	Victoria E/Downey		Overhead	1955	8	8	5	3	200
Alliston	Sir Frederick Banting/Victoria E		Overhead	1974	8	8	6	1	240
Beeton	Main W/Centre N		Overhead	1989	8	13	9	2	360
Penetanguishene	Burke/Country Club		Overhead	1975	2.4	8	5	2	210
Tottenham	(Entire Municipality)		Overhead	1968	4.8	747	152	50	6,090
Vaughan	N/E Side of Major Mac/Islington	V54	Overhead	2005	16	163	62	16	2,480
Markham	S/W Side of Major Mac/Warden	M40	Overhead	2006	16	63	34	21	1,360
Markham	N/W Side of Hwy 7/Kennedy	M33	Overhead	1964	16	466	123	42	4,932
Markham	S/W Side of Bayview/Hwy 407	M52	Overhead	1965	4.8	748	140	67	5,600
Markham	S/E Side of Hwy 7/McCowan	M20	Overhead	1982	16	295	71	24	2,840
Markham	N/W Side of Steeles/Bayview	M51	Overhead	1994	16	305	86	34	3,440
Markham	N/E Side of Steeles/Bayview	M49	O/H & U/G	1962	16	573	173	80	9,364
					Totals	4,058	1,138	396	47,993

Figure 1. Existing rear lot in PowerStream system

The last entry from the above table (N/E Side of Steeles/Bayview) has a small portion of underground rear lot supply in addition to overhead rear lot supply. The underground portion is serving 66 customers (out of 573 customers in the area).

To put things in perspective, the above rear lot numbers are compared to PowerStream total numbers as follows.
There are 4,058 customers supplied by rear lot systems. This accounts for about 1.1% of the total number of 336,107 customers.
There are a total of 1,138 poles in rear lot systems. This accounts for about 2.6% of the total number of 43,347 poles.
There are a total of 396 overhead transformers in rear lot systems. This accounts for about 5.4% of the total number of overhead transformers 7,280.
The average installation year of all rear lot supply is 1967 (45 years old) prorated by number of customers supplied and overall circuit length.

The following table shows the summary of rear lot demographics in the North and South PowerStream service territories:

5.0 Advantage/Disadvantage of Rear Lot Supply

This section will discuss the advantages and disadvantages of rear lot supply to both PowerStream and the customers.

5.1 Advantages

The advantages of rear lot supply to customers and to PowerStream are summarized below.

To Customers

- **Aesthetically pleasing from the street view:**
  Because the pole line is located in rear lot, there are no visible poles, overhead transformers, or conductors located near the front of customer property. Most customers prefer to have no equipment in front of their property.

To PowerStream

- **Lower installation cost:**
  In general, overhead systems are less expensive than underground systems. For example, in the Romfield Phase 3 project (more details in Section 6), the installation cost of the overhead option is $1,362,279 compared to $3,336,017 for the underground option.
- **Shorter distance from main feeder:**
  In many cases, it is the shortest distance to bring electricity to a neighbourhood from the main street. This is particularly true when the local street does not intersect with the main street. In those cases, it is less expensive to install a pole line along the easement at rear lot.
- **The concern of padmount transformer corrosion due to winter road salt is eliminated:**
  Since rear lot overhead transformers are not in close proximity of the road, corrosion due to contact with winter road salt/chemical is not a concern.
- **The risk of equipment being hit by vehicles is eliminated:**
  Padmount transformers could be hit by cars or snow removal vehicles when they are located close to the street.
- **Equipment is less likely to be vandalized when it is located away from the street:**
  Front lot equipments could be vandalized because they are in easily accessible locations.

5.2 Disadvantages

The disadvantages of rear lot supply to customers and to PowerStream are summarized below.

To Customers

- **Long outage restoration time due to difficult accessibility for PowerStream crews:**
  In comparison to front lot customers, rear lot customers have to wait longer for the crews to restore power during an outage. The crews have to gain access to the back yard to identify, locate, isolate, and repair/replace equipment. In heavily vegetated areas, the crews must also clear or trim the vegetation before they can access the equipment.
  If the replacement of major equipment (e.g. pole, transformer) is necessary, the outage time will extend because the crews need specialized equipment (e.g. large crane) to reach over customer houses to the rear lot.
- **More frequent outages due to vegetation, animal contact, and lack of access for PowerStream crews:**
  When a rear lot supply was first constructed, the area was likely clear of obstruction. Over time, however, trees/ bushes have grown near the electrical equipment, and may make contact with the power line. The growth of vegetation also increases the risk of animals (e.g. squirrels) coming into contact with electrical equipment.
  To mitigate this risk, more frequent access by PowerStream to patrol/inspect/maintain and more tree trimming/vegetation management are required.

- **Safety risk associated with close proximity to power line in the backyard:**
  Although the Electrical Safety Code and easement terms specify minimum clearance between customer facilities and power line, there are cases that customers do not follow the safety rules and install facilities too close to power line. Examples are shed, storage, playground, trampoline, swimming pool, patio deck, landscape, house extension, etc. This encroachment creates a safety hazard for both customers and crews.
  To mitigate this risk, better communication and explanation to customers is required.

<u>**To PowerStream**</u>

- **Decreased system reliability:**
  Higher outage frequency and longer outage duration will negatively impact PowerStream system reliability. To put things in perspective, however, it should be noted that the total reliability impact of rear lot system is small in comparison to PowerStream total reliability performance. For example, if Option 1 were chosen and implemented system-wide, it is estimated that the average annual CMI contribution of rear lot supply system would be 505,953 CMI. This accounts for only 2.1% of actual PowerStream 2011 CMI of 23,944,920. For comparison purpose, note that if Option 5 were chosen, the average annual CMI contribution of rear lot system would be 192,932 CMI (lowest of the 5 options). See more details in Section 6.
- **Difficult accessibility for crew and equipment:**
  Due to obstructions such as trees and customer construction, crews may find it difficult to gain access, bring in equipment, and create a safe working space in the rear lot. As a result, it is difficult to inspect, maintain, repair and replace equipment. Under emergencies, it is difficult to identify/isolate faulted components and perform switching. Accessibility for service vehicles is often impractical. In some cases, large cranes may be needed to reach over the rear lot from the street. In addition, system security is also at risk because the pole line is out of sight. This increases the risk of equipment being neglected and left deteriorated.
  To mitigate this risk, more frequent patrol is required with the intent to identify potential problems and take corrective actions.
- **Safety risk associated with reduced clearance due to encroachment of power line:**
  Over time, growth of vegetation and obstruction due to customer facilities may jeopardize the minimum clearance requirements and restrict crew mobility. Occasionally dogs may also be a safety hazard to the crews.
  To mitigate this risk, crews must ensure sufficient clearance and working space (e.g. tree trimming) before they can work on equipment. Proactive communication and explanation to customers on safety risk are also required.
- **Difficulty in addressing issues with customer:**
  Customers may install facilities in the backyard that encroach on easements and violate the vertical and horizontal clearance.
  To mitigate this risk, more frequent patrol is required. If PowerStream discovers the infraction, PowerStream will explain the safety impact and request the customer to take corrective action.
- **Additional cost in tree trimming:**
  In comparison to a “regular” front lot overhead pole line, rear lot pole line requires more frequent tree trimming. It is recommended that the tree trimming be increased to 3 year cycle (as opposed to 5 year cycle for the regular pole line). In addition, the patrol/inspection should be increased to 2 year cycle (as opposed to 3 year cycle for the regular pole line). The incremental tree trimming/patrol/inspection/maintenance cost is reflected in the cost comparison (more details in Section 6). The additional cost is well justified.
- **Management of easements:**
  Rear lot supply requires easement agreements with customers. As a result, time is required to manage the easements. However, at the present time, this task is quite manageable.

6.1.3 Analysis Results

The results of the analysis of the 5 options, including NPV and average CMI, are summarized in the following table.

Analysis Results - One Subdivision (177 Customers)					
	Option 1	Option 2	Option 3	Option 4	Option 5
Average Annual CMI	22,068	17,532	10,519	12,623	8,415
Initial Installation Cost	$0	$1,362,279	$1,362,279	$2,190,805	$3,336,017
Initial Cost Per Customer	$0	$7,696	$7,696	$12,377	$18,848
Total Initial Cost (All Customers)	$0	$31,232,363	$31,232,363	$50,227,608	$76,483,373
Total NPV for 100 Years	$2,083,225	$2,251,943	$1,892,316	$2,917,910	$4,242,891

Figure 12. Analysis Results for one subdivision (177 customers)

Based on the estimate that there are a total of 4,058 customers being supplied by rear lot, the analysis results for system-wide implementation for each option are shown in the following table.

Analysis Results - System-Wide Implementation					
	Option 1	Option 2	Option 3	Option 4	Option 5
Average Annual CMI	505,953	401,941	241,165	289,397	192,932
Initial Installation Cost	$0	$31,232,363	$31,232,363	$50,227,608	$76,483,373
Initial Cost Per Customer	$0	$7,696	$7,696	$12,377	$18,848
Total NPV for 100 Years	$47,761,163	$51,629,301	$43,384,278	$66,707,221	$97,274,873

Figure 13. Analysis Results for system-wide implementation

Based on the above, from the Net Present Value perspective, Option 1 is the most economical option. From the cash flow and capital budget standpoint, it is not advisable to invest the initial installation cost for any of the remaining options (ranging from $31.2M - $76.4M).

The system reliability impact of the rear lot supply system is very modest in comparison to PowerStream's overall reliability performance. In the worst case scenario (Option 1), it will account for 505,953 CMI, about 2.1% of PowerStream's 2011 total of 23,944,920 CMI.

6.2 Scenario 2 – Individual Customer Requesting Underground Service in a Rear Lot Supply Area

In this scenario only the involved customer is considered, the rest of the customers in the area will not be affected and therefore are excluded from the analysis. As a result, a rear lot area will generally remain rear lot.
In most cases, the customer will approach PowerStream with a request for a new underground service, or to convert their existing rear lot overhead supply to underground supply which could be either from rear lot or from front lot.
There are a number of reasons for customer requesting underground service. Some examples are:

- Customer is installing a pool, deck, shed, or other structure which may interfere with the existing rear lot overhead service.
- Customer is rebuilding the house into larger house and therefore requiring larger service (e.g. from 100A to 400A).

Depending on the situation, underground conversion costs may be shared or covered fully by either PowerStream or the customer. If there is likelihood that potential customers in the immediate vicinity may request similar underground services, and that the new services can be supplied by the new underground installation, then an underground installation project may be justified.

To maintain consistency and fairness, the "beneficiary pays" approach should be applied to all customers. New customers should pay the difference between the overhead default and underground premium options. Existing customers with existing adequate rear lot overhead supply should pay 100% of the cost for converting to underground supply.

8.0 Conclusions and Recommendations

Conclusions:

The conclusions for the following scenarios are summarized below:
- Scenario 1 – One subdivision (many customers)
- Scenario 2 – Individual customer requesting underground service in a rear lot supply area

8.1 One Subdivision (Many Customers)

Based on the above discussion, many of the disadvantages of rear lot can be mitigated through increased inspection and maintenance, and customer communication.

At the system level, a system-wide conversion program from rear lot to front lot is not justifiable and not recommended. On the cash flow and capital budget stand point, the initial installation cost ranging from $31,232,363 (Option 2) - $76,483,373 (Option 5) is not affordable. On the reliability stand point, the reliability impact of rear lot supply is modest and manageable.

On a case-by-case basis, however, depending on the specific design details at the location, a conversion from rear lot to front lot may be justifiable. If that is the case then a specific project may be submitted for budget consideration.
Each specific project is considered based on the following criteria:
- Cost versus risk
- Asset condition
- Reliability/capacity impact
- Health & safety/operating impact

The most economical option is Option 1 - Keep the existing rear lot supply at the rear. In order to utilize the full useful life of assets at rear lot, it is recommended to replace the existing rear lot overhead plant with new rear lot overhead plant only when the assets reach end of life.

In general, equipment located at the rear of property will have greater exposure to vegetation. Therefore, to help maintain reliability of these areas it is recommended that tree trimming at rear lot be increased to a 3 year cycle (as opposed to the regular 5 year cycle).

Because most rear lot systems are out of sight, the asset condition and reliability performance should be monitored to help detect potential issues and initiate corrective actions as needed. It is recommended that rear lot inspection work be increased to a 2 year cycle (as opposed to the regular 3 year cycle).

If and when we have to replace the existing rear lot assets because it is at end of life, the following factors should be considered during design stage:
- Convert to higher voltage. This would involve higher new poles (to obtain maximum clearance from trees).
- Growth pattern of the trees in their respective locations (some species will grow more rapidly than others).
- Where to install important equipment (fuses, switches, transformers) to increase accessibility for the crews.
- For large scale projects that would disrupt the neighbourhood, the process as described in section 7.0 should be followed.

8.2 Individual Customer Requesting Underground Service in a Rear Lot Supply Area

At the individual customer level, depending on the specific design details at the location, a conversion from rear lot to front lot may be justifiable. Each specific project is considered based on the following criteria:
- Cost versus risk
- Cost sharing between PowerStream and customer
- Reliability/capacity impact
- Potential for future customers

8.0 Conclusions and Recommendations

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8.1 One Subdivision (Many Customers)

Based on the above discussion, many of the disadvantages of rear lot can be mitigated through increased inspection and maintenance, and customer communication.

At the system level, a system-wide conversion program from rear lot to front lot is not justifiable and not recommended. On the cash flow and capital budget stand point, the initial installation cost ranging from $31,232,363 (Option 2) - $76,483,373 (Option 5) is not affordable. On the reliability stand point, the reliability impact of rear lot supply is modest and manageable.

On a case-by-case basis, however, depending on the specific design details at the location, a conversion from rear lot to front lot may be justifiable. If that is the case then a specific project may be submitted for budget consideration.
Each specific project is considered based on the following criteria:
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- For large scale projects that would disrupt the neighbourhood, the process as described in section 7.0 should be followed.

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At the individual customer level, depending on the specific design details at the location, a conversion from rear lot to front lot may be justifiable. Each specific project is considered based on the following criteria:
- Cost versus risk
- Cost sharing between PowerStream and customer
- Reliability/capacity impact
- Potential for future customers

The recommended remediation capital program is shown below.

On an on-going basis, as more information becomes available, additional analysis will be conducted and the remediation capital program will be adjusted accordingly.

Rear Lot Priority List 2015-2029

Year	Location Reference #	Municipality	Project	# of Customers	Project Cost (Budgeted)	Annual Cost
2015	1	Barrie	Shirley/ Vine	20	$1,065,718	$3,196,778
	2	Barrie	Blake/ Kempenfelt	21		
	4	Barrie	North Park/ Park Dale	40		
	46	Markham	Royal Orchard Phase 1	376	$2,131,060	
2016	22	Tottenham	Queen to Eastern and top of Eastern and Wilson - Phase 1	68	$1,091,614	$3,274,457
	28	Tottenham	North of Mill St. and South of George and West of Queen	16		
	46	Markham	Royal Orchard Phase 2	195	$2,182,843	
2017	22	Tottenham	Queen to Eastern and top of Eastern and Wilson - Phase 2	67	$1,117,968	$3,353,511
	21	Tottenham	Frazer Ave. 3 Phase line & Perdue Pl/ Alphonsus Crt.	62		
	46	Markham	Royal Orchard Phase 3	257	$2,235,543	
2018	24	Tottenham	Queen St. to Adeline Ave. and Rogers to Brown St. North Side - Phase 1	85	$1,144,795	$3,433,987
	46	Markham	Royal Orchard Phase 4	129	$1,025,367	
	45	Markham	Main St. Unionville & Carlton(SW) - {NW side of Hwy 7/Kennedy} - Phase 1	156	$1,263,825	
2019	24	Tottenham	Queen St. to Adeline Ave. and Rogers to Brown St. North Side - Phase 2	46	$1,212,199	$3,636,175
	29	Tottenham	East of Queen from George to Ryan Ln.	27		
	45	Markham	Main St. Unionville & Carlton(SW) - {NW side of Hwy 7/Kennedy} - Phase 2	155	$2,423,976	
2020	23	Tottenham	Queen St. to Keogh St. and Wilson to Dilane St. E - Phase 1	89	$1,248,565	$3,745,261
	45	Markham	Main St. Unionville & Carlton(SW) - {NW side of Hwy 7/Kennedy} - Phase 3	155	$2,496,696	
2021	23	Tottenham	Queen St. to Keogh St. and Wilson to Dilane St. E - Phase 2	30	$1,286,022	$3,857,618
	27	Tottenham	West side of Queen from #146 to Lionel Stone	58		
	48	Markham	Steeles & Henderson (NE & NW) - {NW Side of Steeles/Bayview} - Phase 1	190	$2,571,596	
2022	8	Barrie	Marian/ Pratt/ Shannon - Phase 1	93	$1,324,602	$3,973,347
	49	Markham	Bayview & Steeles (NE) - Phase 1	191	$1,653,302	
	48	Markham	Steeles & Henderson (NE & NW) - {NW Side of Steeles/Bayview} - Phase 2	115	$995,443	
2023	8	Barrie	Marian/ Pratt/ Shannon - Phase 2	29	$1,364,340	$4,092,547
	5	Barrie	Johnathan/ Bathwell	73		
	49	Markham	Bayview & Steeles (NE) - Phase 2	191	$2,004,183	
	42	Aurora	Yonge & Wellington (NW) - Phase 1	69	$724,024	
2024	6	Barrie	Ottoway Ave.	91	$1,400,647	$4,201,455
	49	Markham	Bayview & Steeles (NE) - Phase 3	191	$1,422,751	
	42	Aurora	Yonge & Wellington (NW) - Phase 2	185	$1,378,057	
2025	9	Barrie	Alexander/ Oliver	40	$1,439,536	$4,318,110
	11	Alliston	Queen/ Victoria E.	21		
	20	Penetanguishene	Tessier at west of Main St.	18		
	19	Penetanguishene	Robert St. at Main north side	16		
	42	Aurora	Yonge & Wellington (NW) - Phase 3	185	$2,878,574	
2026	17	Penetanguishene	Maria St. near robert St. E	9	$1,478,424	$4,434,764
	18	Penetanguishene	Shannon Rd. at Main St.	11		
	14	Beeton	Main W./ Centre N.	13		
	26	Tottenham	Brown St. from Railway to Queen St.	36		
	15	Penetanguishene	Burke/ Country Club	10		
	16	Penetanguishene	Maria/ Edward	12		
	47	Markham	Hwy 7 & McCowan (SE) - Phase 1	148	$2,956,339	
2027	7	Barrie	Gunn/ Oakley Park Sq./ St. Vincent	92	$1,517,313	$4,551,417
	47	Markham	Hwy 7 & McCowan (SE) - Phase 2	147	$3,034,104	
2028	3	Barrie	Wellington/ Oak	68	$1,556,202	$4,668,071
	13	Alliston	Sir Frederick Banting/ Victoria E.	8		
	44	Markham	Major Mackenzie & Warden (SW)	63	$3,111,869	
	43	Vaughan	Islington & Seville (NE & SE) - {NE Side of Major Mackenzie/ Islington}-Phase 1	114		
2029	12	Alliston	Victoria W. of Downey	8	$1,595,091	$4,784,725
	25	Tottenham	North side of Adeline from Rogers to Brown St.	33		
	10	Alliston	Regional Rd 15/Victoria	21		
	30	Tottenham	Eastern Ave. backing onto railway from Wilson to Park	18		
	43	Vaughan	Islington & Seville (NE & SE) - {NE Side of Major Mackenzie/ Islington}-Phase 2	64	$3,189,634	
Program Total:				4,625		$59,522,223

7. Remediation Capital Plan

The priorities of all locations are indicted below in Table 1. The cost is calculated using the Hybrid option. The annual cost is increased by 3% per year to account for general inflation.

Rear Lot Priority List 2015-2029						
Year	Location Reference #	Municipality	Project	# of Customers	Project Cost (Budgeted)	Annual Cost
2015	1	Barrie	Shirley/ Vine	20	$1,065,718	$3,196,778
	2	Barrie	Blake/ Kempenfelt	21		
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	46	Markham	Royal Orchard Phase 2	195	$2,182,843	
2017	22	Tottenham	Queen to Eastern and top of Eastern and Wilson - Phase 2	67	$1,117,968	$3,353,511
	21	Tottenham	Frazer Ave. 3 Phase line & Perdue Pl/ Alphonsus Crt.	62		
	46	Markham	Royal Orchard Phase 3	257	$2,235,543	
2018	24	Tottenham	Queen St. to Adeline Ave. and Rogers to Brown St. North Side - Phase 1	85	$1,144,795	$3,433,987
	46	Markham	Royal Orchard Phase 4	129	$1,025,367	
	45	Markham	Main St. Unionville & Carlton(SW) - {NW side of Hwy 7/Kennedy} - Phase 1	156	$1,263,825	
2019	24	Tottenham	Queen St. to Adeline Ave. and Rogers to Brown St. North Side - Phase 2	46	$1,212,199	$3,636,175
	29	Tottenham	East of Queen from George to Ryan Ln.	27		
	45	Markham	Main St. Unionville & Carlton(SW) - {NW side of Hwy 7/Kennedy} - Phase 2	155	$2,423,976	
2020	23	Tottenham	Queen St. to Keogh St. and Wilson to Dilane St. E - Phase 1	89	$1,248,565	$3,745,261
	45	Markham	Main St. Unionville & Carlton(SW) - {NW side of Hwy 7/Kennedy} - Phase 3	155	$2,496,696	
2021	23	Tottenham	Queen St. to Keogh St. and Wilson to Dilane St. E - Phase 2	30	$1,286,022	$3,857,618
	27	Tottenham	West side of Queen from #146 to Lionel Stone	58		
	48	Markham	Steeles & Henderson (NE & NW) - {NW Side of Steeles/Bayview} - Phase 1	190	$2,571,596	
2022	8	Barrie	Marian/ Pratt/ Shannon - Phase 1	93	$1,324,602	$3,973,347
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2023	8	Barrie	Marian/ Pratt/ Shannon - Phase 2	29	$1,364,340	$4,092,547
	5	Barrie	Johnathan/ Bathwell	73		
	49	Markham	Bayview & Steeles (NE) - Phase 2	191	$2,004,183	
	42	Aurora	Yonge & Wellington (NW) - Phase 1	69	$724,024	
2024	6	Barrie	Ottoway Ave.	91	$1,400,647	$4,201,455
	49	Markham	Bayview & Steeles (NE) - Phase 3	191	$1,422,751	
	42	Aurora	Yonge & Wellington (NW) - Phase 2	185	$1,378,057	
2025	9	Barrie	Alexander/ Oliver	40	$1,439,536	$4,318,110
	11	Alliston	Queen/ Victoria E.	21		
	20	Penetanguishene	Tessier at west of Main St.	18		
	19	Penetanguishene	Robert St. at Main north side	16		
	42	Aurora	Yonge & Wellington (NW) - Phase 3	185	$2,878,574	
2026	17	Penetanguishene	Maria St. near robert St. E	9	$1,478,424	$4,434,764
	18	Penetanguishene	Shannon Rd. at Main St.	11		
	14	Beeton	Main W./ Centre N.	13		
	26	Tottenham	Brown St. from Railway to Queen St.	36		
	15	Penetanguishene	Burke/ Country Club	10		
	16	Penetanguishene	Maria/ Edward	12		
	47	Markham	Hwy 7 & McCowan (SE) - Phase 1	148	$2,956,339	
2027	7	Barrie	Gunn/ Oakley Park Sq./ St. Vincent	92	$1,517,313	$4,551,417
	47	Markham	Hwy 7 & McCowan (SE) - Phase 2	147	$3,034,104	
2028	3	Barrie	Wellington/ Oak	68	$1,556,202	$4,668,071
	13	Alliston	Sir Frederick Banting/ Victoria E.	8		
	44	Markham	Major Mackenzie & Warden (SW)	63	$3,111,869	
	43	Vaughan	Islington & Seville (NE & SE) - {NE Side of Major Mackenzie/ Islington}-Phase 1	114		
2029	12	Alliston	Victoria W. of Downey	8	$1,595,091	$4,784,725
	25	Tottenham	North side of Adeline from Rogers to Brown St.	33		
	10	Alliston	Regional Rd 15/Victoria	21		
	30	Tottenham	Eastern Ave. backing onto railway from Wilson to Park	18		
	43	Vaughan	Islington & Seville (NE & SE) - {NE Side of Major Mackenzie/ Islington}-Phase 2	64	$3,189,634	
Program Total:				4,625		$59,522,223

Table 1: Rear Lot Remediation Priority List

TAB 5

Rear Lot Supply Remediation Program

March 31, 2015

Prepared by: System Planning

Quan Tran, P. Eng.

1. Executive Summary

This report describes the long-term remediation program for the existing rear lot overhead supply system at PowerStream. It summarizes the inventory, configurations, condition, concerns, managing approach, and high level schedule and cost for implementation. This long-term program is recommended to strike a balance between addressing operating and customer service concerns and at the same time, smoothing out capital budget increase.

There are many operating, safety, reliability and customer service issues that need to be addressed. Through external consulting firm report (CIMA report "Hardening the Distribution System against severe storms") and PowerStream staff and management discussions, it was confirmed that PowerStream must implement a Rear Lot Supply Remediation Program to convert existing rear lot overhead supply system to front lot underground supply system.

It is recommended that PowerStream proceed with a 15-year remediation program which starts in 2015 and continues to 2029, until all rear lot locations have been addressed. Under this program, the existing rear lot overhead supply system will be converted to front lot underground supply system on a prioritized basis.

Annual cost is estimated to be $3.5M in 2015 then will increase to approx. $6.4M per year thereafter. The high level total cost of the program is $75M over 15 years in 2015 dollars (or $93M in future dollars).

PowerStream will monitor the condition of the rear lot overhead supply system and adjust the remediation program as required.

The annual projects are selected and prioritized based on the following factors:

- Asset Age
- Asset Condition
- Imminent Health, Safety and Environmental Issues
- Standards/Directive Violation, and Obsolescence/Non-compliance
- Capacity Adequacy for Existing and Future Loading
- Criticality of the Circuit
- Failure Statistics
- Customer Complaint

The recommended remediation program is shown in Table 1 below.

Table 1. Rear lot priority list 2015 -2029

Rear Lot Priority List 2015-2029					Estimated Cost		
Year	Location Reference #	Municipality	Project	# of Customers	Cost per Area in 2015 Dollar	Annual Cost in 2015 Dollar	Annual Cost with Inflation (3%)
2015	32	Markham	Royal Orchard - East - Phase 1	219	$ 3,504,000		
						$ 3,504,000	$ 3,504,000
2016	32	Markham	Royal Orchard - East - Phase 2	157	$ 2,512,000		
	32	Markham	Royal Orchard - Baythorn	129	$ 2,064,000		
	1	Barrie	Shirley/ Vine	20	$ 594,585		
	4	Barrie	North Park/ Parkdale	40	$ 787,613		
						$ 5,958,198	$ 6,136,944
2017	22	Tottenham	East of Queen St. to Eastern Ave. / North of Greenway St.	115	$ 1,840,000		
	2	Barrie	Blake/ Kempenfelt	21	$ 336,000		
	11	Alliston	Queen/ Victoria E.	21	$ 336,000		
	19	Penetanguishene	Robert St. at Main North side	16	$ 256,000		
	32	Markham	Royal Orchard - North	195	$ 3,120,000		
						$ 5,888,000	$ 6,246,579
2018	23	Tottenham	East of Queen St. / North of Mill St.	85	$ 1,360,000		
	12	Alliston	Victoria W. of Downey	8	$ 128,000		
	32	Markham	Royal Orchard - South	257	$ 4,112,000		
						$ 5,600,000	$ 6,119,271
2019	26	Tottenham	Queen St. & Lionel Stone Ave. - Phase 1	100	$ 1,600,000		
	21	Tottenham	Frazer Ave. 3 ph line & Perdue Pl./ Alphonsus Crt.	83	$ 1,328,000		
	31	Markham (M33)	Main St. Unionville & Carlton(SW) - {NW side of Hwy 7/Kennedy} - Phase 1	156	$ 2,496,000		
						$ 5,424,000	$ 6,104,760
2020	26	Tottenham	Queen St. & Lionel Stone Ave. - Phase 2	100	$ 1,600,000		
	17	Penetanguishene	Maria St. Near Robert St. E	9	$ 144,000		
	5	Barrie	Johnathan/ Bothwell	73	$ 1,168,000		
	31	Markham (M33)	Main St. Unionville & Carlton(SW) - {NW side of Hwy 7/Kennedy} - Phase 2	155	$ 2,480,000		
						$ 5,392,000	$ 6,250,806
2021	27	Tottenham	Queen St. & Richmond St.	58	$ 928,000		
	34	Markham (M51)	Steeles & Henderson (NE & NW) - {NW Side of Steeles/Bayview} - Phase 2	115	$ 1,840,000		
	31	Markham (M33)	Main St. Unionville & Carlton(SW) - {NW side of Hwy 7/Kennedy} - Phase 3	155	$ 2,480,000		
						$ 5,248,000	$ 6,266,386
2022	8	Barrie	Marian/ Pratt/ Shannon - Phase 1	93	$ 1,488,000		
	10	Alliston	Regional Rd. 15/Victoria	21	$ 336,000		
	18	Penetanguishene	Shannon Rd. at Main St.	11	$ 176,000		
	34	Markham (M51)	Steeles & Henderson (NE & NW) - {NW Side of Steeles/Bayview} - Phase 1	190	$ 3,040,000		
						$ 5,040,000	$ 6,198,564
2023	8	Barrie	Marian/ Pratt/ Shannon - Phase 2	29	$ 464,000		
	25	Tottenham	South of Mill St. / West of CPR Railway / East of Queen St.	96	$ 1,536,000		
	35	Markham	Bayview & Steeles (NE) - Phase 1	191	$ 3,056,000		
						$ 5,056,000	$ 6,404,790
2024	9	Barrie	Alexander/ Oliver	40	$ 640,000		
	28	Aurora	Yonge & Wellington (NW) - Phase 1	69	$ 1,104,000		
	35	Markham	Bayview & Steeles (NE) - Phase 2	191	$ 3,056,000		
						$ 4,800,000	$ 6,262,911
2025	6	Barrie	Ottoway Ave.	91	$ 1,456,000		
	16	Penetanguishene	Maria/ Edward	12	$ 192,000		
	35	Markham	Bayview & Steeles (NE) - Phase 3	191	$ 3,056,000		
						$ 4,704,000	$ 6,321,783
2026	24	Tottenham	North of Mill St. and East of Industrial Rd. and West of Queen	43	$ 688,000		
	29	Vaughan	Islington & Seville (NE & SE) - {NE Side of Major Mackenzie/ Islington}-Phase 2	64	$ 1,024,000		
	28	Aurora	Yonge & Wellington (NW) - Phase 2	185	$ 2,960,000		
						$ 4,672,000	$ 6,467,141
2027	15	Penetanguishene	Burke/ Country Club	10	$ 160,000		
	14	Beeton	Main W./ Centre N.	13	$ 208,000		
	3	Barrie	Wellington/ Oak	68	$ 1,088,000		
	28	Aurora	Yonge & Wellington (NW) - Phase 3	185	$ 2,960,000		
						$ 4,416,000	$ 6,296,160
2028	13	Alliston	Sir Frederick Banting/ Victoria E.	8	$ 128,000		
	20	Penetanguishene	Tessier at west of Main St.	18	$ 288,000		
	29	Vaughan	Islington & Seville (NE & SE) - {NE Side of Major Mackenzie/ Islington}-Phase 1	114	$ 1,824,000		
	33	Markham (M20)	Hwy 7 & McCowan (SE) - Phase 1	148	$ 2,368,000		
						$ 4,608,000	$ 6,767,003
2029	7	Barrie	Gunn/ Oakley Park Sq./ St. Vincent	92	$ 1,472,000		
	30	Markham (M40)	Major Mackenzie & Warden (SW)	63	$ 1,008,000		
	33	Markham (M20)	Hwy 7 & McCowan (SE) - Phase 2	147	$ 2,352,000		
						$ 4,832,000	$ 7,308,834
Program Total:				4,670		$ 75,142,198	$ 92,655,932

2. Background and Purpose

PowerStream has a number of pockets of customers being supplied by rear lot construction. In general, the rear lot areas are older neighbourhoods, and the electrical supply systems are ageing and deteriorating. The rear lot supply system poses many reliability, operations, safety, and customer service concerns. The concerns became more evident during the ice storm event in December 2013 when many trees fell onto power lines at rear lot and caused lengthy outages to customers. It was extremely difficult for PowerStream trouble crews to restore power to the affected customers due to difficult access to the rear lot.

<u>December 2013 Ice Storm Event</u>

On the weekend of December 21-22, 2013, a significant ice storm moved through Southern Ontario. Ice accumulation resulted in downed branches, trees and power lines, which resulted in over 500,000 customers losing power in Ontario. This included, at its peak, over 92,000 customers in PowerStream's service territory, predominantly in Aurora, Markham, Richmond Hill and Vaughan.

The majority of customers within PowerStream's territory were restored within 24 hours of the completion of the storm, and full restoration in PowerStream's service territory was realized on December 30, 2013.

The ice storm produced significant damage to the tree canopy in PowerStream's service territory. It was this damage to the tree canopy that then caused significant damage to the overhead primary and secondary distribution system. The failed trees came down on the power lines causing outages. There were limited pole or transformer failures and those that occurred were generally the result of the weight of the failed tree canopy and not the ice itself.

In addition to the type of failures that occurred, failures were widespread because backup feeders that PowerStream relied upon to provide quick restoration of power were unavailable as failures also occurred in the backup feeders. A significant number of the failures also occurred in the single phase or secondary lines for which there is no backup and direct restoration was required to re-establish power to the customer.

PowerStream wants to consider ways to effectively "harden" the distribution system against ice storms of this nature and storms in general. These may include changes to the distribution design standards, upgrade of old systems to present day standards (i.e. rear lot services) and vegetation management practices.

PowerStream has retained a consulting firm, CIMA, to review PowerStream's distribution system with respect to the capability to withstand severe ice storm in the future. CIMA has completed the review and submitted the final report "Hardening the Distribution System against severe storms".

The conclusion of the CIMA report is quoted below.
"*Conclusions*
In this report, a number of potential distribution system hardening options have been presented for PowerStream's consideration. It is understood that creating a hardening program requires careful consideration of costs to balance rate impact and hardening program progress. By adopting a balanced rate fundable program of a number of these options, PowerStream will position itself as a company that has understood the impact of climate change on distribution infrastructure and has diligently moved forward to adapting its infrastructure to continue to deliver safe and reliable power.
CIMA+ have confidence that the information provided will enable PowerStream to develop a multi-year portfolio of distribution hardening measures that is rate base fundable and provides value to the customer."

One of the major recommendations of the CIMA report is to convert the rear lot overhead supply system to front lot underground supply system. If the electrical components are installed at front lot instead at rear lot, the electrical components would subject to less risk for outages, and trouble crews could restore power to the affected customers faster.

Subsequent PowerStream staff and management discussions confirmed the need for rear lot remediation. It was recommended that the remediation program be implemented over a period of 15 years.

The purpose of this report is to describe the 15-year rear lot supply remediation program to convert all rear lot overhead supply system to front lot underground supply system. The remediation plan will provide various departments with an overview of future work related to rear lot supply and allow coordination among various work programs.

TAB 6

PowerStream

2013 ICE STORM REVIEW

room for maintenance activities. During the ice storm, large limbs and sometimes entire trees came down under the excessive weight of the ice accumulation. While the extent of the damage was mitigated by PowerStream's tree-trimming program, in order to prevent overhead damage in this type of weather event the clearance area would have to be significantly increased, up to and including the proactive removal of entire trees, the vast majority of which reside on private property. There are no current plans to pursue this option.

An area that could be improved is the identification of areas with significant mature tree coverage in order to focus the tree-trimming program. This could be incorporated into the Geographic Information System map to enable cross-referencing against areas with overhead services, thereby providing an overall picture of vulnerable areas throughout PowerStream's territory.

Another area for improvement is better upfront coordination with municipalities to avoid the planting of new trees in the municipal road allowance in the vicinity of power lines, and to encourage customers to acquire qualified foresters to prune trees on private property that could contribute to outages. This will help to mitigate the risk of future outages due to damaged trees in areas outside of PowerStream's direct control.

Action Items:

- *Identify the geographic areas with significant tree coverage to assess vulnerabilities and augment the tree-trimming program (December 31, 2014)*
- *Coordinate with municipalities to avoid tree planting near power lines (June 30, 2014)*
- *Encourage customers to proactively perform tree-trimming on their properties (September 30, 2014)*

5.4.2 Rear Yard Services

Rear yard services have the primary wires, poles and transformers located in customers' back yards, versus the typical front yard service that has the distribution equipment located adjacent to the street. Rear yard services are prevalent in multiple residential subdivisions in PowerStream's service territory, specifically in Markham (including the Thornhill area), Tottenham and some areas of Barrie, and result from historical distribution design standards.

Damage that occurred to the electrical distribution grid in these neighbourhoods was quite extensive, especially in the Thornhill area of Markham. Further, when Lines crews went to work in these areas, there were additional challenges such as gaining access through frozen gates and getting the necessary equipment and machinery in place to make repairs.

As a result, customers with rear yard service generally faced the longest restoration times, with some being out of power for up to a week.

Lines crew clearing tree limbs and debris from a rear yard service during the ice storm restoration

In 2013, PowerStream analyzed all neighbourhoods containing rear yard services, and is reviewing the potential change to front yard service on a case-by-case basis. As these services have generally provided reliable service for many years, this type of decision would be made when the existing plant is nearing the end of its useful life and would otherwise require replacement. There are considerable cost implications that must be factored into this decision, along with potentially complex customer conversion issues that must be examined as well. The current long-term program would remediate all rear yard services by 2030. Management will review this plan to re-assess the approach and timeline given the events that occurred during the December 2013 ice storm.

Action Items:

- *Prepare a report analyzing the current 15-year remediation plan for rear yard services and making recommendations on the appropriate approach and timing, with the results to inform the next rate application in Q2 2015 (December 31, 2014)*

5.4.3 Distribution Design Standards

One of the areas that received heavy criticism from the media, municipalities and the general public is the use of overhead distribution systems. Given the extensive tree damage caused by this event, the overhead distribution equipment was simply not able

TAB 7

CIMA+ Partners in excellence

Best Employers in Canada
By Aon Hewitt

PowerStream

HARDENING THE DISTRIBUTION SYSTEM AGAINST SEVERE STORMS

FINAL REPORT

Prepared by : Walter Lionel Franco, P. Tech.

Ted P. Wojcinski, P. Eng.

Verified by : Denis Chartrand, Eng.

T000320A
October 3rd, 2014

7880 Keele Street, Suite 201
Vaughan ON L4K 4G7
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4. POWERSTREAM STAFF CONSULTATIONS

A number of key PowerStream staff were consulted on their experiences and thoughts on the key issues of the 2013 ice storm and what hardening ideas/actions could be investigated for adaptation to mitigate the effect of future storms.

Some key observations were:

- Most of the 2013 ice storm problems were due to limbs on lines even in recently cleared areas; ice did not bring down infrastructure
- Most trees and limbs causing the problems were outside normal trim zones; hazard trees/limbs outside the trim zone need to be addressed
- Overhead secondaries are not part of the tree trimming program; this is where a number of the problems were
- Backyard construction was the most problematical to deal with from access and restoration perspective; left for last because most labour intensive and time consuming to restore
- Few failures on arterial streets; ice accumulation flashovers resulted in a few pole fires
- Most failures were in heavily treed side streets and rural areas
- Some pole locations are relatively inaccessible once installed (i.e. 407 ramps)
- A number of customer standpipes were damaged as a result of tree/tree limbs taking down the overhead service cable. In a few cases customers had to wait days, even after power was available, to get their services repaired by electricians
- Current overhead and underground standards are good but legacy construction is less robust (pole class and guying)

Some of the key ideas were:

- Remove, at a minimum, the primary from rear lots; this will make it easier for restoration purposes; mitigates weather and animal issues with respect to primary conductors
- In short term, focus on addressing rear lot tree trimming
- Consider expanded uses of insulated tree cable in heavily treed areas
- Coordinate with municipalities to ensure future tree planting along boulevards is compatible with existing overhead powerlines
- Incorporate secondary tree trimming into the vegetation management program

- Investigate more robust alternatives to wood poles (i.e. composite); may be more resistant to pole fires in high contamination areas
- Investigate the use of breakaway clamps for conductors
- Use electronic type reclosers for radial and backlot feeds instead of fuses
- Eliminate radial feeds; ensure loop configuration is in place so all have alternative supply points; diversify supply routes to large commercial customers
- If possible, put highway crossings underground – coordinate with bridge construction to get ducts installed in bridge structure
- Focus on hardening deadend and crossing poles; more storm guying in general
- Increase sectionalizing of feeder segments and distribution automation, especially in high treed area
- Underground major intersections and other strategic sections of line; diversify feeder routing
- Enforce underground supply as policy in undeveloped areas
- Review lifecycle cost of overhead versus underground with the cost of outages to customers included

These consultations were taken into consideration and incorporated into the practice review and hardening recommendations as deemed appropriate.

5. POWERSTREAM PRACTICES AND PHILOSOPHIES - HARDENING REVIEW

5.1 VEGETATION MANAGEMENT

5.1.1 Background

PowerStream's vegetation management practice is documented in its internal procedure ENG-P-018 Vegetation Management Procedure.

A three year tree trimming cycle has been adopted for the entire service area. It consists of annual cycle clearing (1/3 of PowerStream's service territory) and an annual program to address vegetation impacting worst performing feeders. To date the actual cycle clearing time for the whole service area is in the 4-5 year range however this is expected to improve in the near term as resources are allocated to achieve the 3 year cycle target.

Clearing is based on tree species and results in line clearances, between cycles, of 0.1 m – 3.5 m.

6. Consider training design staff and construction in basic vegetation management to help identify potential problems. A ½ day or 1 day course by a trained arborist can identify vegetation conditions that should be brought to the attention of the Line Clearing coordinator.

5.2 BACKYARD CONSTRUCTION

5.2.1 Background

PowerStream's position on residential backyard construction is documented in the Rear Lot Remediation Plan (December 2013). The report recommends a long-term remediation program which starts in 2015, and continues for 15 years to 2029, until all residential rear lot locations have been addressed. A total of 4,058 residential customers (1.1% of PS total) are currently fed from rear lot services. Some rear lot remediation work is currently underway and so for an expected 2015 program start there will be 3589 customers fed from rear lots to be scheduled for remediation. The average age of the rear lot fed areas is 45 years. PowerStream four remediation options:

- **Option 1** – Replace existing rear lot with new rear lot overhead
- **Option 2** – Replace existing rear lot with new front lot overhead
- **Option 3** – Hybrid – Install primary cable & transformer at front lot underground; replace/keep pole & secondary at rear lot
- **Option 4** – Replace existing rear lot with new front lot underground

Option 1 is the least expensive capital option and has been chosen as recently as 2005 when the Kleinburg rear lot supply was rebuilt and converted from 8 kV to 16 kV primary supply. It maintains the status quo of both the primary and secondary supply in the rear lots along easements.

Option 2 while feasible, is not considered achievable due to expected public and political backlash against new overhead plant in an "underground" area. An Option 1 program would cost approximately $27M (~$7.5k/customer).

Option 3 eliminates primary supply vulnerability but maintains secondary supply vulnerability to extreme weather conditions. The total cost of the program, based on Option 3, is approximately $59.5M (~$16.6k/customer).

Option 4 eliminates both the primary and secondary vulnerability to extreme weather conditions and potential political repercussions due to misplaced future reliability expectations. The total cost of the program based on Option 4 is approximately $87.4M, (~24.3k/customer).

Stakeholders interviewed were in general agreement that the rear lot supplies are problematical in both normal and severe weather conditions. There is anecdotal consensus that overall reliability will improve with the removal of rear lot primary in that primary related outages due to vegetation contact would be eliminated leading to less trouble calls and reduced trimming needs. It would be also somewhat safer with the primary removed for both workers and the homeowners. The retention of rear secondaries will continue to pose operational and customer service challenges. The key issue is the high cost and limited value to completely convert these areas to a more robust form of supply that can withstand severe weather impacts.

5.2.2 Analysis

PowerStream has developed a comprehensive strategy to remediate existing residential rear lot construction by 2029. The 15 year plan does not eliminate rear lot construction. In a number of cases, primary supply will be moved to the front yard and undergrounded. This will effectively mitigate the effects of extreme weather on the primary supply in the local area. In most, if not all cases, the secondary supply will remain in the rear and remain vulnerable to extreme weather conditions. Upstream overhead primary will also remain vulnerable to the extremes of severe weather.

The 2013 ice storm demonstrated the vulnerability of front and rear lot overhead secondary services to extreme weather events. Most of the problems were with the secondary services being pulled down due to vegetation issues. The rear lot primary and secondary bus was not as impacted in this particular set of circumstances, other than fuses operating on the overhead rear primary supply. This may not be the case under future scenarios if extreme weather events exceed the conditions experienced in 2013.

Environment Canada indicated that between 20 and 30mm of freezing rain fell in the area between Niagara and Trenton as a result of the 2013 ice storm[65]. Toronto Pearson Airport experienced 43 hours of freezing rain. The City of Markham reported that they had 20 – 25mm of ice accumulation[66], the City of Vaughan had 25mm and the City of Barrie had 20mm[67].

According to the Toronto Hydro Electric System PIEVC Pilot Case Study (2012) freezing rain storms lasting at least 6 hours have a probability of occurring every other year (0.65 annual probability) and can bring ice accumulation levels of up to 25mm. Multiday ice-storms with $\geq$ 25 mm of ice accumulation occur less frequently (0.06 annual probability). **With between 20**

65 Environment Canada – Canada's Top Ten Weather Stories for 2013
66 Ice Storm – December 2013 / Presentation to General Committee January 8, 2014
67 Ontariostorms.com

and 25mm of ice accumulation being reported in the PowerStream service territory, the 2013 ice storm can be considered a moderate one in line with the criteria for the 0.65 annual probability category. Very little if any PowerStream plant was brought down by ice accumulation that one would expect from an ice storm with > 25mm ice accumulation that would fall in the 0.06 annual probability category. This is also supported by the TRCA study that indicated that daily freezing rain amounts of less than 25 mm are expected to occur 1.25 to 2 times per year.

Climate change forecasts indicate that ice storms such as that experienced in 2013 are increasing in frequency (moving from once every two years to more of an annual occurrence). More severe ice storms with greater accumulation (>25 mm) that can take down wires and poles by weight alone, are expected once every 14 years according to the Toronto Hydro Electric System PIEVC Pilot Case Study (2012). The TRCA study was even more conservative with a range of 4 to 10 years repeat time for such storms.

This Option 3 remediation proposal will leave the rear lot secondaries exposed to extreme weather (mitigated by the vegetation management program) and it is likely that the customers will be impacted by service teardowns in future ice storms similar to what they experienced in 2013. It is expected that the underground primary supply will not be as impacted as in the past so outages may be limited to more individual homes versus all rear lot homes unless the secondary bus is torn down. Some secondary mitigation measures, such as breakaway connectors, may limit future damage to the customer service entrance equipment, but operational difficulties in accessing rear lots will lengthen repair and restoration times as in 2013. There would be less need for electricians to rebuild customer service stacks and get ESA permits for restoration.

The overall reliability of rear lot secondary overhead is similar to front lot overhead secondary. Both are impacted by weather and vegetation events. It is only in extreme weather conditions, as in the 2013 ice storm, that the differences in accessibility and restoration times between back and front are magnified. This needs to be taken into account in determining the “value” gained from the rear lot remediation options.

If Option 3 is chosen, it needs to be considered together with a program (material & labour) to install secondary breakaway connectors. This effectively raises the cost of Option 3 to $60.6M.

The 2013 ice storm also demonstrated the need to accelerate the mitigation program. The current program pace results in poles and hardware being replaced at points well past the Typical Useful Life standard (45 years) that have been reported to the OEB. With expected increases in return times in December through to February, it is quite feasible to have multiple freezing rain events, of varying ice accumulation and wind strength, over a 15 year period. Customer outcomes, expressed through direct feedback and municipal representative feedback to PowerStream staff, expect that appropriate actions will be taken to prevent reoccurrence of backlot problems that occurred as a result of the 2013 ice storm.

Of related interest is Toronto Hydro's rear lot conversion program. Since 2007, Toronto Hydro has embarked on a 20+ year program to convert rear lot overhead supply to front lot underground supply. The program is a full conversion program where the primary and secondary lines are removed from the rear lots and placed underground in the front lots. The poles have been left in the rear lot for the telecommunication provider needs (pole ownership transferred over). The cost to do this has been around $30k per customer with the biggest cost being the work to trench/bore secondary cables to the meter bases in the back of each customer's house. Annual program expenditures have been around $15 - $20M and represent a positive NPV expenditure for rate case financial analysis. Future annual expenditures are in the $10M range. All conversion costs have been borne by Toronto Hydro and are rate base funded. Customer communication is key in the successful implementation of the conversion program (i.e. equipment location, property disruption, etc.).

5.2.3 Summary of good utility practice in Backyard Construction

- PowerStream has a documented asset management program for rear lot residential plant. The long term plan is to move most of overhead rear lot primary supply to front yard underground supply. The Program has been smoothed ($3.2M/year + 3% inflation) to mitigate rate impacts. Prioritization is based on area end-of-life status.

5.2.4 Potential Practice Adaptations

In reviewing PowerStream's practices for backyard construction, there are a number of initiatives that PowerStream should consider adopting:

1. Consider accelerating the mitigation program to expeditiously deal with plant installed in the 1950s through to the 1970s that are already past the Typical Use for Lies (TUL) pole point (45 years). Consider a 6 year-$41M program to expedite replacement of pre-1980 vintage plant. This will partially address expected customer outcomes and mitigate risk of backyard plant subject to a future freezing rain event similar to the 2013 ice storm. Post 1980 plant ($18.6M program) can be scheduled for the 2024 – 2030 period.

2. For Option 3, consider installing breakaway connectors on overhead secondary services. Expedite installation, as a separate program, if current 15 year backyard remediation program is to be maintained. A three year install program is recommended. This will mitigate the problem of customer standpipe damage due to teardowns.
3. Consider Option 4 to completely eliminate residential rear lot supply. This will address expected customer outcomes and mitigate risk of backyard plant subject to a future freezing rain event similar to the 2013 ice storm. A 10 year - $60M program could expedite replacement of pre-1980 vintage plant. Post 1980 plant ($27.4M program) can be scheduled for the 2025 – 2030 period.

5.3 UNDERGROUNDING PRACTICES

5.3.1 Background

PowerStream's undergrounding practice/philosophy is documented in its Conditions of Service and Underground relocation policy. Overhead construction has been PowerStream's standard method of distribution on arterial streets as it is a lower cost of installation, it provides a high degree of flexibility in dealing with changing infrastructure requirements due to new commercial customers coming on stream, is not impacted by the space issues for required switching units that an underground system would need and has less technical barriers. For example, in the PowerStream north service area, the 44 kV distribution system is overhead as there are technical barriers related to very limited product availability for undergrounding 44 kV, particularly in regards to compact switching units. 44 kV undergrounding is not technically practical except for limited straight runs. In summary, the general practice is to consider undergrounding where overhead supply facilities are not possible for various reasons (i.e. limited building clearances). Note that this is not applicable to residential and commercial subdivisions where municipal by-laws and subdivision agreements require the developer to install underground plant for aesthetic reasons.

Section 3 of the Conditions of Service indicates that residential and general service customers are eligible to obtain overhead or underground service connections. This would be determined by the nature of the infrastructure in the area for single site plan applications. For example, an applicant in overhead area would likely get an overhead service connecting (depending on service size and voltage). Residential and commercial/industrial subdivisions are generally supplied via an underground distribution system as a result of municipal planning requirements that require undergrounding of power lines and other infrastructure (phone, cable, etc.).

6.1 RECOMMENDATIONS

The report recommendations, for the most part, focus on hardening related matters as defined in Figure 15. These hardening options are discussed in the Controlling the Behaviour of the Distribution System, and Securing Stations sections.

It is understood that a number of the other 37 areas for review focus on resiliency and communication related matters such as emergency plans, mutual aid agreements, emergency generators, customer communications, etc. and as such resiliency related matters are not noted here.

The following recommendations have been derived based on previous information presented in this report related to climate change, best practices in physical hardening and PowerStream's existing practices in the design, configuration and operation of its distribution system. They augment PowerStream's existing good utility practices in distribution design, construction and operation.

Recommendations have been prioritized for implementation, in each of the three hardening categories, based on importance, cost and effectiveness in advancing hardening of the distribution system. Some recommendations involve expenditures that will be capital and others operating. Relative cost and hardening impact assessments (high, medium or low) are also provided. In some cases, a number of recommendations can be acted on concurrently. Some recommendations are presented in multiple options generally dealing with a "going forward" approach or a "legacy remediation" approach.

Where available, unit costs were based on PowerStream information, CIMA+ information, utility equipment supplier information and finally general estimates on perceived effort.

6.1.1 Vegetation control

There are 6 Vegetation control recommendations presented in Table 8. They are listed in order of priority with respect to a combination of cost and impact towards distribution system hardening. They are Operating in nature and would be funded as such.

Item	Option	Hardening Recommendation Description	Units	Program	Cost	Cost level	Impact level
V1		Create enhanced trim zone	total clearance to be 3.5m side;3.5m below; all above	Operating	$5.1M	Medium	High
V2		Incorporate aspects of reliability centered maintenance into the line clearing cycle	N/A	Operating	<$20k	Low	Medium
V3		Hazard tree program	Trees off road allowance	Operating	$100k	Medium	High
V4		Overhead service line clearing	32 300	Operating	$300k	Medium	Medium
V5		Educate stakeholders	N/A	Operating	<$20k	Low	Low
V6		Train design and construction staff	N/A	Operating	<$20k	Low	Low

TABLE 8 – VEGETATION CONTROL RECOMMENDATIONS

6.1.2 Strengthening the Distribution System

There are 18 Strengthening the Distribution System recommendations presented in Table 9. They are listed in order of priority with respect to a combination of cost and impact towards distribution system hardening. A number of recommendations address a common specific hardening action but have alternatives (a or b) that can be selected. In some cases the alternatives are strictly choose "a or b" but not both (i.e. backyard conversion). Other alternatives represent a split in program effort to address past infrastructure, future infrastructure or even both if so desired. This represents an understanding that funding for hardening programs is not unlimited and careful selection of programs and scope is required.

Item	Option	Hardening Recommendation Description	Units	Program	Cost	Cost level	Impact level
S1	a	Hybrid conversion - 5-6 years for pre 1980; address post-1980 in 2024 thru 2029	3589	Capital	$59.5M	High	Medium
		Breakaway connectors	3589	Capital	$1.1M	Medium	Medium
	b	Full conversion - 8 years for pre 1980; address post-1980 in 2024 thru 2029	3589	Capital	$87.4M	High	High
S2		All new or upgraded services underground	+ 400 annually	Capital	<$20k	Low	High
S3		Joint use standards	N/A	Capital	<$20k	Low	Medium
S4		Critical poles designed to handle 120kmh winds	459	Capital	$1.84M	Medium	High
S5		Breakaway connectors	36 100	Capital	$5.4M	Medium	Medium
S6		Periodic in-line anchoring (ie. storm dead end)	every 6 - 10 poles	Capital	$8M	Medium	Medium
S7		Poles with 2 or more primary circuits to Grade 1 construction -consider non-wood material	1200+	Capital	$24M	High	High
S8		70% strength replacement target for Grade 1 construction	As identified per pole testing	Capital	<$50k annually	Low	Medium
S9		Develop composite pole standards	stds book	Capital	<$50k	Low	Medium
S10	a	Controlled failure mechanism	See cost	Capital	+6%	Medium	Medium
	b	Controlled failure mechanism	See cost	Capital	$45k/km	Medium	Medium
S11		Opportunities for closing the "loop" on "radials" should be identified and implemented.	potential locations	Capital	TBD	Medium	Medium
S12	a	Underground station egress cables to 2 circuit riser points - going forward only	800m	Capital	$4M	Medium	Medium
	b	Underground station egress cables to 2 circuit riser points - existing infrastructure	TBD	Capital	$5000/m	Medium	Medium
S13	a	Strategic undergrounding - Limit overhead circuits to maximum of 2 for the key supply voltage in the area	51.7 km future	Capital	$155M	High	Medium
	b	Strategic undergrounding - convert existing 4 circuit poles to 2 circuit poles and 2 circuit underground	49km exist	Capital	$157M	High	High
S14		Strategic Undergrounding - Incorporate ducts in new/refurbished bridge structures or similar critical points	404/400 crossings	Capital	$300/m	Low	High
S15	a	Underground the distribution system – going forward only	120km	Capital	$360M	High	Medium
	b	Underground the distribution system – existing infrastructure	All	Capital	$4,500M	Very High	High
S16		Review and update feeder protection coordination	TS and MS feeders	Capital	$150k	Low	Low
S17		Install and enable High Impedence fault detection where appropriate	5 TS	Capital	$1.5M+	Medium	Low
S18		Cable chamber and vault drainage standards	as required	Capital	$10k/unit	Low	Low

TABLE 9 – STRENGTHENING THE DISTRIBUTION SYSTEM RECOMMENDATIONS

6.1.3 Securing stations – Transmission / Distribution Network

This area covers practices that tend to deal with securing transformer stations with respect to severe storm events. There are 3 Securing stations recommendations presented in Table 10. They are listed in order of priority with respect to a combination of cost and impact towards distribution system hardening. The After-storm management plan requires station inspection after service has been restored to ensure that all station assets are in good operating condition and standards have not been compromised.

Item	Option	Hardening Recommendation Description	Units	Program	Cost	Cost level	Impact level
SS1		Move existing flood sensitive equipment above grade in existing stations.	As per list	Capital	$1.1M	Medium	Medium
SS2		Updates on transmission system capability to withstand severe weather events.	annually	Operating	<$20k	Low	Medium
SS3		After storm management plan	as required	Operating	<$20k	Low	Low

TABLE 10 – SECURING STATIONS RECOMMENDATIONS

A summary graphic of respective option cost and impact assessment is shown in Table 11.

OPTION COST / IMPACT ASSESSMENT				
IMPACT	HIGH	S2; S14	V1; V3 S4;	S1b; ; S7; S13b; S15b*
	MEDIUM	V2; S3; S8; S9; S10 SS2	V4 S5; S6; S10a; S10b; S11; S12a; S12b SS1	S1a; S13a; S15a
	LOW	V5; V6 S16; S18 SS3	S17	
		LOW	MEDIUM	HIGH
		COST		

TABLE 11 – OPTION COST / IMPACT ASSESSMENT

** Very High cost*

In general, programs have been prioritized in the three recommendation sections by their impact on weather hardening the distribution system and relative cost to implement along with information from interviews with PowerStream Executive and staff. Interviews provided useful information on customer feedback received related to severe weather and service reliability expectations; existing asset management programs; and practical experiences in designing, constructing, operating and maintaining distribution infrastructure in PowerStream's service territory.

TAB 8

JTC 1.14: To provide the information on the requirements under which they operate.

RESPONSE:

For new residential subdivisions, subdivision agreements between the Municipality and the Developer include a clause related to electrical servicing by PowerStream. Included in the clause is a requirement for underground. As an example, these are the words on a typical agreement - "…*The owner further agrees that all lands shall be serviced by underground electrical distribution systems*…".

At the point in time when the underground electrical distribution system is required to be replaced, the municipality, as the road authority, has the right to determine where the electrical facilities are located, specifically under the Electricity Act, 1998, S.O. 1998, c. 15, Sched. A, subsection 41. 9, location:

> *(9) The location of any structures, equipment or facilities constructed or installed under subsection (1) shall be agreed on by the transmitter or distributor and the owner of the street or highway, and in case of disagreement shall be determined by the Board. 1998, c. 15, Sched. A, s. 41 (9).*

This approval is typically governed by the Municipal Consent application process for submission by utilities or their contractors for work within the municipal right of way.

The City of Markham's Official Plan approved by the Region in June, 2014, section 7.2.3.5 states:

> *To work with the Region and utility providers to ensure appropriate utility design and placement, including locating cables, electrical circuits and other utility structures underground in order to minimize visual impacts. Markham and the Region shall encourage priority areas for underground installation of utilities in new communities and intensification areas.*

At the conclusion of the technical conference, a specific request was made to municipal staff, asking:

- can PowerStream obtain approval to move or relocate rear lot poles of an overhead system to the front?;
- would the municipality consider granting municipal consent for rebuilding an existing underground hydro system to overhead?; and
- If no approvals are obtained, what are the by-laws or regulations that would prohibit PowerStream from doing so?

No response was received.

From a technical and practical perspective, design requirements dictate that roads with curves require extensive guying on lands that customers typically value as their own. Also, pole lines could provide issues with mature trees and result in issues with finding acceptable locations with all parties. There is also a perception of decreased property values. The results are dissatisfied ratepayers.

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TAB 11

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J-CCC-61

REF: Ex. J/T1/p. 3

Vegetation Management costs are increasing significantly from $300 million in 2015 to more than $600 million in 2016 and more than $500 million in the other years throughout the plan period. Please provide the business case analysis to justify these increased expenditures. Is this work carried out by permanent staff or by contractors?

RESPONSE:

The December 2013 Ice Storm caused widespread outages on the PowerStream distribution system, with power lines being severely impacted by falling trees and limbs. Much damage was sustained in areas with a significant concentration of rear-lot distribution, and these areas required significant amounts of resources and the longest periods of time to repair distribution plant and restore power. As a result of the Ice Storm, external reviews were conducted around system hardening, and vegetation management was an OM&A focus in order to help prevent outages like the 2013 Ice Storm from occurring again. Therefore, vegetation management costs increased $300,000 in 2015 from 2014 and another $600,000 in 2016 over 2015 and continue to increase at $500,000 per year from 2017 to 2020. These increases are the result of PowerStream implementing system hardening measures which include increasing the tree clearance cutback around lines, complete removal of any limbs overhanging lines (referred to as “blue-skying”), removal of hazard trees located close to a power line where failures of the tree could pose a hazard to the line, and implementing vegetation management around secondary wires on customer properties.

These changes are supported by a study that was conducted by CIMA (an independent third party) and is attached in J-CCC-61 Appendix A. This study was conducted as a result of the 2013 ice storm and supports effectively “hardening” the distribution system against ice storms and severe weather in general. Specifically related to vegetation management, CIMA recommended the following:

- enhancing the trim zone
- incorporating aspects of reliability centered maintenance in the fixed pruning cycle program

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- instituting a "Hazard Tree" program that identifies trees outside the trim zone that are tall enough to contact the overhead distribution system and are also dead, declining, diseased, or otherwise structurally unsound
- including proactive service line clearing on private property as part of the three year trim cycle; continuing to educate and inform the municipalities, property developers and clients on vegetation near power lines and how they can help to keep the network safe
- training design staff and construction in basic vegetation management to help identify potential problems

The work that is expected to be performed will be carried out by contractors.

TAB 12

A-CCC-10

REF: Ex. A/T1/p. 5

The evidence indicates that PowerStream proposes that some unexpected or unpredictable events might be best addressed through a re-opening of the Custom IR rate plan and in other cases may require termination of the plan. PowerStream has provided examples of events that could trigger a re-opening or termination of the plan. In this context how does PowerStream define "material"? Would a future merger or acquisition trigger a re-opening or termination of the plan? If not, why not?

RESPONSE:

For purposes of re-opening or termination of the rate plan, PowerStream defines material as 5% of target net income which would be approximately $2 million for 2016. PowerStream proposes that externally driven events with net costs to PowerStream of this magnitude would allow PowerStream to apply for re-opening or termination of the Custom IR rate plan.

PowerStream does not think that a future merger or acquisition need trigger a re-opening or termination of the plan. The Board Report: Rate-Making Associated with Distributor Consolidation, March 26, 2015 (EB-2014-0138) provides guidance on this situation.

A-CCC-11

REF: Ex. A/T1/p. 5

Given the fact that PowerStream is spending a significant amount on "storm hardening" throughout the term of the plan, how would costs associated with storm damage be treated during the term of the rate plan? Has PowerStream embedded storm damage costs in it budgets? If so, please identify where these costs are accounted for.

RESPONSE:

PowerStream has budgeted for storm damage on the basis of historical data and also considered the proposed "storm hardening" initiatives being carried out. Table A-CCC.11-1 summarizes the Storm damage capital and OM&A budget amounts included in the Rate Proposal.

Table A-CCC.11-1: Storm Damage Budgeted Costs ($ thousands)

	2016	2017	2018	2019	2020
Capital Budget	$1,000	$1,006	$1,006	$1,010	$1,010
OM&A Budget	$377	$385	$391	$397	$403

Table 17

	Historical					Proposed				
Material Investments	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
System Renewal	**Actual**	**Actual**	**Actual**	**Actual**	**Plan**	**Plan**	**Plan**	**Plan**	**Plan**	**Plan**
UG Lines - Planned Asset Replacement	**($)**	**($)**	**($)**	**($)**	($)	($)	($)	($)	($)	($)
Cable Injection Program	349,694	771,664	4,141,808	5,913,763	4,024,219	4,138,312	4,255,465	4,375,771	4,499,323	4,626,219
Cable Replacement Program	3,917,735	2,219,486	15,417,075	15,036,321	11,718,862	12,538,684	13,607,273	14,288,297	15,085,861	15,340,181
Emerging Cable Replacement Projects	119,989	1,968,435	1,463,874	1,070,775	491,687	520,801	1,050,756	1,081,576	1,113,287	1,145,915
Submersible Transformer Replacement - North	6,451	508,952	1,168,202	856,776	1,040,300	620,000	-	-	-	-
Switchgear Replacement Program	566,295	662,337	990,400	2,138,988	2,003,445	2,327,404	2,462,129	2,533,373	2,606,624	2,681,945
Distribution Lines - Emergency/Reactive Replace										
Storm damage - Replacement of Distribution Equip due to Storm	428,418	482,911	767,149	1,160,050	999,785	1,000,232	1,005,603	1,005,624	1,010,352	1,010,159
Switchgears - Unscheduled Replacement of Failed Switchgear	-	1,381,861	1,663,004	1,495,974	1,420,148	1,431,384	1,420,148	1,421,218	1,400,444	1,140,858
Unscheduled Replacement of Other Failed Distribution Equip	6,525,087	4,878,957	4,791,473	4,890,357	4,904,357	5,107,035	5,206,156	5,358,281	5,455,354	5,305,986
Overhead Lines - Planned Asset Replacement										
Pole Replacement Program	1,638,822	4,111,507	5,045,992	4,872,277	4,645,383	4,933,143	5,570,700	5,870,246	6,241,483	6,244,377
Unforeseen Projects Initiated by PowerStream	1,076,240	1,499,516	4,232,576	2,429,637	1,046,472	1,070,527	1,093,812	1,117,360	1,141,172	1,165,266
Storm Hardening										
Storm Hardening & Rear Lot Supply	-	-	-	-	3,499,998	7,900,017	7,999,752	7,499,834	6,900,540	7,200,072
Stations/P&C - Planned & Emergency										
Planned Circuit Breaker Replacement Markham TS1&2, Lazenby	-	-	-	-	747,766	-	-	1,087,788	1,119,281	-
Station Switchgear Replacement (ACA) 8th Line MS323	-	-	-	-	-	-	412,339	1,106,666	-	-
Station Switchgear Replacement (ACA) Patterson MS336	-	-	-	-	-	-	-	421,896	895,805	-
Total Material Investments System Renewal	**14,628,731**	**18,485,627**	**39,681,553**	**39,864,918**	**36,542,420**	**41,587,538**	**44,084,133**	**47,167,931**	**47,469,526**	**45,860,979**

1