SUSTAINING CAPITAL PROGRESS REPORT

SUMMARY

On page 14 of its May 15, 2008 Decision in EB-2007-0680, the Board stated, in part:

> "…the Board requires the Company to provide a report reflecting its progress in its replacement and maintenance programs for its underground cable replacement and plant replacement program, to be filed at the time of its next application dealing with rates beyond the test period dealt with in this proceeding."

This Report is filed in compliance with the Board's direction.

THESL has been, and will continue to be, committed to maintaining reliability levels commensurate with the needs of its customers by proactively addressing the root causes of customer interruptions and the issues relating to safe and reliable operation of its distribution system infrastructure. During the 2008 and 2009 time frame, THESL maximized customer benefits by utilizing its approved sustaining capital funds for investments into critical assets such as switches, cables, and transformers. By directing capital investments into the appropriate assets in the right locations, THESL has been successful in beginning to show improvement in reliability, which is demonstrated by a reduction (ten percent) in SAIFI level during the 2008 calendar year. The main contributor to this improvement is THESL's continuous focus on rehabilitation and renewal of its key assets that are at the end of their useful lives.

While asset sustaining investments in 2008 and 2009 are producing improvements in reliability, sustaining investment will need to increase significantly to reduce the risk of in-service failure of assets that have reached the end of their useful lives and are now due for replacement. This is evident from asset condition assessment results as well as the fact that defective equipment, on an increasing trend, continues to be the major cause of outages (over 50 percent). Furthermore, results from THESL's risk based review of selected asset classes, which considers condition, and failure probability and impact, strongly suggest a large backlog of replacement requirements. These are assets that should have already been replaced as they pose an unacceptable risk of outages to customers. Many of these deferrals are a result of the OEB's Decision in EB-2007-0680, which reduced THESL's sustaining capital budget by 20 percent.

Under the rehabilitation/renewal program completed over the past two years, for some of the asset classes, fewer units were replaced/rehabilitated than planned, whereas for other assets, more units have been replaced or rehabilitated. In spite of these minor variations in project implementation, based on the overall progress, THESL will exceed its planned target of replacing high risk assets by more than ten percent, which is equivalent to over 500 units.

During this time period, THESL also assessed the effectiveness and cost efficiency of a number of additional measures to improve power supply reliability. Some of these measures are aimed at extending the life expectancy of existing assets, others complement asset replacement investments by further improving reliability. In either case, these measures help mitigate, to some degree, the adverse impacts of deferral of capital investments.

Pilot projects involving cable replacement through directional boring technique and cable rehabilitation through injection of cable with silicone compounds were planned, completed, and analyzed. The pilot project revealed that these alternatives to traditional cable replacement can be effective and cost efficient only in a relatively small fraction of the identified cable replacement projects. Some typical problems with these alternatives include increased number of customer outages and complaints during project implementation, significantly higher costs than anticipated and continued cable failures even after the rejuvenation procedure.

The cable rejuvenation projects through silicone injection are less effective on cable circuits that are experiencing repeated failures due to advanced stage of insulation tree development and that contain a large number of splices due to prior cable failures. Similarly, directional boring is not cost effective in congested right-of-ways with large number of obstacles, requiring sharp turns in cable installation routes. Based on the lessons learned from the pilot projects, these alternatives would be useful in some limited cases under specific conditions, but a majority of the cable circuits at the end of their useful life will need to be replaced using conventional techniques. Furthermore, to reduce and defer the costs associated with the cable replacement projects, THESL has embarked on a risk based approach for identifying cable segments for replacement. This risk based technique is intended to focus the investments into cable replacements that would maximize the benefits and reduce the overall project costs.

THESL will continue to replace and rehabilitate assets as they reach the end of their useful lives, using prudent approaches to maximize the benefits and reduce costs. Since a large number of assets are approaching end of life, THESL plans to continue to focus its capital investments into critical assets for the foreseeable future in order to maintain acceptable levels of reliability and public safety.

BACKGROUND

In its Application for rates to be effective May 1, 2008, May 1, 2009 and May 1, 2010 (EB-2007-0680), THESL submitted a sustaining capital plan encompassing the renewal of existing assets at the end of their useful lives and the development of new assets to expand and extend the distribution system to serve new customers or load growth by existing customers. The plan included investments in 17 asset classes. A unit replacement forecast was developed for each of the asset classes, and the classes were grouped into functional portfolios. A list of projects estimated to cost greater than $500,000 was submitted in support of the planned investment.

The Board Decision in EB-2007-0680 ordered a 20 percent reduction in sustaining capital spending for each of 2008 and 2009, amounting to approximately $40 million, which required prioritization of projects for implementation and selection of projects for deferral. Projects for deferral were selected by taking into account the short-term resource/asset efficiencies and impacts of project deferral on customer reliability.

It should be noted that due to the large scope of some projects, it is necessary to commence construction on these projects early in the year, so that they can be completed during the year. For example, many projects in Portfolio 1 require that civil construction start in the earlier part of the year so that cable installation work and final project commissioning can be completed on schedule. Thus, at the time of the Board's decision on May 15, 2008, it was not practical to stop work on those projects that had already been started. Consequently, the candidate projects for deferral were limited.

A cross-functional team reviewed available projects to determine which were suitable for deferral and investigated appropriate mitigation measures to limit the adverse impacts of project deferrals on reliability and safety. During this review process, feeder/project maps were analyzed with respect to reliability risks in order to recommend the most appropriate course of action in each case. The actions taken to mitigate the impact of project deferrals and their effectiveness are briefly described below. Many of these mitigation measures are not alternatives to asset renewal and replacement, but rather are complementary and provide additional benefits. In any case, implementation of these measures helps reduce the adverse impacts of project deferral on reliability.

- install additional equipment (fuses, switches, animal guards)

- more frequent asset cleaning
- injection of cables with silicone fluids
- directional boring

While the reliability improvement measures offer important benefits when projects involving asset replacement are deferred, they cannot produce acceptable reliability levels by themselves. Assets at the end of their useful lives ultimately must be replaced to realize long-term reliability improvements.

Taking into account the benefits from asset renewal and replacement and the additional reliability improvement measures described above that will be implemented by the end of 2009, THESL estimates that over 2.2 million Customer Minutes Out ("CMOs"), over 56,091 Customer Interruptions ("CIs"), and over 92 outages will be addressed at the end of the two year period from the direct buried cable portfolio (Portfolio 1 in the ten-year capital plan) alone. This portfolio is primarily driven by the end-of-life of early vintage XLPE direct-buried cable and its main benefit is reliability improvement.

SCOPE OF SUSTAINING INVESTMENTS

To explain the scope and type of sustaining investments, the projects implemented during 2008 and 2009 are described under the following three titles : (a) Sustaining Capital Expenditures, which provides forecasts of capital investments into renewal of different asset classes to be completed by the end of 2009, (b) Asset Class Unit Attainment, which documents quantities of assets forecast to be replaced by the end of 2009 and (c) Status of projects greater than $500,000, which provides project specific details for large projects.

Sustaining Capital Expenditures

Summary

In EB-2007-0680, THESL proposed sustaining capital budgets for 2008 and 2009 totalling $239.2 million; the Board approved $191.4 million (80 percent of the amount requested). As described previously, projects for deferral were selected to achieve a balance between the short-term resource/asset efficiencies and the impacts of project deferrals on customer reliability.

Analysis

Based upon THESL's 2008 actual sustaining capital investments and its 2009 forecast, THESL's sustaining capital spending is expected to be $218.9 million, which is 14 percent above the amount authorized in EB-2007-0680. This increase in capital expenditure is primarily attributable to:

- $12.3 million ($10 million in 2008 and $2.3 million forecasted for 2009) in contributions that have not been netted out of sustaining capital figures;
- $10.0 million in extra civil work to allow for execution of the larger capital program planned for 2010
- reliability improvements and new initiatives such as increased installation of animal guards, fault current indicators, re-insulation and smart grid pilot projects in feeder automation and distribution transformer monitors

Table 1 below represents a summary of the original budget, the approved budget and the forecast expenditure on sustaining capital for 2008 and 2009 combined.

Table 1: Summary of Sustaining Capital for 2008 and 2009

Sustaining Capital	EB-2007-0680 Requested ($ million)	EB-2007-0680 Approved ($ million)	2008 - Actuals plus 2009 - Forecast	Attainment vs EB-2007-0680 Decision	
				($ million)	%
2008	115.1	92.1	102.9	+10.8	112%
2009	124.1	99.3	116.0	+16.7	117%
Total	**239.2**	**191.4**	**218.9**	**+27.5**	**114%**

Asset Class Units

Summary

Asset class unit figures are shown in comparison to Table 5 of the previously filed report in THESL's 2008 Application titled "2007-2016 Electrical Distribution Capital Plan" (EB-2007-0680, Exhibit D1, Tab 8, Schedule 10, page 12). The asset classes that are shown in that report and addressed here are:

- Station Transformers
- Circuit Breakers
- Switchgear Assemblies
- Network Transformers/Protectors
- Submersible Transformers
- Vault Transformers
- Pole-Mounted Transformers
- Pad-Mounted Transformers
- Poles
- Overhead Switches – Remote Operated
- Pad-Mounted Switchgear
- Automatic Transfer Switches
- Underground Cable in Duct
- Underground Cable Direct-Buried

- Network Vaults
- Cable Chambers

In EB-2007-0680, THESL recommended the unit replacement forecast shown in Table 5 of the previously filed "2007-2016 Electrical Distribution Capital Plan." The Board's 20 percent reduction to sustaining capital resulted in a reduction to unit replacements that impacted certain asset classes more than others.

1 *Analysis*

2 **Table 2: Scorecard of Asset Class Units for 2008-2009**

2008 and 2009 Units						
Asset Class	UoM	Target		Actuals	Attainment	
		THESL-Initial	Post EB-2007-0680	Replaced 2008/2009	Units[1]	%
Station Transformers	ea	12	12	12	0	100%
Circuit Breakers (Station)	ea	45	45	55	10	122%
Switchgear Assemblies (Station)	ea	8	8	8	0	100%
Network Trans/Protectors	ea	123	114	100	-14	88%
Submersible Transformers	ea	1,232	1,106	914	-192	83%
Vault Transformers	ea	51	42	85	43	202%
Pole-Mounted Transformers	ea	704	620	1,158	538	187%
Pad-Mounted Transformers	ea	352	346	108	-238	31%
Wood/Concrete Poles	ea	2,229	1,918	2,411	493	126%
Overhead Switches - Remote Operated	ea	100	81	74	-7	91%
Pad-Mounted Switchgear	ea	115	110	116	6	105%
Automatic Transfer Switches	ea	10	10	10	0	100%
Underground Cable In Duct	km	103	103	149	46	145%
Underground Cable Direct Buried	km	475	263	147	-115	56%
Network Vaults	ea	20	20	3	-17	15%
Cable Chambers	ea	60	60	75	15	125%
Total		**5,639**	**4,858**	**5,426**	**568**	**112%**

3 [1] Difference between actual and post-OEB decision unit numbers

Table 3: Unit attainment for 2008 and 2009

2008 and 2009 Units – Attainment				
Asset Class	< 95%	95%-105%	< 105%	Comments
Station Transformers		√		Two additional transformers were purchased for emergency purposes but not installed. These two transformers do not form part of the attainment figures.
Circuit Breakers (Station)			√	Deteriorated field conditions called for more circuit breaker replacements.
Switchgear Assemblies (Station)		√		
Network Trans/Protectors	√			Previous EDR cut
Submersible Transformers	√			Many units failed and were required to be replaced on a reactive basis.
Vault Transformers			√	Deteriorated field conditions called for more Vault Transformer replacements.
Pole-Mounted Transformers			√	This is a run-to-fail asset. Many units failed and were required to be replaced on a reactive basis.
Pad-Mounted Transformers	√			Under-attainment due to City restrictions on installing Pad-mounted transformers. Require further co-ordination with City.
Wood/Concrete Poles			√	Initial targets were intended to include concrete poles as well, thus attainment figures include both wood and concrete poles. Over-attainment required to address backlog of deteriorated poles.

2008 and 2009 Units – Attainment				
Asset Class	< 95%	95%-105%	< 105%	Comments
Overhead Switches - Remote Operated	√			Many units failed and were required to be replaced on a reactive basis.
Pad Mounted Switchgear			√	
Automatic Transfer Switches		√		
Underground Cable In Duct			√	Additional cable piece-out program initiated due to recently addressed safety related issue. This is intended to alleviate cable congestion issues in the downtown core.
Underground Cable Direct Buried	√			Due to timing of EB-2007-0680 Decision, civil expenditures were incurred, however no direct buried cable was replaced. Risk-based approach for identifying cable segments (rather then full length of feeder) is in development to address concerns about the higher cost full replacement approach. Alternatives such as Directional Boring and Cable Injection have been investigated. In some cases, this may lead to more cost effective alternatives.
Network Vaults	√			At some locations, roofs were rebuilt rather than rebuilding the entire network vault.
Cable Chambers			√	Deteriorated field conditions and cable congestion called for more cable chamber replacements.

Table 2 and Table 3 illustrate the number of units installed in 2008 and planned for installation in 2009. These tables show that for some asset classes more units will be replaced or rehabilitated than planned, while for other asset classes fewer units will be completed. In spite of these minor variations from plan in the mix of asset classes, based on the overall progress, Toronto Hydro will exceed its planned target of replacing high risk assets by more than ten percent, which is equivalent to over 500 units.

Projects Greater Than $500k

Summary

Many projects proposed in EB-2007-0680 had to be deferred to meet the sustaining capital reductions.

Analysis

Approximately 40 percent of the projects presented in the last filing were deferred; many of them as a direct result of the 20 percent reduction to sustaining capital ordered in the EB-2007-0680 Decision. In addition, even for the projects that were constructed during 2008 as planned and those planned for completion in 2009, many variances are evident.

Tables 4 and 5 below represent a summary of the project status for 2008 and 2009 combined.

Table 4: Summary of Project Status for 2008-2009

Completed or Forecast Complete	59%
Deferred	41%

1 **Table 5: Project Status for 2008 and 2009 Projects greater than $500,000**

Projects Greater Than $500,000 2008 and 2009				
Project #	Estimated Cost ($)	Status	Actual/Forecast during 2008/2009 ($)	Percent Variance (%)
E07316	3,267,000	Deferred		
E07317	5,118,000	Completed	5,277,997	3%
E07319	4,768,000	Forecast Complete	4,388,883	-8%
E07323	6,801,000	Forecast Complete	9,730,519	43%
E07355	684,000	Forecast Complete	751,065	10%
E07358	6,010,000	Deferred		
E08300	784,196	Deferred		
E08118	4,057,000	Completed	3,831,436	-6%
E08119	2,726,000	Completed	3,236,241	10%
E08124	1,760,000	Deferred		
E08141	1,766,000	Completed	1,363,254	-23%
E08161	886,000	Completed	312,012	-65%
DC_E08066	1,200,000	Completed	1,128,066	-6%
DC_E08070	1,454,600	Completed	528,517	-64%
DC_W08086	1,455,000	Completed	242,327	-83%
DC_W08091	800,000	Completed	990,921	24%
E08037	519,000	Completed	697,955	34%
E08061	615,000	Deferred		
E08069	1,200,800	Completed	2,029,937	69%
N08214	805,000	Completed	796,419	-1%
W07324	570,000	Deferred		
W07327	700,000	Deferred		
W07366	2,343,000	Completed	5,151,931	120%
W08029	2,253,000	Completed	2,858,768	27%
W08030	2,250,000	Forecast Complete	2,300,000	2%
W08087	1,599,000	Forecast Complete	2,434,182	52%
W08109	1,117,000	Completed	2,173,207	95%

Projects Greater Than $500,000
2008 and 2009

Project #	Estimated Cost ($)	Status	Actual/Forecast during 2008/2009 ($)	Percent Variance (%)
W08139	655,000	Deferred		
W08192	2,000,000	Deferred		
W08209	1,352,000	Deferred		
W08213	1,500,000	Completed	770,399	-49%
W08217	1,343,000	Deferred		
W08243	797,000	Deferred		
W08244	1,350,000	Forecast Complete	1,500,000	11%
DC_E08074	518,000	Completed	194,899	-62%
DC_W08090	518,000	Completed	986,640	90%
E08033	1,574,000	Completed	1,918,488	22%
E08215	1,827,000	Completed	1,295,115	-29%
E08229	793,602	Completed	1,152,013	45%
E08232	3,800,000	Completed	2,498,732	-34%
E08245	802,000	Completed	963,799	20%
W07278	1,827,000	Completed	1,095,356	-40%
W08131	766,000	Forecast Complete	1,200,000	57%
W08191	650,000	Deferred		
N08144	5,000,000	Completed	3,914,964	-22%
N08148	654,000	Completed	557,867	-15%
S08132	3,000,000	Forecast Complete	1,576,405	-47%
S08153	3,000,000	Forecast Complete	5,933,028	98%
S08190	3,000,000	Forecast Complete	5,624,177	87%
S08081	700,000	Completed	200,000	-71%
S08170	645,000	Completed	735,378	14%
E07315	9,851,000	Forecast Complete	13,483,760	37%
E08113	1,733,822	Deferred		
E08115	4,680,000	Deferred		
E08116	5,310,000	Deferred		

Projects Greater Than $500,000 2008 and 2009				
Project #	Estimated Cost ($)	Status	Actual/Forecast during 2008/2009 ($)	Percent Variance (%)
E08117	4,860,000	Forecast Complete	3,736,949	-23%
E08130	3,080,000	Forecast Complete	335,454	-89%
E09084	1,320,000	Deferred		
E09085	2,420,000	Deferred		
E09086	2,640,000	Deferred		
E09087	1,430,000	Deferred		
E09088	4,510,000	Deferred		
E09089	880,000	Deferred		
E09091	3,630,000	Completed	602,606	-83%
W09081	600,000	Deferred		
W09097	780,000	Deferred		
W09098	2,280,000	Deferred		
E08220	815,428	Deferred		
DC_E09128	1,200,000	Forecast Complete	1,060,000	-12%
DC_E09129	1,454,600	Forecast Complete	1,485,000	2%
DC_W09132	1,455,000	Forecast Complete	1,046,300	-28%
DC_W09134	800,000	Forecast Complete	940,000	18%
E09116	1,200,800	Forecast Complete	2,029,937	69%
W09145	1,800,000	Completed	1,963,691	9%
W09101	4,000,000	Forecast Complete	5,900,000	48%
W09102	2,500,000	Deferred		
W09123	1,500,000	Deferred		
W09125	650,000	Deferred		
W09157	625,868	Deferred		
E09170	600,000	Deferred		
DC_E09131	518,000	Forecast Complete	523,000	1%
DC_W09133	518,000	Forecast Complete	600,000	16%
E07163	1,419,726	Deferred		

Projects Greater Than $500,000 2008 and 2009				
Project #	Estimated Cost ($)	Status	Actual/Forecast during 2008/2009 ($)	Percent Variance (%)
E08050	1,520,000	Forecast Complete	1,214,707	-20%
E09117	1,900,000	Forecast Complete	2,962,900	56%
W09042	1,900,000	Deferred		
W07111	550,000	Deferred		
W07297	1,100,000	Deferred		
W09095	500,000	Deferred		
W09096	3,500,000	Deferred		
W09099	1,200,000	Deferred		
W09103	800,000	Deferred		
W09104	2,500,000	Deferred		
W09124	500,000	Deferred		
E09135	2,500,000	Forecast Complete	2,500,000	0%
W09119	2,500,000	Forecast Complete	2,680,000	7%
S09043	3,145,560	Forecast Complete	500,000	-84%
S09120	700,000	Forecast Complete	200,000	-71%
S09169	1,200,000	Forecast Complete	534,046	-55%
Total (for Completed or Forecast Complete)	122,909,962		126,639,247	3%

Table 4 and Table 5 show that many of the largest projects that were originally planned to be executed in 2008 and 2009 were deferred to later years. In most cases this was due to the 20 percent reduction in sustaining capital. Also, for the same reason, many projects had significant scope change as THESL worked to achieve reliability improvements while managing the overall level of investment. This explains some of the variations projected between final costs and original estimates for individual projects. Overall, for the completed large projects, the final costs are projected to be three percent higher than original estimates.

Maintenance Expenditures

Summary

In EB-2007-0680, THESL proposed maintenance expenditures of $57.5 million for 2008 and 2009. The 2008 actual and the 2009 forecasted expenditures are $52.8 million.

Analysis

Based upon THESL's 2008 actual and 2009 forecasted expenditures, THESL's Maintenance expenditures are $4.7 million below the proposed expenditures. This represents an eight percent decrease. The reductions in maintenance expenditures can be attributed to the following:

- ($0.1) million reduction in Predictive maintenance unit costs in 2008,
- $0.1 million increase in Corrective maintenance units to clear backlog in 2008,
- ($2.1) million reduction in Emergency maintenance due to realignment of the emergency response crew to focus primarily on power restoration in 2008 and 2009,
- ($0.3) million reduction in Preventive maintenance due to readjusted costs for some of the preventive maintenance programs to reflect field conditions in 2009,
- ($0.1) million reduction in Predictive maintenance due to the advancement of a portion of pole testing from in 2009 to 2008,
- ($2.2) million reduction in Corrective maintenance due to the ramping up of the capital renewal program.

Maintenance data collected is used to provide information on condition of assets. This aids in the selection of capital renewal requirements. Table 6 below represents a summary of the maintenance expenditures for 2008 and 2009 combined.

Table 6: Summary of Maintenance Expenditures for 2008-2009

2008 and 2009	EB-2007-0680 Requested ($ million)	2008 - Actual 2009 - Forecast	Attainment	
			($ million)	%
Preventive	17.6	17.3	-0.3	98
Predictive	3.0	2.8	-0.2	93
Corrective	21.4	19.3	-2.1	90
Emergency	15.5	13.4	-2.1	86
Total Maintenance Programs	**57.5**	**52.8**	**-4.7**	**92**

ALTERNATE CABLE STRATEGIES AND PLANNING METHODS

The following sections are intended to provide an overview of the alternative strategies THESL has and will continue to investigate for direct-buried rehabilitation:

CABLE INJECTION

Since its previous Application (EB-2007-0680), THESL has invited some vendors to share the details of their cable injection technology. Subsequently, THESL selected two leading vendors (Novinium and Transelec) to test cable injection techniques and gain experience in cable rejuvenation. The pilot project sites, shown in Figure 1 below, were selected based on cable age and failure history. These projects were identified as direct buried cable replacement projects under Portfolio 1 for 2008. A cross-functional team of professionals at THESL developed an evaluation matrix for assessing the two vendors.

The process requires assessing the condition of the neutral conductor, locating splice joints, digging pits to expose the old splices and replacing with two new splices and a piece of cable that must allow flow through. Where the neutral conductor has corroded, the cable injection process is not recommended, therefore leaving cable replacement as the only viable option. Only after establishing a healthy neutral can the injection process begin. Locating splices is not always accurate and often requires extra digging leading to increased civil costs, multiple switching operations causing customer interruptions, and delays in the project schedule. In some cases, interruptions were long and disruptive to customers.

THESL's field experience indicates that following the cable injection process, there were two cable failures at the pilot sites in a short period of time. Upon analysing the failed cable sections, it was determined that the subject cable section had already deteriorated to the point where it had developed electrical trees. The cable rejuvenation process is unable to remediate cable sections that have developed electrical trees and therefore pose a risk in the process of extending the useful life of the cables. Furthermore, the cable injection can only be performed once on any given section of cable which eventually leads to cable replacement.

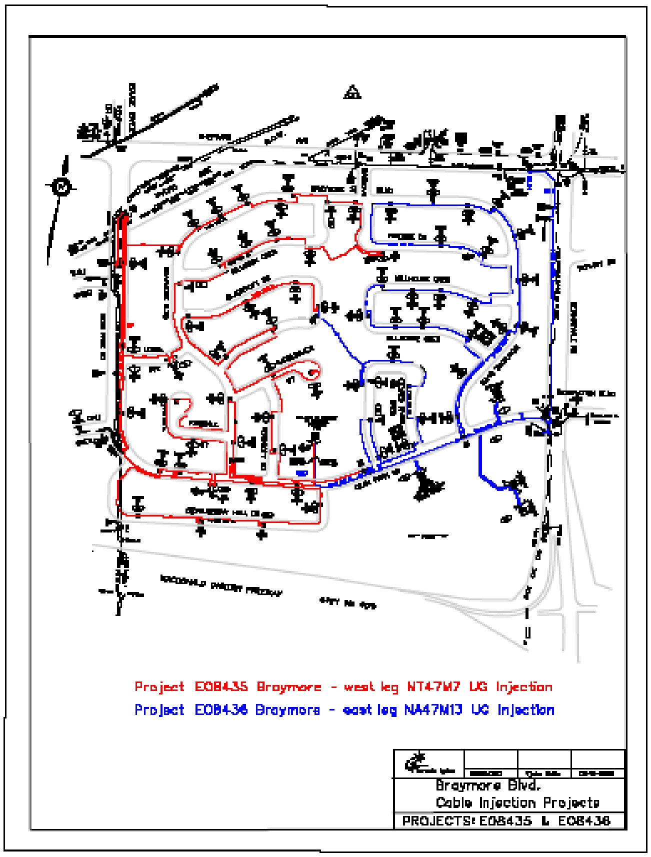

Figure 1: Pilot Project Site for 2008 Cable Injection (Braymore East – Transelec and Braymore West – Novinium)

In summary, the cable rejuvenation by cable injection is not deemed to be an economical and technically optimal solution as it is only feasible on a small selection of THESL's rapidly aging asset base with significant negative factors contributing to higher costs and lower customer satisfaction due to increased power interruptions.

DIRECTIONAL BORING

In 2008, THESL also started to evaluate another alternative to the standard approach of open trenching when replacing direct buried cable. A pilot project, as shown in Figure 2 below, was setup to assess the feasibility of directional boring in a typical rehabilitation project. THESL selected a leading civil contractor and reviewed their criteria for directional boring. The civil contractor required:

- 1.0 meter clearance from the existing direct buried energized cables,
- certain limitations on number of cable ducts and bend radius, and
- day-lighting for all utilities being crossed.

These factors greatly limit the extent of directional drilling. For the pilot project, the actual portion of the project that was feasible by directional boring was limited to four percent.

In summary, while directional boring has some benefits such as, lower civil costs, minimum tree disturbance and reduced surface disruption, it has inherent constraints that challenge the viability of this approach on typical rehabilitation projects.

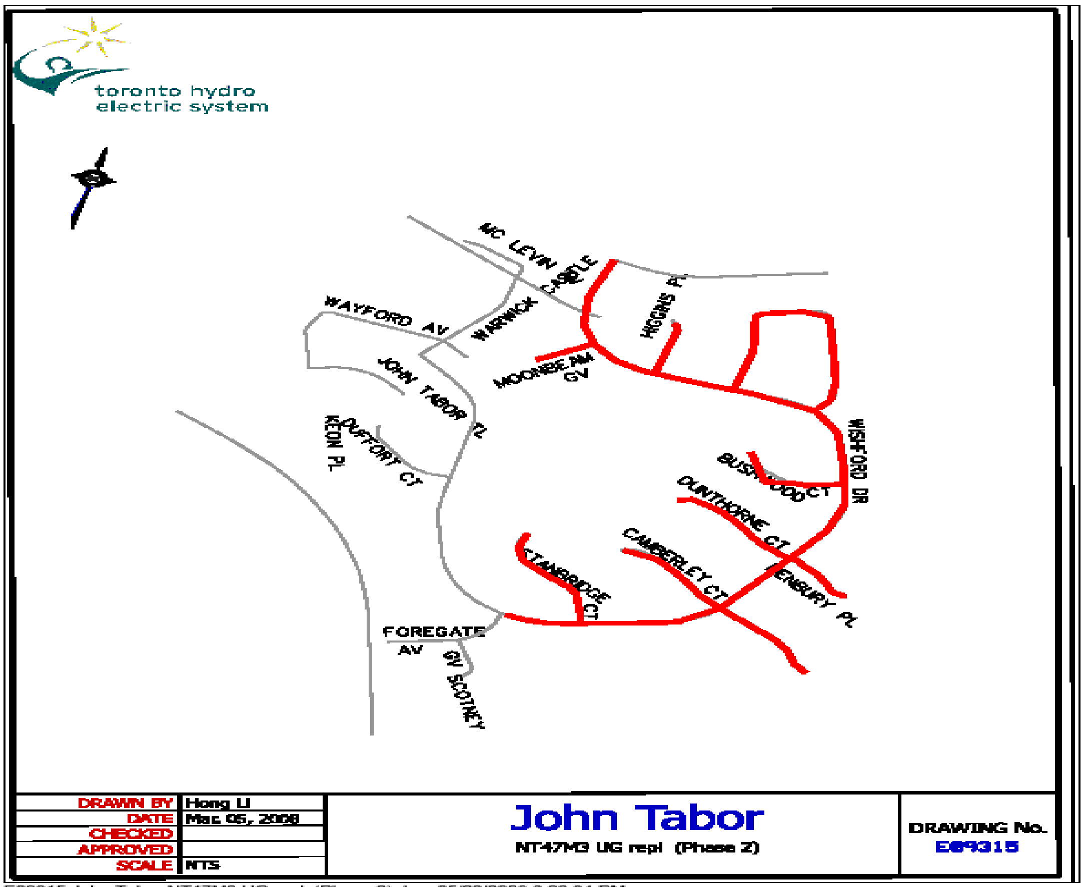

Figure 2: Pilot Project Site for 2008 Directional Boring

CABLE TESTING

In the spring of 2009 THESL embarked on a cable testing experiment using “Off-Line” Partial Discharge testing to identify possible defects in the insulation of direct buried cable systems. Partial Discharge testing involves applying high voltage to sections of the cable system and interpreting the results to detect existing defects.

Key Findings:

- THESL tested 55 cable sections or 7.5 kilometres of direct-buried cable
- The testing required significant planned outages for our customers
- Overall, 54.5 percent (30 cable sections) had defects identified

- One section that was interpreted as being in good condition, failed shortly afterwards

Overall, the testing confirmed the previously assessed poor condition of the direct-buried cable systems and THESL will continue to further evaluate the testing methodology to determine its accuracy and practical use.

RISK-BASED APPROACH

THESL is continuing to examine best practice planning methods to proactively evaluate and select assets that require replacement. For this examination, THESL has introduced a risk-based approach, which focuses on individual assets and is data-driven. It assists engineers in identifying the optimal replacement time for each asset based on asset condition, risk, criticality, and life-cycle costs of asset ownership. Currently, the risk-based analysis modules have been built for four of THESL's sixteen major asset classes namely:

- Underground Transformers (Submersibles, Vault and Pad-mounts),
- Underground Direct Buried Cable,
- Underground Pad-mounted Switches (PMHs), and
- Network Units (Network Transformer and Protector).

Risk is evaluated based on probability of failure (age, faults, material type, condition) and consequences of failure (outages, safety, environment, financial). This allows for prioritization of the cables (or other assets) requiring replacements. Figure 3 is a representation of the required spending for primary direct buried cable based on the cable risk method. The results show the need for immediate investment to address the backlog, and show only the spending required on cable and not overall project cost. However, for practical reasons (planned outages, resource requirements, and funding) it is not feasible to undertake an investment this large in one year, and therefore THESL proposes this spending over several years as per its ten-year capital plan.

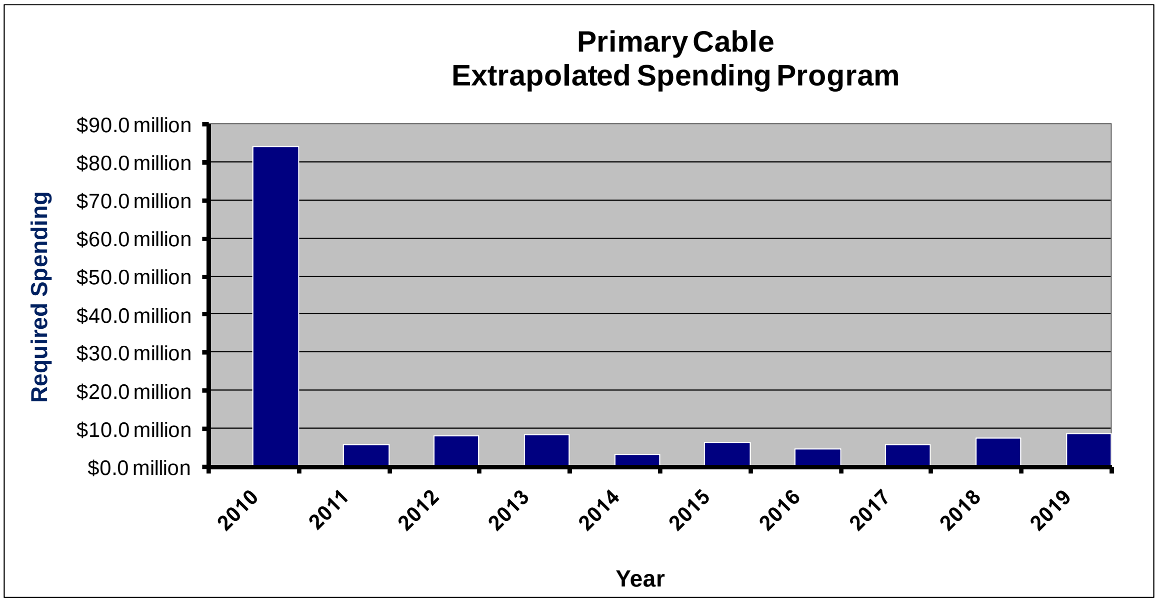

Figure 3: Required spending for primary direct buried cable (cable only)

Figure 4 is a representation of the process used to enable the capture and analysis of risk for direct buried cable.

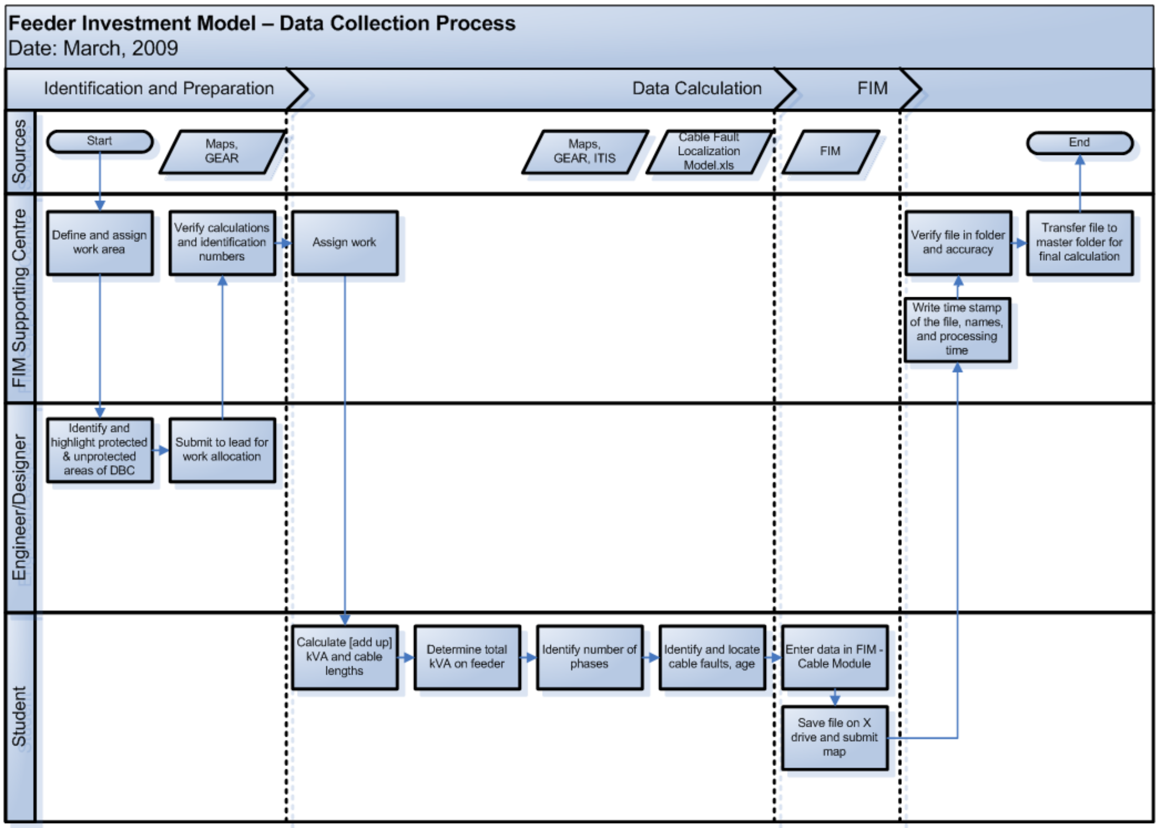

Figure 4: Process used to enable the capture and analysis of risk for direct buried cable.

THESL will continue advancing its Asset Management approach by introducing risk as an additional element for asset-related investment decisions by extending the risk-based intervention decision-making model, tools and methodologies across remaining asset classes. Since data is a key driver of the model output, a key success factor in the quality of the model output is the quality of the data input. THESL will need to improve the quality of data related to condition, failure rate, and consequences of failure. Improved data quality will allow engineers and managers to pin point intervention periods and the costs and consequences of delaying action with more precision and, consequently, improve capital planning.