

1                                   **ASSET CONDITION ASSESSMENT & ANALYSIS**

2  
3   **1.0   INTRODUCTION**

4  
5   This Schedule summarizes Hydro One Distribution’s Asset Condition Assessment (ACA)  
6   practices, processes and ACA findings for key distribution system components,  
7   equipment, and facilities. Hydro One Distribution’s ACA practices are based on studies  
8   carried out by Acres International Ltd, comparisons with other members in the electrical  
9   utility industry and expert opinion available within Hydro One. The practices are also  
10   based on a review of good utility practice.

11  
12   ACA is one of the tools that are used to detect and quantify the extent of asset  
13   degradation of distribution system equipment and to provide a means of estimating  
14   remaining asset life based on condition. The rate of change in asset condition over time  
15   helps to identify deterioration trends. This information also helps to establish  
16   maintenance, refurbishment or replacement requirements based on the asset’s ability to  
17   perform reliably. It must be recognized that the level of ongoing maintenance can have a  
18   pronounced effect on the life of some assets, and where this is the case, it is the ACA  
19   results that provide a barometer to assess the effectiveness of these maintenance  
20   programs, as well as identifying future end-of-life (EOL) replacement requirements.

21  
22   Hydro One Distribution monitors the condition of its assets through a number of  
23   activities that include targeted asset condition assessments, maintenance activities, EOL  
24   assessment studies and incident investigations. These techniques are used to identify  
25   assets whose performance could have serious negative impact on Hydro One’s business  
26   values and therefore require refurbishment or replacement, or in some cases, removal.  
27   The information is also used to decide on changes to maintenance practices when this is

1 the economical solution. ACA information is a significant factor in determining the  
2 priority of work requirements for Sustaining Capital and OM&A programs.

3  
4 **2.0 OVERVIEW**

5  
6 The effective and efficient operation of the asset management model requires accurate,  
7 timely and sufficient asset information for decision making purposes. This information is  
8 used to support investment decision processes by enabling the assessment of risks to the  
9 Business Values (“BVs”) and Key Performance Indicators (“KPIs”) for various  
10 alternatives. For additional information concerning the BVs and KPIs refer to Exhibit A,  
11 Tab 3, Schedule 1.

12  
13 The effective management of distribution assets requires the identification and optimum  
14 mitigation of risk to the BVs. This is achieved by balancing lifecycle costs and the  
15 related asset performance. If the asset management focus were strictly on improving or  
16 maintaining asset condition without due consideration of the resultant risk mitigation,  
17 then the result would be unnecessarily high expenditure levels. A specific asset health or  
18 condition does not automatically prescribe a set course of action or its timing. Other  
19 considerations include operating conditions (e.g. loading levels), technical obsolescence,  
20 asset demographics, spare parts availability, asset performance (e.g. asset failure rates,  
21 reliability trends), environmental factors, financial implications and the long term  
22 strategy for managing a particular asset type. Additional details concerning work  
23 program prioritization can be found in Exhibit A, Tab 14, Schedule 5.

24  
25 Recognizing that gathering detailed condition information on every individual asset and  
26 every “nut and bolt” is both practically infeasible and not required, distribution assets  
27 were grouped into 20 logical asset classes. These classes were prioritized and further  
28 grouped into three categories, Priority 1 (P1); Priority 2 (P2); and Priority 3 (P3) based on

1 their value to the business. These priorities determine the importance of acquiring  
 2 condition information. The asset priority results are shown below.

3  
 4  
 5

**Figure 1: Prioritization of Assets**

Priority 1 (P1) <ul style="list-style-type: none"> <li>• High Value</li> <li>• High Risk</li> </ul>	Priority 2 (P2) <ul style="list-style-type: none"> <li>• Moderate Value</li> <li>• High Risk</li> </ul>	Priority 3 (P3) <ul style="list-style-type: none"> <li>• Low Value</li> <li>• Lower Risk</li> </ul>
Asset Class	Asset Class	Asset Class
Station Transformers	Station Reclosers & Breakers	Other Spares
Station Land Assessment & Remediation (Site Contamination)	Station HV Switches & Fuses	AC/DC Service Equipment
Overhead Line Sections	Station Sites and Structures	Feeder Protection (Switch/Fuse)
Wood Poles	Mobile Substations	Oil Containment
Right of Way (ROW) Vegetation	Transformer Spares	PCBs – Stations
	Submarine Cables	Switches – Lines
	Underground Cables	Reclosers - Lines
		Transformers - Lines

6  
 7 P1 assets represent the highest priority assets and are of high value (in terms of total  
 8 sustaining program expenditures) and high risk to the business. P2 assets are second in  
 9 priority with moderate program expenditures and high risk; and P3 assets are lowest in  
 10 priority with low program expenditures and lower risk to the business. For the high  
 11 value/high risk P1 assets, detailed asset condition assessments are carried out that involve  
 12 documenting asset description, demographics, condition criteria, and condition  
 13 assessment results. For P2 assets, in some cases detailed asset condition assessments are  
 14 carried out, but not to the same level of detail as with P1, and in other cases, the  
 15 management of condition relies on routine or time based maintenance programs.  
 16

1 The P3 assets are managed to a great extent using routine programs (e.g. line patrols,  
2 defect corrections, trouble call response) that collect condition data as necessary and  
3 ensure they are maintained to Hydro One Distribution's standards. The routine programs  
4 put in place for P3 assets have longer cycles and use data to trigger asset management  
5 actions.

6

### 7 **3.0 THE ACA PROCESS**

8

9 Hydro One Distribution carries out asset condition assessments using an approach that  
10 describes the ACA objectives, prioritization, process, and criteria to be used for assessing  
11 the condition of its distribution assets. Hydro One Distribution assesses the condition of  
12 its assets through inspections, testing, and preventative maintenance activities, making  
13 improvements to its data collection process and carrying out special condition surveys or  
14 EOL assessment studies when required. Valuable asset condition information may also  
15 be obtained through incident investigations and special EOL studies for specific assets.

16

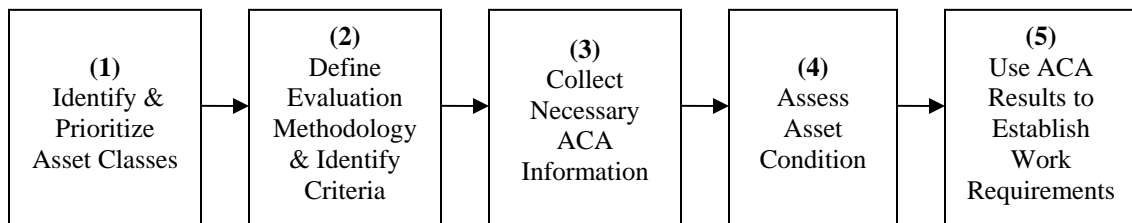
17 An outline of the steps involved in the asset condition assessment process is illustrated in  
18 Figure 1 below.

19

20

**Figure 2: General ACA Process**

21



22

23

24 The major steps in the ACA process as depicted in Figure 1 are:

25

- 1 1. Identify asset classes and prioritize them (i.e. P1, P2, P3) based on the value the  
2 assets represent to the business, which in turn determines the importance of acquiring  
3 condition information.  
4
- 5 2. Define the asset information needed to determine and evaluate asset condition against  
6 predefined condition indicators based on failure mode analysis and expected results  
7 or specifications for higher priority asset classes.  
8
- 9 3. Collect the necessary asset condition information. Define the measurements, and  
10 coordinate and schedule the necessary work to collect relevant asset condition  
11 information that will enable the development of appropriate work programs or  
12 projects to respond to condition deficiencies and mitigate the BV risks. This  
13 information may be obtained through regular testing, surveys, inspections or studies.  
14
- 15 4. Analyze the asset condition and performance information to identify population  
16 condition, performance trends and high risks and impacts of asset condition on  
17 meeting business objectives, including service quality standards.  
18
- 19 5. Use the asset condition assessment results to support detailed Sustaining and  
20 Development Capital and OM&A programs and projects. ACA information is a  
21 critical input to determine the level of work required in conjunction with other factors  
22 such as equipment performance, environmental considerations, availability of spares  
23 and customer reliability.  
24

### 25 **3.1 Asset Condition in Comparison to Asset Defects**

26

27 The ACA process is intended to measure asset degradation, the criticality of the  
28 degradation, and the remaining asset “life.” When considering ACA, it is important to

1 understand the differences between defect management and regular maintenance versus  
2 long term asset degradation and asset condition assessment. Defects are usually well  
3 defined and associated with failed or defective components which make up an asset and  
4 affect the operation and reliability of the asset well before end of life. These do not  
5 normally affect the life of the asset itself, if detected early and corrected. Defects are  
6 routinely identified during inspection and dealt with by maintenance activities to repair or  
7 replace failed components and thereby ensure continued reliable operation of the asset.

8

9 Long term degradation is generally less well defined and is not easily determined by  
10 routine visual inspection. The asset condition assessment's purpose is to detect and  
11 quantify long-term degradation and provide some means of quantifying remaining asset  
12 life. This includes identifying assets that are of "high risk" or at end of life that will  
13 require major capital expenditure to refurbish or replace, or eliminate altogether.

14

#### 15 **4.0 ASSET CONDITION SUMMARY AND RESULTS**

16

17 The following sections highlight the prioritized asset classes that Hydro One Distribution  
18 uses and provides the most recent set of summarized ACA results for high priority asset  
19 classes. Subsequently, detailed, analysis and comments are provided on the results.

20

#### 21 **4.1 Detailed ACA Results for P1 Assets**

22

23 The application of the ACA process to each asset quantifies the proportion of the assets  
24 that will require work through planned sustaining and development programs. A  
25 summary of the P1 asset conditions based on data collected up to the end of 2006 are  
26 shown in Table 4.1 below.

27

**Table 4.1: Summary of Priority 1 (P1) ACA Results**

Asset	ACA Results		
	"Poor" or "Very Poor"	"Fair"	"Good" or "Very Good"
<b>Stations</b>			
Transformers	3%	1%	96%
Land Assessment & Remediation (LAR)	5%	0%	95%*
<b>Lines</b>			
Distribution Line Sections	-	-	-
Wood Poles	4%	1%	95%
ROW Vegetation Management	31%	39%	30%

\* Includes sites that are contaminated but that have been addressed through remediation activities, or present low environmental risks. The low risk contaminated sites are included in the "good to very good" category as there are no plans in place for further remediation in the foreseeable future based on site specific risk assessments.

A consistent approach has been used in developing asset condition assessment results so that the meaning of the categories is generally understood across the asset classes. It must be recognized that condition ratings in the table above represent a snapshot in time and may not include factors that may accelerate deterioration or increase the percentage of assets which are in a deteriorated state in the future. These factors include changing demographics (a large number of assets reaching the critical stage where degradation accelerates, as is the case with wood poles), degree of damage caused by failures of sub-systems (as may be the case with transformers where a fault may shorten the life of a transformer), or environmental factors that may be influenced by changes in regulations. The categories developed are:

- "Very Poor" and "Poor" condition assets are high risk and will require replacement, refurbishment or other remedial action within the next 5 years to correct significant deterioration. The exception is for rights-of-way vegetation as explained below.
- "Fair" condition assets have experienced noticeable deterioration but should survive another 5 years with regular maintenance, and future work will be based on subsequent risk assessments.

- 1 • “Good” to “Very Good” Condition assets are currently at a lower risk than the other  
2 categories.

3  
4 As noted above, Rights-of-Way vegetation does not fall into the time frames noted, as  
5 conditions change more rapidly for vegetation than with other asset classes. The more  
6 suitable descriptions for rights-of-way vegetation are: “Very Poor” and “Poor” category  
7 relates to feeders that will require maintenance within 2 years; “Fair” which relates to  
8 rights-of-way that may require maintenance in 3 to 4 years depending on further analysis;  
9 and “Good” to “Very Good” which relates to rights-of-way that have been recently (i.e.  
10 within 3 years) maintained or those that will not require attention within the next 4 years.

11  
12 The following sections provide details on the key asset groups and highlight ACA results  
13 based on information and observations gathered up to December 31, 2006.

14  
15 4.1.1 Distribution Station Transformers

16  
17 The condition of station transformers is assessed using the following methods:

- 18  
19 • Dissolved Gas in oil Analysis (DGA) and Standard Oil Tests involve withdrawing a  
20 sample of oil from a transformer with follow-up laboratory analysis to determine  
21 quantities and type of gas in the oil and the condition of the oil. The results provide  
22 an indication concerning the degradation of oil and insulating material.  
23 • Furan testing is an additional oil test that provides information regarding the  
24 condition of the paper insulation in the core of the transformer. Degradation of paper  
25 causes it to lose its tensile strength and results in release of furans.  
26 • Winding Doble Test is an electrical test used to identify the insulation quality within  
27 the transformer core measuring the dielectric loss of leakage current.

- 1 • Bushings, control cabinets, transformer tanks and cooling systems are inspected  
2 visually.

3  
4 Hydro One Distribution makes use of proactive measures and diagnostic methods and  
5 tools such as noted above to facilitate early detection of deteriorating transformer  
6 condition and incipient failure to detect the remaining life of these costly assets. Based  
7 on DGA results, about 3% of distribution station transformers are at high risk of failure  
8 and will need to be replaced within the next five years. These transformers will be  
9 proactively taken out of service should their condition deteriorate further to prevent  
10 failures and reduce impacts to Hydro One Distribution's customers.

11  
12 It must be recognized that transformers are a very important class of distribution assets.  
13 At this time, 97% of in-service transformers are in "Fair" to "Good" or "Very Good"  
14 condition, but this could change relatively quickly if they are not maintained in an  
15 ongoing and prudent manner. Events that can lead to rapid deterioration include;  
16 electrical failures of components or faults occurring from animal contact, lightning,  
17 contamination of equipment, etc; mechanical failure caused by movement of internal  
18 windings, or failures caused by malfunctioning cooling systems. These failures can cause  
19 damage that is not easily detected and can lead to rapid deterioration of condition,  
20 especially in aging equipment, as is the case with Hydro One Distribution's transformers.  
21 As a result, station transformers can move from the "Fair" and "Good" categories into the  
22 "Poor" category very rapidly due to normal wear and exposure.

23  
24 Hydro One Distribution's proactive efforts based on ACA results appear to be showing  
25 some improvement in transformer failures. This is highlighted in Table 4.2 below that  
26 identifies the number of transformer failures experienced during 2004 to 2006. It must be  
27 recognized that the proactive maintenance strategy adopted during 2005 is in the initial

1 stages, as such the change in the number of failures is not conclusive, but is providing a  
2 directionally positive indicator.

3

4

5

**Table 4.2: Summary of Transformer Failures 2004 to 2006**

<b>Year</b>	<b>Number of Transformer Failures (Forced Outages)</b>
2004	37
2005	32
2006	25

6

7 In total, Hydro One Distribution purchases about six to ten transformers annually to  
8 replace failed units that are beyond repair and to maintain adequate spares coverage. The  
9 proposed Sustaining OM&A (Exhibit C1, Tab 2, Schedule 2) and Capital (Exhibit D1,  
10 Tab 3, Schedule 2) programs provide appropriate funds to effectively manage the life  
11 cycle of these costly assets and will address those transformers identified to be at high  
12 risk over the next 5 year period, either by replacement or refurbishment if it is determined  
13 to be a cost effective solution.

14

15 4.1.2 Site Contamination – Land Assessment & Remediation

16

17 Hydro One Distribution assesses the environmental condition of Distribution Stations by  
18 examining soil, ground water and the surface run off from a site. Soil contamination is  
19 determined by the laboratory analysis of soil samples. Soil samples can be obtained from  
20 shallow open excavations or by drilling to gain samples at various depths. Ground water  
21 quality is determined by the laboratory analysis of ground water samples taken from  
22 monitoring wells that are installed on station property or adjacent property. Surface  
23 water runoff quality is determined by the laboratory analysis of runoff water samples

1 taken by automated sampling devices. The results of these lab tests is then compared to  
2 contaminant levels permitted in provincial and federal regulations.

3  
4 The chemical contaminants that exist on some sites were as a result of leaks and spills  
5 from equipment, or from previous industry accepted applications of certain long lasting  
6 chemicals (e.g. wood preservatives, herbicides) that complied with environmental  
7 regulations at the time that they were used. The primary contaminants of concern are:

- 8
- 9 • Arsenic (AS) – From arsenic trioxide, a registered herbicide at the time, used for total  
10 vegetation control within Distribution Stations from the 1950s until about 1965
  - 11 • Total Petroleum Hydrocarbons (TPH) - From leaked or spilled transformer mineral  
12 insulating oil
  - 13 • Polychlorinated Biphenols (PCBs) – From leaked or spilled transformer insulating oil
  - 14 • Pentachlorophenol (PCP) – From treated wood poles

15  
16 Hydro One Distribution has assessed all distribution station sites for site contamination  
17 and has found that about 45% do contain some degree of contamination, and of those, 5%  
18 still require remediation to ensure the contaminates do not present any threat to humans  
19 and the surrounding environment.

20  
21 Remediation activities are scheduled using a risk based ranking system that focuses on  
22 high risk sites and on mitigating the risk of off-property impacts related to human and  
23 ecological exposure. Medium risk sites, are those containing some degree of  
24 contamination that is unlikely to migrate off-site but the risks are high enough to warrant  
25 sampling and monitoring on an ongoing basis. The remaining sites may contain some  
26 degree of contamination, but the risk of off site contamination is very low, or samples do  
27 not show any significant levels of arsenic, PCBs or TPH.

28

1 The plan that is being implemented under the Land Assessment and Remediation (LAR)  
2 program is highlighted in Sustaining OM&A under Stations (Exhibit C1, Tab 2, Schedule  
3 2).

4

5 4.1.3 Distribution Overhead Line Sections

6

7 Hydro One Distribution does not conduct asset condition assessments on Overhead Lines  
8 Sections in the same manner as other P1 assets. This particular asset is considered  
9 unique compared to other P1 assets as it consists of a grouping of diverse overhead line  
10 components (e.g. conductor, insulators and wood poles) each of which have very  
11 different characteristics, condition deterioration factors, and maintenance requirements.  
12 It is for this reason, and the fact that it would be extremely costly to collect ACA  
13 information system wide on all of the lower level components that comprise a line  
14 section, that Table 4.1 above does not contain a percentage breakdown for Overhead  
15 Lines Sections.

16

17 The most practical and cost-effective approach for assessing the condition of distribution  
18 line sections is to collect relevant information on individual components. This includes  
19 collecting information on degradation levels of components that make up the line section.

20 The information is obtained through:

21

- 22 • pole testing and line patrol activities as outlined in Sustaining OM&A (Exhibit C1,  
23 Tab 2, Schedule 2), which provides information on defects and condition of wood  
24 poles.
- 25 • a business process whereby field staff report suspect conditions that require more  
26 detailed assessments.
- 27 • reliability information indicating poor performance of a feeder or section.

28

1 When a critical mass of components reaches end-of-life, such that it is more cost-  
2 effective to refurbish an entire line section than to replace components individually, then  
3 a Line (Refurbishment) Project is undertaken as proposed in Sustaining Capital (Exhibit  
4 D1, Tab 3, Schedule 2).

5  
6 As noted above, it is cost prohibitive to collect asset condition information on all  
7 distribution line sections nor is it necessary, as many of the line sections are in good  
8 condition. The process noted above is considered to be the most practical and cost  
9 effective means to manage the condition of these assets.

10  
11 4.1.4 Wood Poles

12  
13 Information used for determining the condition of wood poles is gathered from pole  
14 inspections and tests. Visual inspections identify numerous defects such as split tops,  
15 leaning poles, lightning damage, broken poles, wood pecker damage, rodent damage,  
16 shell rot, fire damage, insect infestation and other mechanical damage. The number and  
17 severity of these defects is used to assess condition. In addition, sounding tests using a  
18 hammer are employed to detect the presence hollow areas in the pole, shell separation, or  
19 external decay. Poles that appear to have internal rot are further tested using a drill test  
20 that measures the shell thickness (amount of wood in good condition in the outer area of a  
21 pole).

22  
23 Based on inspection and testing results accumulated up to the end of 2006, Hydro One  
24 Distribution estimates that approximately 4% of the wood poles in the system are in  
25 “Poor” to “Very Poor” condition. The exact locations of these poles are identified during  
26 the normal course of the inspection cycle. Once identified, poles that are found to be in  
27 very poor condition are replaced in an expedient manner and those found to be in poor  
28 condition are replaced as part of the Wood Pole Structure Replacement Program as

1 described in Exhibit D1, Tab 3, Schedule 2. The finding that approximately 4% of poles  
2 are at risk supports the need to maintain pole assessment plans proposed in Sustaining  
3 OM&A (Exhibit C1, Tab 2, Schedule 2) and to maintain pole replacements at levels  
4 proposed in Sustaining Capital (Exhibit D1, Tab 3, Schedule 2).

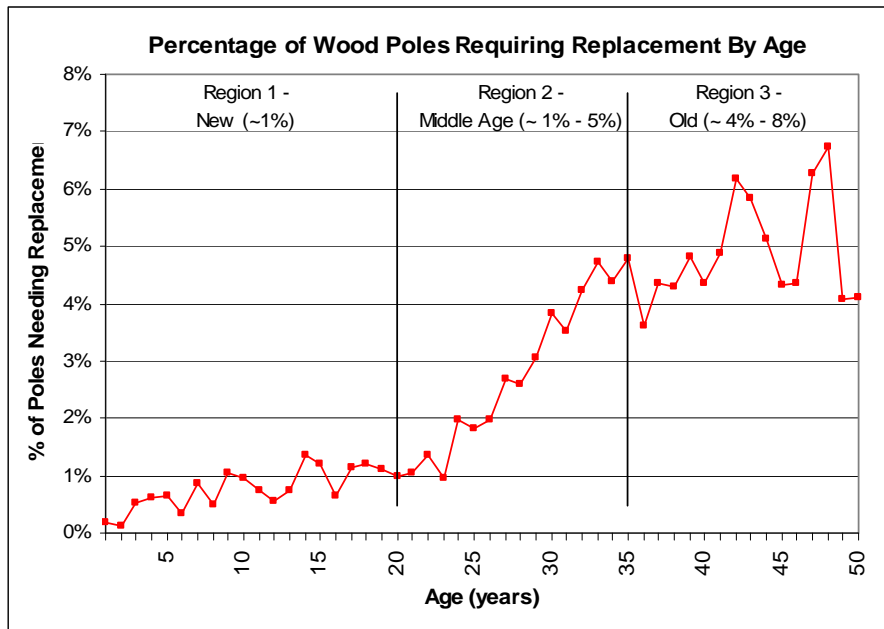
5

6 ACA results have also been analyzed in relation to Hydro One Distribution's wood pole  
7 demographics. Figure 3 below, indicates the percentage of poles that required  
8 replacement (i.e. "Poor" or "Very Poor" condition) relative to their age based on  
9 inspection and testing data.

10

11 **Figure 3: Wood Pole Inspection & Testing Results Relative to Pole Age**

12



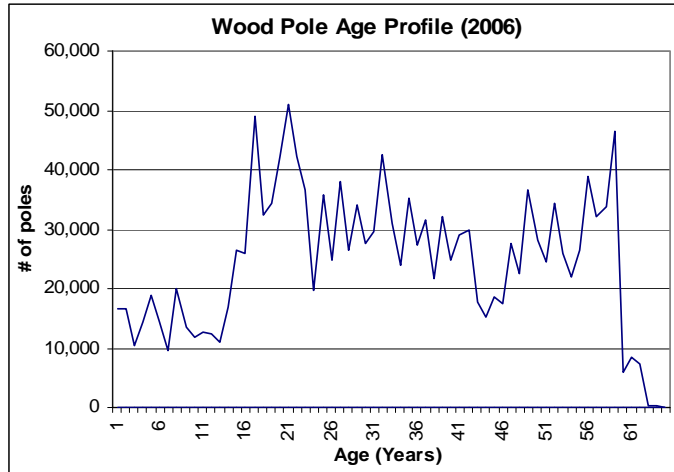
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14

15 The results indicate that the likelihood of a pole requiring replacement during its first 20  
16 years is relatively low (i.e. approximately 1% - Region 1). Between years 20 and 35, the  
17 likelihood of a replacement increases rapidly (i.e. over 4% - Region 2). Beyond year 35  
18 indications are that replacement rates are in the 4% to 8% range.

1  
2  
3

**Figure 4: Hydro One Distribution Wood Pole Demographics**



4  
5

6 Figure 4 above is a representation of Hydro One Distribution's wood pole demographics  
7 and of particular interest is the large number of poles that are currently between 15 and  
8 20 years of age. These poles will move through Region 2 illustrated in Figure 3, over the  
9 next 10 years where the replacement rates increase rapidly from approximately 1% to  
10 over 4%. In the past, the number of poles/year that have entered this Region has been  
11 about 30,000 to 35,000, but over the next 10 years the number will increase to as much as  
12 50,000, thereby increasing the number of poles expected to be found at end of life. This  
13 information indicates that in the future one can expect an increasing number of pole  
14 replacements.

15

16 The leading indicator discussed above and the results from the current pole assessment  
17 program, support the need to replace those poles found to be substandard under the pole  
18 assessment program, as the number of replacements in the future will in all likelihood  
19 increase.

20

1 4.1.5 Rights-of-Way Vegetation

2

3 Vegetation asset condition assessments are undertaken by collecting data on various  
4 vegetation parameters including tree clearances (i.e. percentage of trees within 1m of the  
5 conductor), overhang (i.e. percentage of trees overhanging the conductor), danger trees,  
6 tree densities, and average brush height and average brush density (i.e. stems per line  
7 span). This information is combined to yield asset condition assessment results for  
8 feeders and is used to prioritize line clearing and brush control programs.

9

10 Assessment of vegetation conditions identify that about 31% (31,000 km) of rights-of-  
11 way are in the “Very Poor” and “Poor” category and are at risk and require clearance  
12 work within the next two years. The increase in percentage of rights-of-way in this  
13 category (about 3%) over the last two years is primarily attributed to a need to redirect  
14 resources during 2006 in response to the unusually high number of storms, and the 2005  
15 labour disruption. As a result, accomplishment levels were below plan.

16

17 ACA results and the performance of specific feeders are the primary inputs that are used  
18 to schedule line clearing and brush control work on overhead lines. For Hydro One  
19 Distribution, the condition of rights of way is of great concern, as vegetation caused  
20 interruptions are the single greatest contributor to unreliability, as illustrated in Exhibit A,  
21 Tab 3, Schedule 1, and Exhibit C1, Tab 2, Schedule 2.

22

23 The projected accomplishment of 12,900 km during 2007 and the 12,500 km during 2008  
24 will not fully address the “Poor” and “Very Poor” locations over these two years. These  
25 conditions will diminish over the next few years, but will not be fully addressed until one  
26 maintenance cycle has been achieved.

27

1 **4.2 Comments on ACA results for P2 Assets**

2  
3 The following sections provide ACA information for P2 assets. It is recognized that P2  
4 assets are of lower priority, and as a result, detailed analysis is not carried out to the same  
5 extent as with P1 assets. In a number of cases it may not be cost effective or practical to  
6 acquire the necessary information to support detailed ACA analysis, in which case  
7 maintenance processes and reliability indicators are used to manage the assets. This is  
8 further discussed in each of the asset groups below.

9  
10 4.2.1 Station Reclosers

11  
12 Hydro One Distribution currently manages approximately 6,000 distribution station  
13 reclosers consisting of single-phase and three-phase units, and about 170 circuit breakers.  
14 These pieces of equipment are currently on a six-year maintenance interval for  
15 refurbishment or replacement and amount to 1,000 units/year. Due to the comprehensive  
16 maintenance program, separate detailed asset condition assessments are not completed  
17 for station reclosers and breaker assets. The condition of these assets is monitored  
18 through reliability/performance data and the ongoing maintenance program funded under  
19 the Stations Program in Exhibit C1, Tab 2, Schedule 2.

20  
21 4.2.2 High Voltage Fuses

22  
23 There are approximately 1,000 3-phase sets of High Voltage fuses installed on the Hydro  
24 One Distribution system. The cost effective method of collecting ACA information on  
25 this asset group is to inspect these devices during regular station maintenance activities,  
26 Devices that are found to be in substandard condition are replaced in an expedient  
27 manner under the Station Program in Exhibit C1, Tab 2, Schedule 2.

1    4.2.3   Station Sites and Structures

2

3    Based on ongoing inspections carried out during regular maintenance and asset condition  
4    assessment findings, stations that require significant improvements to site facilities are  
5    completed as part of the station refurbishment work described in Exhibit D1, Tab 3,  
6    Schedule 2. This work includes, as appropriate, the refurbishment or replacement of  
7    fences, high voltage and low voltage structures, buildings, yards and roads. The first  
8    phase of the assessment is completed during the regular station inspections and if  
9    required, a more detailed assessment is made to establish the condition of wood poles,  
10   steel structures, building envelope and roof, etc. The refurbishment plans in Capital  
11   Sustaining (Exhibit D1, Tab 3, Schedule 2) will address those sites that have been  
12   identified to be in poor condition.

13

14   4.2.4   Mobile Substations

15

16   Mobile substations are comprised of a trailer and distribution equipment such as  
17   transformers, switches, fuses or reclosers as well as ancillary electrical systems. Trailers  
18   are inspected on a regular basis as required by the Ministry of Transportation and  
19   electrical equipment is inspected in detail on an annual basis. Inspection standards for  
20   the related electrical equipment are identical to that of a distribution station, but more  
21   frequent, as these assets must perform when called upon to do so. Any significant defects  
22   are logged and immediate plans are made to correct these. Minor defects are corrected as  
23   part of the Stations Program in Exhibit C1, Tab 2, Schedule 2.

24

25   Out of Hydro One Distribution's 28 mobile substations, 2 need to be refurbished during  
26   2008 to maintain an operational fleet of 28 units. Replacement of major electrical  
27   equipment and refurbishment of the trailers is carried out under sustaining capital; refer  
28   to Exhibit D1, Tab 3, Schedule 2.

1    4.2.5   Transformer Spares

2  
3    Hydro One Distribution utilizes 1,477 in-service transformers and regulators, ranging in  
4    size from 0.5 to 40 MVA in 71 different categories and requires a complement of spare  
5    transformers in order to respond to about 32 failures per year (average over the last four  
6    years). The majority of spare transformers are stored in a central location and are  
7    inspected on an annual basis to ensure that they are serviceable when required. Primary  
8    activities include the visual inspections of main components, i.e., bushings, cabinets,  
9    tanks and cooling systems. The visual inspection standards for spare transformers are  
10   identical to that of in-service units, and if required oil samples are taken and analysed.  
11   Spare transformers are maintained in a serviceable condition, such that they are available  
12   for deployment if required.

13  
14   A comprehensive transformer spare complement strategy has been developed to ensure  
15   the correct number and types of spares are available. Additional details are provided in  
16   Sustaining Capital, Exhibit D2, Tab 2, Schedule 3.

17  
18   4.2.6   Submarine and Underground Cables

19  
20   Hydro One Distribution's system contains about 4,200 km of underground cable and  
21   2,200 km of submarine cable. The maintenance activities for these assets involve a  
22   three-year inspection for urban circuits and a 6-year inspection for rural circuits in  
23   accordance with the requirements of the Distribution System Code.

24  
25   For underground cables, the inspections involve visual examination of the components  
26   associated with the cable termination, pothead, elbows, and cable riser poles. For the  
27   large majority of cables, which are buried directly underground, no examination of cable  
28   or splices is undertaken. For a few cables that are in ducts some examination of the

1 external condition may be carried out for troublesome or critical circuits. For submarine  
2 cables, the inspections involve visual examination of the cable between the transformer  
3 and where it enters the water. A specific area of concern is the location where cables  
4 enter the water, as this is the location where damaging corrosion of the armour wires  
5 (neutral wires) has been observed. Neutral corrosion has been identified as a potential  
6 safety issue.

7

8 Hydro One Distribution's management practices for underground and submarine cables  
9 also include performance criteria: two failures within a section of cable would normally  
10 lead to the decision to replace the cable. The decision whether to repair or replace is  
11 made on condition information from a visual assessment and performance of the cable,  
12 and if deemed necessary, laboratory testing is carried out before decisions are made  
13 concerning replacement. The condition of these assets is managed on an ongoing basis  
14 from data gathered during inspections and performance monitoring. The underground  
15 cable system is relatively new and has not shown any significant deterioration trends, but  
16 this is not the case with submarine cable. Over the last 5 years, a number of cable  
17 locations have been identified during inspections as requiring section replacements due to  
18 corrosion of the neutral wires at the shore. Funding for these repairs is discussed in  
19 Exhibit D1, Tab 3, Schedule 2.

20

21 Hydro One Distribution's program for managing distribution underground and submarine  
22 cables is generally consistent with the approach adopted by many other utilities for such  
23 cables.

24