TABLE OF CONTENTS

2.5 EXHIBIT 2 - RATE BASE

2.5.1 Rate Base

2.5.1.1 Overview

The Rate Base used for the purpose of calculating the revenue requirement in this Application follows *Chapter 2 of the Filing Requirements for Electricity Distribution Applications* issued by the Ontario Energy Board ("Board") on July 18, 2015 (the "Filing Requirements"). In accordance with the Filing Requirements, Waterloo North Hydro Inc. ('WNH') has calculated the Rate Base as the average of the Net Capital Balances at the beginning and the end of the 2016 Test Year plus a Working Capital Allowance, which is 13% of the sum of the Cost of Power and Controllable Expenses.

WNH applied the 13% working capital allowance in the application because the filing requirements stated the following:

In a letter dated April 12, 2012, the Board provided an update to electricity distributors and transmitters on the options established in the June 22, 2011 cost of service filing requirements for the calculation of the allowance for working capital for the 2013 rate year. The applicant may take one of two approaches for the calculation of its allowance for working capital: (1) the 13% allowance approach; or (2) the filing of a lead/lag study.
The only exception is if the applicant has been previously directed by the Board to undertake a lead/lag study on which its current working capital allowance is based.

WNH was not previously directed by the Board to undertake a lead/lag study. As a result, WNH choose the 13% allowance approach.

WNH is aware that the working capital allowance issue has been addressed by the Board in at least two cases and based on the Board's decision in these cases the 13% approach is consistent with the Board decision. In the first case Kitchener-Wilmot Hydro Inc. (EB-2013-0147) the Board's findings are as follows:

> *On the matter of whether KWHI responded to all relevant Board directions from previous proceedings, the Board accepts KWHI's interpretation of the Board's April 12, 2012 letter as being reasonable and therefore does not find that KWHI was required to perform and file a lead-lag study in support of this Application.*
>
> *Based on the finding above, and in recognition of section 2.5.1.3 of the Filing Requirements for Electricity Distribution Rate Applications, which establishes the Board's expectation with respect to the WCA and allows for the default 13% approach in the absence of previous direction by the Board to undertake a lead/lag study; the Board does not find it necessary to consider whether any WCA other than the default 13% used by KWHI is more appropriate in this Application.*

In the second case Hydro One Brampton Networks Inc. (EB-2014-0083) the Board's findings were as follows.

> *The Board has been clear that an applicant may follow one of two approaches, (1) the 13% Working Capital Allowance, an amount which was determined as a result of the Board's policy, or (2) the filing of a lead lag study. The only exception to this approach is if the applicant has been previously directed by the Board to file a lead lag study on which its Working Capital Allowance is based. HOBNI has not been ordered to conduct such a study.*
>
> *The Board has commenced a policy review on Working Capital Allowance. Until that work is complete, the existing policy will remain in effect.*

WNH has adopted the change-over to Modified International Financial Reporting Standards ("MIFRS") as of January 1, 2015 with comparatives completed in MIFRS for

2014. On July 17, 2013 the Board issued a statement that changes to depreciation rates and capitalization policies that would have been implemented under International Financial Reporting Standards ("IFRS") could be made in 2013 under Canadian Generally Accepted Accounting Principles ("CGAAP") (i.e. effective January 1, 2012), and must be made no later than 2013 (i.e. effective January 1, 2013), regardless of whether the Canadian Accounting Standards Board (AcSB) permitted further deferrals beyond 2013 for the changeover to IFRS (Board Letter, July 17, 2013 *"Regulatory accounting policy direction regarding changes to depreciation expense and capitalization policies in 2013 and 2014"*). In 2013, WNH implemented the change to depreciation rates and capitalization policies which is explained in further detail in the section "Changes to Capitalization Policy" further below. For Rate Base purposes, 2013 has been calculated with these changes implemented. Table 2-12 through 2-18 provide the fixed asset continuity schedules, excluding Work In Progress ("WIP"), used for Rate Base calculations; for comparative purposes 2013 is provided under both CGAAP and Revised CGAAP ("RCGAAP") to reflect depreciation and overhead capitalization changes. As WNH does not have any material differences under Revised CGAAP and MIFRS, 2015 is provided under MIFRS only.

Net Capital Assets include in-service assets that are associated with activities that enable the conveyance of electricity for distribution purposes minus Accumulated Depreciation and Contributed Capital from third parties. For purposes of this Exhibit, Distribution Assets refer to those assets that are most directly related to the distribution system, such as poles, overhead and underground lines, and transformers. General Plant refers to assets that support the operation of the distribution system such, as computer hardware and software, vehicles, buildings, equipment. Capital Assets include Property, Plant and Equipment ("PP&E") and Intangible Assets; these are referred to as "Capital" or "Fixed" Assets throughout this evidence. The Rate Base calculation excludes any Non-Distribution Assets. WNH has not applied for, nor received, any Incremental Capital Module ("ICM") adjustments.

WNH has completed the requirement of Appendix 2-BA in Tables 2-12 through 2-18.

Controllable expenses include operations and maintenance, billing and collecting, community relations and administration expenses.

WNH has provided its Rate Base calculations for the years 2011 Board Approved, 2011 Actual, 2012 Actual, 2013 Actual, 2014 Actual, 2015 Bridge Year and 2016 Test Year in Table 2-1 below:

2011 COS Settlement Agreement Issue

In WNH's 2011 COS Filing, Item 2.1, pages 10 and 11, it states:

"The parties have agreed to establish a variance account in respect of WNH's new Administrative Building and Service Centre ("Building"). The Building is included in WNH's 2011 Revenue Requirement; however, if the building is not in service by the end of 2011, any over-collection of the amount that is included in the 2011 revenue requirement for the building will be placed into a variance account. The variance is only to capture any over-collection in the 2011 rate year and would only be applicable if the building is not in service in 2011…"

WNH's Building was in service before the end of 2011, thus, the variance account detailed in the Settlement Agreement is not applicable. WNH personnel moved into the Building on December 5, 2011.

Table 2-1 - Summary of Rate Base

Description	2011 Board Approved	2011	2012	2013	2014	2015	2016
Reporting Basis	**CGAAP**	**CGAAP**	**CGAAP**	**RCGAAP**	**MIFRS**	**MIFRS**	**MIFRS**
Gross Fixed Assets Opening Balance	222,256,275	220,796,326	265,545,785	288,113,454	305,994,618	316,996,025	332,747,684
Gross Fixed Assets Closing Balance	260,326,104	265,545,785	288,113,454	305,994,618	316,996,025	332,747,684	349,220,792
Average Gross Fixed Assets	**241,291,190**	**243,171,056**	**276,829,620**	**297,054,036**	**311,495,321**	**324,871,854**	**340,984,238**
Accumulated Depreciation Opening Balance	105,947,980	105,250,602	113,739,171	123,325,504	131,404,275	133,975,417	142,317,056
Accumulated Depreciation Closing Balance	112,600,734	113,739,171	123,325,504	131,404,275	133,975,417	142,317,056	150,917,658
Average Accumulated Depreciation	**109,274,357**	**109,494,887**	**118,532,338**	**127,364,890**	**132,689,846**	**138,146,237**	**146,617,357**
Average Net Book Value	**132,016,832**	**133,676,169**	**158,297,282**	**169,689,146**	**178,805,475**	**186,725,617**	**194,366,880**
Working Capital	126,529,154	134,678,193	144,794,492	159,632,515	169,005,182	178,648,140	177,783,549
Working Capital Allowance (%)	15%	15%	15%	15%	15%	15%	13%
Working Capital Allowance	**18,979,373**	**20,201,729**	**21,719,174**	**23,944,877**	**25,350,777**	**26,797,221**	**23,111,861**
Rate Base	**150,996,206**	**153,877,898**	**180,016,456**	**193,634,023**	**204,156,252**	**213,522,838**	**217,478,742**

WNH has calculated its 2016 Rate Base as $217.48M, an increase of $66.48M over the 2011 Board Approved Rate Base of $151.0M. This increase in Rate Base of $66.48M is attributable to an increase in the Average Net Book Value of Capital Assets of $62.35M and an increase in the Working Capital Allowance of $4.13M. WNH has reinvested significantly in its distribution system since the last Cost of Service (COS) Application, including some significant one-time investments discussed below and this is reflected in the Net Book Value variance; 94% of the incremental increase to Rate Base is driven by investment in the system through an increase in Net Book Value. Approximately 93% of the Working Capital increase of $51.25M is related to Cost of Power. Controllable OM&A expenses increased 6% over the 2011 Board-Approved amounts for Working Capital.

WNH notes that included in the increase in Rate Base is the full cost of its Service Centre and Administration Building, Land Furniture and Equipment which was a 2011 Addition. In the 2011 COS only one-half of its projected costs, which was $13.37M, was included in Rate Base, the balance of the $13.37M cost is reflected in this COS Application. Also included in Rate Base in this Application is an increase of $9.5M in Approved Smart Meter Costs and its associated communications equipment, rebuilding and upgrading grid-connected transformer station equipment and significant net relocation costs ($2.5M) for a new Light Rail Transit system in the Region of Waterloo.

WNH has provided a summary of its calculations of the Cost of Power and Controllable Costs used in the calculations for determining Working Capital for the years 2011 Board Approved, 2011 Actual, 2012 Actual, 2013 Actual, 2014 Actual, 2015 Bridge Year and

2016 Test Year in Table 2-2 below. Further details of WNH's calculation of its Cost of Power calculations are provided in Table 2-24. The 2015 Bridge Year is forecast data.

Table 2-2 Summary of Working Capital Calculation

Description	2011 Board Approved	2011 Actual	2012 Actual	2013 Actual	2014 Actual	2015 Bridge	2016 Test
Distribution Expenses - Operation	3,877,534	3,567,713	4,464,684	6,122,581	6,246,577	5,876,324	5,799,381
Distribution Expenses - Maintenance	1,559,180	1,287,857	1,266,289	1,283,983	1,845,659	1,607,062	1,613,140
Billing and Collecting	2,075,189	2,208,871	2,940,036	2,632,182	2,615,114	2,702,873	2,902,731
Community Relations	236,777	164,146	202,478	193,918	163,854	147,200	142,200
Administrative and General Expenses	2,255,657	2,421,554	2,125,788	2,682,238	2,795,055	3,042,602	3,221,882
Donations - LEAP	34,944	102,925	69,244	46,179	35,044	35,000	42,000
Taxes Other than Income Taxes	-	223,281	704,659	353,440	469,952	480,131	489,734
Less Allocated Depreciation	-	(806,135)	(860,085)	(612,134)	(675,045)	(733,797)	(754,014)
Power Supply Expenses	116,489,872	125,507,981	133,881,400	146,930,128	155,508,973	165,490,745	164,326,495
Total Working Capital Expenses	**126,529,154**	**134,678,193**	**144,794,492**	**159,632,515**	**169,005,182**	**178,648,140**	**177,783,549**

Variance Analysis of Rate Base

The following Table 2-3 sets out WNH's Rate Base and Working Capital calculations for the 2016 Test Year, 2015 Bridge Year, 2014 Actual, 2013 Actual, 2012 Actual, 2011 Board Approved and Actual, and the following variances:

- 2016 Test Year against 2015 Bridge Year
- 2015 Bridge Year against 2014 Actual
- 2014 Actual against 2013 Actual
- 2013 Actual against 2012 Actual
- 2012 Actual against 2011 Actual and
- 2011 Actual against 2011 Board Approved

Table 2-3 - Rate Base Variances

Description	2011 Board Approved	2011 Actual	Variance from 2011 Board Approved	2012 Actual	Variance from 2011 Actual	2013 Actual	Variance from 2012 Actual	2014 Actual	Variance from 2013 Actual	2015 Bridge Year	Variance from 2014 Actual	2016 Test Year	Variance from 2015 Forecast
Average Gross Fixed Assets	241,291,190	243,171,056	1,879,866	276,829,620	33,658,564	297,054,036	20,224,416	311,495,321	14,441,286	324,871,854	13,376,533	340,984,238	16,112,383
Average Accumulated Depreciation	109,274,357	109,494,887	220,530	118,532,338	9,037,451	127,364,890	8,832,552	132,689,846	5,324,957	138,146,237	5,456,390	146,617,357	8,471,120
Average Net Book Value	**132,016,832**	**133,676,169**	**1,659,337**	**158,297,282**	**24,621,113**	**169,689,146**	**11,391,864**	**178,805,475**	**9,116,329**	**186,725,617**	**7,920,142**	**194,366,880**	**7,641,263**
Working Capital	126,529,154	134,678,193	8,149,039	144,794,492	10,116,300	159,632,515	14,838,023	169,005,182	9,372,666	178,648,140	9,642,958	177,783,549	(864,591)
Working Capital Allowance (%)	15%	15%		15%		15%		15%		15%		13%	
Working Capital Allowance	**18,979,373**	**20,201,729**	**1,222,356**	**21,719,174**	**1,517,445**	**23,944,877**	**2,225,703**	**25,350,777**	**1,405,900**	**26,797,221**	**1,446,444**	**23,111,861**	**(3,685,360)**
Rate Base	**150,996,206**	**153,877,898**	**2,881,693**	**180,016,456**	**26,138,558**	**193,634,023**	**13,617,567**	**204,156,252**	**10,522,229**	**213,522,838**	**9,366,586**	**217,478,742**	**3,955,903**

WNH has calculated the materiality threshold on its Rate Base to be $177,062 for 2016 in accordance with the Filing Requirements. On this basis, WNH has selected a materiality threshold of $175,000. This calculation is summarized in Exhibit 1 Table 1-17.

WNH offers the following comments in respect of the relevant variances identified above:

- **2016 Test Year:**

Description	2016
Average Gross Fixed Assets	340,984,238
Average Accumulated Depreciation	146,617,357
Average Net Book Value	**194,366,880**
Working Capital	177,783,549
Working Capital Allowance (%)	13%
Working Capital Allowance	**23,111,861**
Rate Base	**217,478,742**

As shown above, the total Rate Base in the 2016 Test Year is forecast to be $217.48M. Average Net Fixed Assets account for $194.4M of this total. The Allowance for Working Capital totals $23.11M; $21.36M (or 93%) is related to Cost of Power Expenses.

- **2016 Test Year vs. 2015 Bridge Year:**

Description	2015 Bridge Year	2016 Test Year	Variance from 2015 Forecast
Average Gross Fixed Assets	324,871,854	340,984,238	16,112,383
Average Accumulated Depreciation	138,146,237	146,617,357	8,471,120
Average Net Book Value	**186,725,617**	**194,366,880**	**7,641,263**
Working Capital	178,648,140	177,783,549	(864,591)
Working Capital Allowance (%)	15%	13%	
Working Capital Allowance	**26,797,221**	**23,111,861**	**(3,685,360)**
Rate Base	**213,522,838**	**217,478,742**	**3,955,903**

The Total Rate Base is expected to be $3.96M higher in the 2016 Test Year than in the 2015 Bridge Year. This increase is shown above and is attributable primarily to an increase in Average Net Book Value of $7.64M which partially offset by a decrease in Working Capital Allowance of $3.69M. The addition to Gross Fixed Assets in 2016 is forecast at $16.4M and Table 2-21 provides a more detailed variance of year over year changes to Gross Assets. Details with respect to WNH's 2016 Capital Expenditure Program are provided in WNH's Distribution System Plan ("DSP"), found in Attachment 2-1. The Working Capital Allowance decrease was primarily a result of a reduction in the Working Capital Allowance Percentage from 15% to 13%.

The detailed calculation of the Cost of Power Expense for the 2016 Test Year can be found in Table 2-26.

- **2015 Bridge Year vs. 2014 Actual:**

Description	2014 Actual	2015 Bridge Year	Variance from 2014 Actual
Average Gross Fixed Assets	311,495,321	324,871,854	13,376,533
Average Accumulated Depreciation	132,689,846	138,146,237	5,456,390
Average Net Book Value	**178,805,475**	**186,725,617**	**7,920,142**
Working Capital	169,005,182	178,648,140	9,642,958
Working Capital Allowance (%)	15%	15%	
Working Capital Allowance	**25,350,777**	**26,797,221**	**1,446,444**
Rate Base	**204,156,252**	**213,522,838**	**9,366,586**

The Total Rate Base for the 2015 Bridge Year is expected to be $213.5M, which represents an increase of $9.37M over the 2014 Actual year. This increase is shown above and is attributable primarily to an increase in Average Net Book Value of $7.92M. Distribution Assets additions in 2015 are forecasted to increase $19.14M, General Plant Assets by $1.53M, which is offset by Contributed Capital of ($4.91M) for a total change of $15.75M in Gross Fixed Assets. WNH notes that the 2014 Net Book Value was also impacted by the removal of Stranded Meters in 2014. The Gross Cost removed was $6.65M, further details are provided below on pages 52 - 56. Table 2-21 and the subsequent narrative provide a more detailed explanation of the change in Gross

Assets year over year. The change in Accumulated Amortization is a result of changes in capital additions, depreciation expense and disposals, including disposals of Stranded Meters.

The increase in the 2015 Working Capital Allowance can be attributed to the increase in Cost of Power Expenses from 2014.

- **2014 Actual vs. 2013 Actual:**

Description	2013 Actual	2014 Actual	Variance from 2013 Actual
Average Gross Fixed Assets	297,054,036	311,495,321	14,441,286
Average Accumulated Depreciation	127,364,890	132,689,846	5,324,957
Average Net Book Value	**169,689,146**	**178,805,475**	**9,116,329**
Working Capital	159,632,515	169,005,182	9,372,666
Working Capital Allowance (%)	15%	15%	
Working Capital Allowance	**23,944,877**	**25,350,777**	**1,405,900**
Rate Base	**193,634,023**	**204,156,252**	**10,522,229**

The Rate Base of $204.16M for 2014 Actual increased over 2013 Actual by $10.52M. This increase is shown above and is driven significantly by an increase in the Average Net Book Value of $9.11M. Distribution Assets increased in 2014 by $10.46M, General Plant Assets by $2.13M, which is offset by Contributed Capital of ($1.59M) for a total change of $11.0M in Gross Fixed Assets. Table 2-21 and the subsequent narrative provide a more detailed explanation of the change in Gross Assets year over year. WNH notes that the 2014 Net Book Value was also impacted by the removal of Stranded Meters in 2014. The Gross Cost removed was $6.65M. The treatment and detailed calculation of the Stranded Meter Assets related to Smart Meter deployment can be found in section 2.5.1.4 “Treatment of Stranded Assets Related to Smart Meter Deployment” further below within this Exhibit.

The change in Accumulated Amortization is a result of changes in capital additions, depreciation expense and disposals, including disposal of Stranded Meters.

The primary driver of the increase in Working Capital of $9.37M is related to an increase in the Cost of Power Expense of $8.58M. A summary of the Cost of Power Expenses for 2011 through 2016 can be found in Table 2-26.

- **2013 Actual vs. 2012 Actual:**

Description	2012 Actual	2013 Actual	Variance from 2012 Actual
Average Gross Fixed Assets	276,829,620	297,054,036	20,224,416
Average Accumulated Depreciation	118,532,338	127,364,890	8,832,552
Average Net Book Value	**158,297,282**	**169,689,146**	**11,391,864**
Working Capital	144,794,492	159,632,515	14,838,023
Working Capital Allowance (%)	15%	15%	
Working Capital Allowance	**21,719,174**	**23,944,877**	**2,225,703**
Rate Base	**180,016,456**	**193,634,023**	**13,617,567**

The Rate Base of $193.63M for 2013 Actual increased over 2012 Actual by $13.62M. This increase is shown above and is made up of a change in Average Net Assets of $11.39M as a result of capital additions. Distribution Assets increased in 2013 by $17.81M, General Plant Assets $1.74M, which is offset by Contributed Capital of ($1.67M) for a total change of $17.88M in Gross Fixed Assets. Table 2-24 and the subsequent narrative provide a more detailed explanation of the change in Gross Assets year over year. The change in Accumulated Amortization is a result of changes in capital additions, depreciation expense and disposals.

WNH notes that in 2012 it received approval for the disposition and recovery of its Smart Meter costs related to the Smart Meter deployment initiated in 2008 by WNH. The total capital cost of this initiative, which was recorded in 2012 was $9.50M. Further details are provided in the section 2012 Actual vs 2011 Actual below.

Additionally, the Working Capital Allowance in 2013 increased by $2.23M. A summary of the Cost of Power Expenses can be found in Table 2-26; $1.96M of the change in the Working Capital Allowance is related to the Cost of Power Expenses.

- **2012 Actual vs. 2011 Actual:**

Description	2011 Actual	2012 Actual	Variance from 2011 Actual
Average Gross Fixed Assets	243,171,056	276,829,620	33,658,564
Average Accumulated Depreciation	109,494,887	118,532,338	9,037,451
Average Net Book Value	**133,676,169**	**158,297,282**	**24,621,113**
Working Capital	134,678,193	144,794,492	10,116,300
Working Capital Allowance (%)	15%	15%	
Working Capital Allowance	**20,201,729**	**21,719,174**	**1,517,445**
Rate Base	**153,877,898**	**180,016,456**	**26,138,558**

The Rate Base of $180.02M for 2012 Actual increased over 2011 Actual by $26.14M. This increase is shown above and is made up primarily of a change in Average Net Assets of $24.62M as a result of capital additions. Distribution Assets increased in 2012 by $26.19M, General Plant Assets decreased by $.73M, which was offset by Contributed Capital of ($2.89M) for a total change of $22.57M in Gross Fixed Assets. Table 2-23 and the subsequent narrative provide a more detailed explanation of the change in gross assets year over year. The change in Accumulated Amortization is a result of changes in capital additions, depreciation expense and disposals.

2012 was impacted by three assets, namely the disposal of a Service Centre and Administration Land and Building, as well as the approval of Smart Meter disposition and recovery of costs. These items are described below.

The disposal of the land and building had been shown in the 2011 COS as being disposed of in 2011 in the amount of $5.43M, however, these items were not transferred to the Work in Progress Account 2070 until 2012. The land and building were ultimately sold in 2013.

WNH received approval for its Smart Meter Disposition on October 4, 2012 (corrected October 12, 2012), *EB-2012-0266,* regarding the disposition and recovery of costs related to the Smart Meter deployment initiated in 2008 by WNH. The Board granted its approval of historically incurred costs and as such WNH recorded these costs in its Gross Fixed Assets in 2012. The Gross Fixed Assets recorded in 2012 were $7.79M in Meters, $1.18M in Other Equipment, $.22M Computer Hardware, $.31M Computer Software and $.23M in Applications Software.

WNH proposed not to dispose of Stranded Meter Costs through *EB-2012-0266*, but to deal with the disposition in its next rebasing application. As part of this COS application, WNH will be seeking disposition of the Net Book Value ("NBV") of its Stranded Meters and has adjusted its Rate Base accordingly in 2014 to recognize the disposition; this ensures that the opening value of the 2016 Test Year properly reflects PP&E for rate setting purposes. The treatment and detailed calculation of the Stranded Meter Assets related to Smart Meter deployment can be found in section 2.5.1.4 "Treatment of Stranded Assets Related to Smart Meter Deployment" further below within this Exhibit.

The Working Capital Allowance increased by $1.52M; $1.26M is a result of increased Cost of Power Expenses.

- **2011 Actual vs. 2011 Board Approved:**

Description	2011 Board Approved	2011 Actual	Variance from 2011 Board Approved
Average Gross Fixed Assets	241,291,190	243,171,056	1,879,866
Average Accumulated Depreciation	109,274,357	109,494,887	220,530
Average Net Book Value	**132,016,832**	**133,676,169**	**1,659,337**
Working Capital	126,529,154	134,678,193	8,149,039
Working Capital Allowance (%)	15%	15%	
Working Capital Allowance	**18,979,373**	**20,201,729**	**1,222,356**
Rate Base	**150,996,206**	**153,877,898**	**2,881,693**

The rate base of $153.88M for 2011 Actual was higher than the 2011 Board Approved by $2.88M.

The variance is primarily related to the disposal of a Service Centre and Administration Land Building which was reflected as a disposal in the 2011 COS, however, it was transferred to WIP in 2012. Details are provided above in the section 2011 Actual vs 2012 Actual. The land and building were shown as disposals in the 2011 COS in the amount of $5.43M. Table 2-23 and the subsequent narrative provide a more detailed explanation of the change in gross assets year over year. Table 2-31 provides the project level detail of 2011 capital spending as compared 2011 Board Approved amounts. The change in Accumulated Amortization is a result of changes in capital additions, depreciation expense and disposals.

Cost of Power Expenses was also higher than Board Approved in 2011 which resulted in an increase to the Board Approved Working Capital Allowance of $1.22M.

Fixed Asset Continuity Schedules, Including Work in Progress

Table 2-6 through Table 2-11 provide the Fixed Asset Continuity Schedules, including WIP for each of 2011 Actual, 2012 Actual, 2013 Actual, 2014 Actual, 2015 Bridge Year, and 2016 Test Year.

The Total Gross Asset balances in WNH's Fixed Asset Continuity Schedules do not balance to the opening and closing balances of Gross Assets used to calculate the Fixed Asset component of Rate Base. WIP has been removed from the Fixed Asset Continuity Schedule balances for Rate Base calculation purposes, as mandated by the Board. A reconciliation of Year-End NBV by year is provided in Table 2-5 below. The opening and closing balances of Accumulated Depreciation used to calculate the Fixed Asset component of Rate Base correspond to the Fixed Asset Continuity Schedule, thus, no reconciliation is required for Accumulated Depreciation.

Table 2-5 – Reconciliation of Opening and Closing Balances

Description	2011 Board Approved	2011 Actual	2012 Actual	2013 Actual	2014 Actual	2015 Bridge Year	2016 Test Year
Total Gross Assets for Rate Base	260,326,104	265,545,785	288,113,454	305,994,618	316,996,025	332,747,684	349,220,792
Work in Progress (WIP)	2,463,788	2,476,939	2,559,371	3,027,484	3,744,173	2,539,260	2,538,211
WIP - Electric Plant Held for Future Use			6,781,677				
Total Gross Assets Including WIP	**262,789,892**	**268,022,724**	**290,672,825**	**309,022,101**	**320,740,198**	**335,286,943**	**351,759,002**
Total Accumulated Depreciation for Rate Base	112,600,734	113,739,171	123,325,504	131,404,275	133,975,417	142,317,056	150,917,658
Accumulated Depreciation WIP - Electric Plant Held for Future Use			1,838,324				
Total Accumulated Depreciation for Rate Base Including WIP	**112,600,734**	**113,739,171**	**125,163,828**	**131,404,275**	**133,975,417**	**142,317,056**	**150,917,658**
Total Net Book Value for Rate Base	147,725,370	151,806,614	164,787,950	174,590,342	183,020,608	190,430,627	198,303,133
Work in Progress	2,463,788	2,476,939	7,502,724	3,027,484	3,744,173	2,539,260	2,538,211
Total Net Book Value Including WIP	**150,189,158**	**154,283,553**	**172,290,673**	**177,617,826**	**186,764,781**	**192,969,887**	**200,841,344**

Table 2-6 - Fixed Asset Continuity Schedule as at December 31, 2011, CGAAP

			Cost				Accumulated Depreciation				
CCA Class	OEB	Description	Opening Balance	Additions	Disposals	Closing Balance	Opening Balance	Additions	Disposals	Closing Balance	Net Book Value
N/A	1805	Land	1,577,530	1,489,660		3,067,191	0			0	3,067,191
1b	1806	Land Rights	394,606	31,950		426,556	0			0	426,556
1b	1808	Buildings and Fixtures	8,465,550	23,882,978		32,348,528	2,555,754	198,587		2,754,342	29,594,186
13	1810	Leasehold Improvements				0				0	0
47	1815	Transformer Station Equipment - Normally Primary above 50 kV	29,442,101	888,390		30,330,491	8,028,692	709,961		8,738,653	21,591,838
47	1820	Distribution Station Equipment - Normally Primary below 50 kV	4,657,396	2,220		4,659,616	3,116,991	79,529		3,196,521	1,463,096
47	1825	Storage Battery Equipment				0				0	0
47	1830	Poles, Towers and Fixtures	45,116,967	4,930,506		50,047,474	19,036,299	1,852,736		20,889,035	29,158,439
47	1835	Overhead Conductors and Devices	20,981,924	2,714,041		23,695,965	7,388,990	895,887		8,284,877	15,411,088
47	1840	Underground Conduit	13,839,928	917,661		14,757,589	6,648,606	541,742		7,190,348	7,567,241
47	1845	Underground Conductors and Devices	30,650,624	2,187,098		32,837,721	15,193,535	1,199,287		16,392,823	16,444,899
47	1850	Line Transformers	41,330,071	3,155,616		44,485,687	17,625,971	1,700,667		19,326,639	25,159,048
47	1855	Services	20,424,994	1,139,152		21,564,146	10,227,278	768,485		10,995,762	10,568,384
8	1860	Meters	9,379,724	384,912		9,764,636	5,696,425	344,019		6,040,444	3,724,192
N/A	1865	Other Installations on Customer's Premises				0				0	0
N/A	1905	Land				0				0	0
CEC	1906	Land Rights				0				0	0
47	1908	Buildings and Fixtures				0				0	0
13	1910	Leasehold Improvements				0				0	0
8	1915	Office Furniture and Equipment	812,409	674,564	16,200	1,470,774	640,402	105,173	12,960	732,615	738,159
45/50	1920	Computer Equipment - Hardware	3,035,778	354,469		3,390,247	2,792,267	171,518		2,963,785	426,462
12/50	1925	Computer Software	3,916,791	658,023		4,574,813	3,223,192	508,935		3,732,127	842,686
10	1930	Transportation Equipment	6,874,924	851,227	503,885	7,222,266	5,104,875	546,481	514,311	5,137,046	2,085,220
8	1935	Stores Equipment	180,403	335,735		516,138	105,001	44,715		149,717	366,421
8	1940	Tools, Shop and Garage Equipment	831,341	204,266		1,035,607	550,019	74,250		624,269	411,339
8	1945	Measurement and Testing Equipment	685,917	115,101		801,018	584,261	29,810		614,071	186,947
8	1950	Power Operated Equipment				0				0	0
8	1955	Communication Equipment	446,091	418,652		864,743	163,198	81,335		244,533	620,209
8	1960	Miscellaneous Equipment	678,460	679,368		1,357,827	510,912	94,300		605,212	752,615
47	1970	Load Management Controls - Customer Premises				0				0	0
47	1975	Load Management Controls - Utility Premises				0				0	0
8	1980	System Supervisory Equipment	2,861,401	738,065		3,599,466	1,986,362	159,331		2,145,693	1,453,773
47	1985	Sentinel Lighting Rentals				0				0	0
47	1990	Other Tangible Property				0				0	0
47	1995	Contributions and Grants	(25,788,604)	(1,484,110)		(27,272,714)	(5,928,431)	(1,090,909)		(7,019,339)	(20,253,375)
	2005	Property under Capital Lease				0				0	0
		Total before Work in Process	**220,796,326**	**45,269,544**	**520,085**	**265,545,785**	**105,250,602**	**9,015,840**	**527,271**	**113,739,171**	**151,806,614**
WIP	2055	Work in Process	12,024,820	1,642,283	12,024,820	1,642,283	0			0	1,642,283
WIP	2040	Electric Plant Held for Future Use	834,656			834,656				0	834,656
		Total after Work in Process	**232,821,146**	**46,911,827**	**12,544,905**	**268,022,724**	**105,250,602**	**9,015,840**	**527,271**	**113,739,171**	**154,283,553**

Table 2-7 - Fixed Asset Continuity Schedule as at December 31, 2012, CGAAP

CCA Class	OEB	Description	Cost: Opening Balance	Cost: Additions	Cost: Disposals	Cost: Closing Balance	Accumulated Depreciation: Opening Balance	Accumulated Depreciation: Additions	Accumulated Depreciation: Disposals	Accumulated Depreciation: Closing Balance	Net Book Value
N/A	1805	Land	3,067,191		743,394	2,323,796	0			0	2,323,796
1b	1806	Land Rights	426,556	84,140		510,696	0			0	510,696
1b	1808	Buildings and Fixtures	32,348,528	1,257,145	4,618,012	28,987,662	2,754,342	571,560	1,838,324	1,487,578	27,500,084
13	1810	Leasehold Improvements	0			0	0			0	0
47	1815	Transformer Station Equipment - Normally Primary above 50 kV	30,330,491	899,868		31,230,359	8,738,653	732,198		9,470,851	21,759,508
47	1820	Distribution Station Equipment - Normally Primary below 50 kV	4,659,616	152,180		4,811,797	3,196,521	79,528		3,276,048	1,535,748
47	1825	Storage Battery Equipment	0			0	0			0	0
47	1830	Poles, Towers and Fixtures	50,047,474	4,974,753		55,022,226	20,889,035	2,024,926		22,913,961	32,108,265
47	1835	Overhead Conductors and Devices	23,695,965	3,376,784		27,072,749	8,284,877	1,022,110		9,306,987	17,765,762
47	1840	Underground Conduit	14,757,589	753,185		15,510,774	7,190,348	544,326		7,734,673	7,776,101
47	1845	Underground Conductors and Devices	32,837,721	2,194,333		35,032,055	16,392,823	1,251,831		17,644,654	17,387,401
47	1850	Line Transformers	44,485,687	3,566,566		48,052,253	19,326,639	1,790,257		21,116,896	26,935,357
47	1855	Services	21,564,146	1,265,434		22,829,581	10,995,762	794,482		11,790,245	11,039,336
8	1860	Meters	9,764,636	8,655,270		18,419,906	6,040,444	1,884,065		7,924,509	10,495,397
N/A	1865	Other Installations on Customer's Premises	0			0	0			0	0
N/A	1905	Land	0			0	0			0	0
CEC	1906	Land Rights	0			0	0			0	0
47	1908	Buildings and Fixtures	0			0	0			0	0
13	1910	Leasehold Improvements	0			0	0			0	0
8	1915	Office Furniture and Equipment	1,470,774	286,774		1,757,548	732,615	131,771		864,386	893,162
45/50	1920	Computer Equipment - Hardware	3,390,247	425,135		3,815,382	2,963,785	378,588		3,342,372	473,010
12/50	1925	Computer Software	4,574,813	832,820		5,407,634	3,732,127	537,546		4,269,673	1,137,960
10	1930	Transportation Equipment	7,222,266	885,871	643,002	7,465,135	5,137,046	608,072	523,687	5,221,431	2,243,703
8	1935	Stores Equipment	516,138	20,399	2,612	533,925	149,717	46,084	1,994	193,806	340,119
8	1940	Tools, Shop and Garage Equipment	1,035,607	160,116	13,581	1,182,142	624,269	78,991	10,865	692,395	489,747
8	1945	Measurement and Testing Equipment	801,018	90,263		891,281	614,071	36,838		650,909	240,372
8	1950	Power Operated Equipment	0			0	0			0	0
8	1955	Communication Equipment	864,743	37,716		902,458	244,533	85,107		329,641	572,817
8	1960	Miscellaneous Equipment	1,357,827	1,205,849		2,563,676	605,212	403,777		1,008,989	1,554,687
47	1970	Load Management Controls - Customer Premises	0			0	0			0	0
47	1975	Load Management Controls - Utility Premises	0			0	0			0	0
8	1980	System Supervisory Equipment	3,599,466	349,669		3,949,135	2,145,693	165,873		2,311,566	1,637,568
47	1985	Sentinel Lighting Rentals	0			0	0			0	0
47	1990	Other Tangible Property	0			0	0			0	0
47	1995	Contributions and Grants	(27,272,714)	(2,886,001)		(30,158,715)	(7,019,339)	(1,206,727)		(8,226,066)	(21,932,649)
	2005	Property under Capital Lease	0			0	0			0	0
		Total before Work in Process	**265,545,785**	**28,588,269**	**6,020,600**	**288,113,454**	**113,739,171**	**11,961,203**	**2,374,870**	**123,325,504**	**164,787,950**
WIP	2055	Work in Process	1,642,283	1,724,715	1,642,283	1,724,715	0			0	1,724,715
WIP	2070	Other Utility Plant		6,781,677		6,781,677		1,838,324		1,838,324	4,943,353
WIP	2040	Electric Plant Held for Future Use	834,656			834,656	0			0	834,656
		Total after Work in Process	**268,022,724**	**37,094,661**	**7,662,883**	**297,454,502**	**113,739,171**	**13,799,528**	**2,374,870**	**125,163,828**	**172,290,674**
			0				0			0	0

Less: Fully Allocated Depreciation	
Transportation	608,072
Truck Tools	78,991
Stores	46,084
Engineering	126,938
Net Depreciation	**11,101,118**

Table 2-8 - Fixed Asset Continuity Schedule as at December 31, 2013, Revised CGAAP

			Cost				Accumulated Depreciation				
CCA Class	OEB	Description	Opening Balance	Additions	Disposals	Closing Balance	Opening Balance	Additions	Disposals	Closing Balance	Net Book Value
N/A	1805	Land	2,323,796			2,323,796	0			0	2,323,796
1b	1806	Land Rights	510,696	43,423		554,119	0			0	554,119
1b	1808	Buildings and Fixtures	28,987,662	589,011		29,576,672	1,487,578	819,730		2,307,308	27,269,365
13	1810	Leasehold Improvements	0			0	0			0	0
47	1815	Transformer Station Equipment - Normally Primary above 50 kV	31,230,359	531,484		31,761,843	9,470,851	1,307,488		10,778,339	20,983,504
47	1820	Distribution Station Equipment - Normally Primary below 50 kV	4,811,797	425,404		5,237,201	3,276,048	132,757		3,408,805	1,828,396
47	1825	Storage Battery Equipment	0			0	0			0	0
47	1830	Poles, Towers and Fixtures	55,022,226	4,855,044		59,877,270	22,913,961	946,536		23,860,497	36,016,773
47	1835	Overhead Conductors and Devices	27,072,749	3,401,590		30,474,339	9,306,987	579,778		9,886,765	20,587,575
47	1840	Underground Conduit	15,510,774	909,575		16,420,349	7,734,673	205,572		7,940,245	8,480,104
47	1845	Underground Conductors and Devices	35,032,055	2,267,662		37,299,717	17,644,654	798,336		18,442,990	18,856,727
47	1850	Line Transformers	48,052,253	2,890,480		50,942,733	21,116,896	897,220		22,014,116	28,928,617
47	1855	Services	22,829,581	1,255,108		24,084,688	11,790,245	304,826		12,095,071	11,989,618
8	1860	Meters	18,419,906	809,494		19,229,400	7,924,509	1,077,226		9,001,735	10,227,665
N/A	1865	Other Installations on Customer's Premises	0			0	0			0	0
N/A	1905	Land	0			0	0			0	0
CEC	1906	Land Rights	0			0	0			0	0
47	1908	Buildings and Fixtures	0			0	0			0	0
13	1910	Leasehold Improvements	0			0	0			0	0
8	1915	Office Furniture and Equipment	1,757,548	19,537	231,777	1,545,307	864,386	106,927	170,500	800,813	744,494
45/50	1920	Computer Equipment - Hardware	3,815,382	112,736		3,928,118	3,342,372	200,839		3,543,212	384,907
12/50	1925	Computer Software	5,407,634	342,714		5,750,348	4,269,673	535,469		4,805,143	945,205
10	1930	Transportation Equipment	7,465,135	911,991	107,383	8,269,742	5,221,431	368,941	107,383	5,482,989	2,786,753
8	1935	Stores Equipment	533,925	8,581		542,506	193,806	46,942		240,748	301,758
8	1940	Tools, Shop and Garage Equipment	1,182,142	81,737	36,180	1,227,700	692,395	196,252	19,113	869,535	358,165
8	1945	Measurement and Testing Equipment	891,281	4,726		896,007	650,909	68,859		719,768	176,239
8	1950	Power Operated Equipment	0			0	0			0	0
8	1955	Communication Equipment	902,458	8,031		910,489	329,641	93,972		423,612	486,877
8	1960	Miscellaneous Equipment	2,563,676	17,608	22,108	2,559,176	1,008,989	238,202	16,788	1,230,403	1,328,773
47	1970	Load Management Controls - Customer Premises	0			0	0			0	0
47	1975	Load Management Controls - Utility Premises	0			0	0			0	0
8	1980	System Supervisory Equipment	3,949,135	465,383		4,414,517	2,311,566	207,899		2,519,466	1,895,052
47	1985	Sentinel Lighting Rentals	0			0	0			0	0
47	1990	Other Tangible Property	0			0	0			0	0
47	1995	Contributions and Grants	(30,158,715)	(1,672,705)		(31,831,420)	(8,226,066)	(741,216)		(8,967,282)	(22,864,138)
	2005	Property under Capital Lease	0			0	0			0	0
		Total before Work in Process	**288,113,454**	**18,278,612**	**397,448**	**305,994,618**	**123,325,504**	**8,392,554**	**313,783**	**131,404,275**	**174,590,343**
WIP	2055	Work in Process	1,724,715	2,192,828	1,724,715	2,192,828	0			0	2,192,828
WIP	2070	Other Utility Plant	6,781,677		6,781,677	0	1,838,324		1,838,324	0	0
WIP	2040	Electric Plant Held for Future Use	834,656			834,656	0			0	834,656
		Total after Work in Process	**297,454,502**	**20,471,439**	**8,903,840**	**309,022,102**	**125,163,828**	**8,392,554**	**2,152,107**	**131,404,275**	**177,617,826**

Less: Fully Allocated Depreciation	
Transportation	368,941
Truck Tools	196,252
Stores	46,942
Net Depreciation	**7,780,420**

Table 2-9 - Fixed Asset Continuity Schedule as at December 31, 2014, MIFRS

			Cost				Accumulated Depreciation				
CCA Class	OEB	Description	Opening Balance	Additions	Disposals	Closing Balance	Opening Balance	Additions	Disposals	Closing Balance	Net Book Value
N/A	1805	Land	2,323,796			2,323,796	0			0	2,323,796
1b	1806	Land Rights	554,119	99,902		654,021	0			0	654,021
1b	1808	Buildings and Fixtures	29,576,672	726,502		30,303,174	2,307,308	834,772		3,142,079	27,161,095
13	1810	Leasehold Improvements	0			0	0			0	0
47	1815	Transformer Station Equipment - Normally Primary above 50 kV	31,761,843	194,308		31,956,150	10,778,339	1,298,965		12,077,303	19,878,847
47	1820	Distribution Station Equipment - Normally Primary below 50 kV	5,237,201	359,883		5,597,083	3,408,805	165,694		3,574,499	2,022,584
47	1825	Storage Battery Equipment	0			0	0			0	0
47	1830	Poles, Towers and Fixtures	59,877,270	4,965,069		64,842,339	23,860,497	1,056,871		24,917,368	39,924,971
47	1835	Overhead Conductors and Devices	30,474,339	4,052,486		34,526,826	9,886,765	711,784		10,598,549	23,928,277
47	1840	Underground Conduit	16,420,349	949,493		17,369,842	7,940,245	224,524		8,164,769	9,205,073
47	1845	Underground Conductors and Devices	37,299,717	1,715,849		39,015,566	18,442,990	809,522		19,252,512	19,763,054
47	1850	Line Transformers	50,942,733	2,960,653		53,903,386	22,014,116	1,005,298		23,019,414	30,883,972
47	1855	Services	24,084,688	1,286,256		25,370,945	12,095,071	331,589		12,426,660	12,944,285
8	1860	Meters	19,229,400	370,695	6,652,977	12,947,118	9,001,735	618,947	5,287,642	4,333,040	8,614,078
N/A	1865	Other Installations on Customer's Premises	0			0	0			0	0
N/A	1905	Land	0			0	0			0	0
CEC	1906	Land Rights	0			0	0			0	0
47	1908	Buildings and Fixtures	0			0	0			0	0
13	1910	Leasehold Improvements	0			0	0			0	0
8	1915	Office Furniture and Equipment	1,545,307	22,322		1,567,630	800,813	109,160		909,973	657,657
45/50	1920	Computer Equipment - Hardware	3,928,118	127,191		4,055,309	3,543,212	178,627		3,721,839	333,470
12/50	1925	Computer Software	5,750,348	362,002		6,112,349	4,805,143	479,831		5,284,974	827,375
10	1930	Transportation Equipment	8,269,742	1,032,897	446,378	8,856,261	5,482,989	484,213	439,069	5,528,133	3,328,128
8	1935	Stores Equipment	542,506	0		542,506	240,748	46,942		287,690	254,816
8	1940	Tools, Shop and Garage Equipment	1,227,700	116,661		1,344,361	869,535	143,890		1,013,424	330,937
8	1945	Measurement and Testing Equipment	896,007	36,197		932,204	719,768	52,571		772,339	159,865
8	1950	Power Operated Equipment	0			0	0			0	0
8	1955	Communication Equipment	910,489	19,274		929,763	423,612	91,386		514,999	414,764
8	1960	Miscellaneous Equipment	2,559,176	35,224		2,594,400	1,230,403	241,511		1,471,915	1,122,485
47	1970	Load Management Controls - Customer Premises	0			0	0			0	0
47	1975	Load Management Controls - Utility Premises	0			0	0			0	0
8	1980	System Supervisory Equipment	4,414,517	261,141		4,675,659	2,519,466	192,295		2,711,760	1,963,898
47	1985	Sentinel Lighting Rentals	0			0	0			0	0
47	1990	Other Tangible Property	0			0	0			0	0
47	1995	Contributions and Grants	(31,831,420)	(1,593,244)		(33,424,664)	(8,967,282)	(780,539)		(9,747,822)	(23,676,842)
	2005	Property under Capital Lease	0			0	0			0	0
		Total before Work in Process	**305,994,618**	**18,100,762**	**7,099,355**	**316,996,025**	**131,404,275**	**8,297,854**	**5,726,711**	**133,975,418**	**183,020,607**
WIP	2055	Work in Process	2,192,828	2,909,517	2,192,828	2,909,517	0			0	2,909,517
WIP	2070	Other Utility Plant	0			0	0			0	0
WIP	2040	Electric Plant Held for Future Use	834,656			834,656	0			0	834,656
		Total after Work in Process	**309,022,102**	**21,010,279**	**9,292,183**	**320,740,198**	**131,404,275**	**8,297,854**	**5,726,711**	**133,975,418**	**186,764,780**
			-			-	-				0

Less: Fully Allocated Depreciation	
Transportation	484,213
Truck Tools	143,890
Stores	46,942
Net Depreciation	**7,622,809**

Table 2-10 - Fixed Asset Continuity Schedule as at December 31, 2015, MIFRS

			Cost				Accumulated Depreciation				
CCA Class	**OEB**	**Description**	**Opening Balance**	**Additions**	**Disposals**	**Closing Balance**	**Opening Balance**	**Additions**	**Disposals**	**Closing Balance**	**Net Book Value**
N/A	1805	Land	2,323,796			2,323,796	0			0	2,323,796
1b	1612	Land Rights	654,021	43,159		697,180	0			0	697,180
1b	1808	Buildings and Fixtures	30,303,174	154,039		30,457,213	3,142,079	841,280		3,983,359	26,473,854
13	1810	Leasehold Improvements	0			0	0			0	0
47	1815	Transformer Station Equipment - Normally Primary above 50 kV	31,956,150	703,598		32,659,748	12,077,303	1,319,243		13,396,546	19,263,202
47	1820	Distribution Station Equipment - Normally Primary below 50 kV	5,597,083			5,597,083	3,574,499	135,823		3,710,322	1,886,761
47	1825	Storage Battery Equipment	0			0	0			0	0
47	1830	Poles, Towers and Fixtures	64,842,339	3,813,057		68,655,396	24,917,368	1,141,605		26,058,973	42,596,423
47	1835	Overhead Conductors and Devices	34,526,826	3,582,646		38,109,472	10,598,549	843,466		11,442,015	26,667,457
47	1840	Underground Conduit	17,369,842	1,418,703		18,788,545	8,164,769	252,898		8,417,667	10,370,879
47	1845	Underground Conductors and Devices	39,015,566	3,989,900		43,005,466	19,252,512	913,797		20,166,309	22,839,157
47	1850	Line Transformers	53,903,386	3,696,021		57,599,407	23,019,414	1,097,078		24,116,492	33,482,915
47	1855	Services	25,370,945	1,038,588		26,409,533	12,426,660	353,256		12,779,915	13,629,617
8	1860	Meters	12,947,118	662,062		13,609,180	4,333,040	835,022		5,168,061	8,441,119
N/A	1865	Other Installations on Customer's Premises	0			0	0			0	0
N/A	1905	Land	0			0	0			0	0
CEC	1906	Land Rights	0			0	0			0	0
47	1908	Buildings and Fixtures	0			0	0			0	0
13	1910	Leasehold Improvements	0			0	0			0	0
8	1915	Office Furniture and Equipment	1,567,630	9,500		1,577,130	909,973	106,607		1,016,580	560,550
45/50	1920	Computer Equipment - Hardware	4,055,309	179,480		4,234,789	3,721,839	195,522		3,917,361	317,428
12/50	1611	Computer Software	6,112,349	711,366		6,823,715	5,284,974	508,875		5,793,849	1,029,866
10	1930	Transportation Equipment	8,856,261	912,044	642,135	9,126,170	5,528,133	568,909	624,772	5,472,270	3,653,900
8	1935	Stores Equipment	542,506			542,506	287,690	46,942		334,631	207,875
8	1940	Tools, Shop and Garage Equipment	1,344,361	103,000		1,447,361	1,013,424	117,947		1,131,371	315,990
8	1945	Measurement and Testing Equipment	932,204	14,000		946,204	772,339	51,055		823,394	122,810
8	1950	Power Operated Equipment	0			0	0			0	0
8	1955	Communication Equipment	929,763	14,500		944,263	514,999	92,837		607,835	336,428
8	1960	Miscellaneous Equipment	2,594,400	31,500		2,625,900	1,471,915	241,910		1,713,824	912,076
47	1970	Load Management Controls - Customer Premises	0			0	0			0	0
47	1975	Load Management Controls - Utility Premises	0			0	0			0	0
8	1980	System Supervisory Equipment	4,675,659	231,448		4,907,107	2,711,760	207,646		2,919,406	1,987,701
47	1985	Sentinel Lighting Rentals	0			0	0			0	0
47	1990	Other Tangible Property	0			0	0			0	0
47	1995	Contributions and Grants	(33,424,664)			(33,424,664)	(9,747,822)	(779,728)		(10,527,550)	(22,897,114)
	2005	Property under Capital Lease	0			0	0			0	0
47	2440	Deferred Revenue - Contributed Capital	0	(4,914,818)		(4,914,818)		(125,577)		(125,577)	(4,789,241)
		Total before Work in Process	**316,996,025**	**16,393,793**	**642,135**	**332,747,683**	**133,975,418**	**8,966,411**	**624,772**	**142,317,057**	**190,430,627**
WIP	2070	Other utility plant	0			0					0
WIP	2055	Work in Process	2,909,517	1,704,604	2,909,517	1,704,604	0			0	1,704,604
WIP	2040	Electric Plant Held for Future Use	834,656			834,656				0	834,656
		Total after Work in Process	**320,740,198**	**18,098,397**	**3,551,652**	**335,286,943**	**133,975,418**	**8,966,411**	**624,772**	**142,317,057**	**192,969,887**
			0				0				0

Less: Fully Allocated Depreciation	
Transportation	568,909
Truck Tools	117,947
Stores	46,942
Net Depreciation	**8,232,613**

Table 2-11 - Fixed Asset Continuity Schedule as at December 31, 2016, MIFRS

			Cost				Accumulated Depreciation				
CCA Class	OEB	Description	Opening Balance	Additions	Disposals	Closing Balance	Opening Balance	Additions	Disposals	Closing Balance	Net Book Value
N/A	1805	Land	2,323,796			2,323,796	0			0	2,323,796
1b	1612	Land Rights	697,180	43,259		740,439	0			0	740,439
1b	1808	Buildings and Fixtures	30,457,213	128,050		30,585,263	3,983,359	844,031		4,827,391	25,757,873
13	1810	Leasehold Improvements	0			0	0			0	0
47	1815	Transformer Station Equipment - Normally Primary abov	32,659,748	516,518		33,176,266	13,396,546	1,138,051		14,534,598	18,641,668
47	1820	Distribution Station Equipment - Normally Primary below	5,597,083	94,587		5,691,670	3,710,322	137,510		3,847,832	1,843,838
47	1825	Storage Battery Equipment	0			0	0			0	0
47	1830	Poles, Towers and Fixtures	68,655,396	3,732,213		72,387,609	26,058,973	1,183,075		27,242,048	45,145,562
47	1835	Overhead Conductors and Devices	38,109,472	3,640,323		41,749,795	11,442,015	908,508		12,350,523	29,399,272
47	1840	Underground Conduit	18,788,545	905,772		19,694,317	8,417,667	261,956		8,679,622	11,014,695
47	1845	Underground Conductors and Devices	43,005,466	2,460,395		45,465,861	20,166,309	942,675		21,108,984	24,356,877
47	1850	Line Transformers	57,599,407	3,872,425		61,471,832	24,116,492	1,145,179		25,261,671	36,210,161
47	1855	Services	26,409,533	1,044,553		27,454,086	12,779,915	364,147		13,144,063	14,310,024
8	1860	Meters	13,609,180	644,367		14,253,547	5,168,061	856,501		6,024,562	8,228,984
N/A	1865	Other Installations on Customer's Premises	0			0	0			0	0
N/A	1905	Land	0			0	0			0	0
CEC	1906	Land Rights	0			0	0			0	0
47	1908	Buildings and Fixtures	0			0	0			0	0
13	1910	Leasehold Improvements	0			0	0			0	0
8	1915	Office Furniture and Equipment	1,577,130	7,000		1,584,130	1,016,580	106,957		1,123,536	460,593
45/50	1920	Computer Equipment - Hardware	4,234,789	108,650		4,343,439	3,917,361	132,136		4,049,497	293,943
12/50	1611	Computer Software	6,823,715	871,760		7,695,475	5,793,849	476,948		6,270,797	1,424,678
10	1930	Transportation Equipment	9,126,170	619,409	316,071	9,429,508	5,472,270	589,154	305,084	5,756,340	3,673,169
8	1935	Stores Equipment	542,506			542,506	334,631	46,942		381,573	160,933
8	1940	Tools, Shop and Garage Equipment	1,447,361	77,000		1,524,361	1,131,371	117,919		1,249,290	275,072
8	1945	Measurement and Testing Equipment	946,204	15,000		961,204	823,394	45,677		869,071	92,133
8	1950	Power Operated Equipment	0			0	0			0	0
8	1955	Communication Equipment	944,263			944,263	607,835	92,368		700,203	244,060
8	1960	Miscellaneous Equipment	2,625,900	32,000		2,657,900	1,713,824	243,393		1,957,217	700,683
47	1970	Load Management Controls - Customer Premises	0			0	0			0	0
47	1975	Load Management Controls - Utility Premises	0			0	0			0	0
8	1980	System Supervisory Equipment	4,907,107	265,636		5,172,743	2,919,406	206,447		3,125,853	2,046,890
47	1985	Sentinel Lighting Rentals	0			0	0			0	0
47	1990	Other Tangible Property	0			0	0			0	0
47	1995	Contributions and Grants	(33,424,664)			(33,424,664)	(10,527,550)	(778,853)		(11,306,403)	(22,118,261)
	2005	Property under Capital Lease	0			0	0			0	0
47	2440	Deferred Revenue - Contributed Capital	(4,914,818)	(2,289,738)		(7,204,556)	(125,577)	(155,031)		(280,607)	(6,923,949)
		Total before Work in Process	**332,747,683**	**16,789,179**	**316,071**	**349,220,791**	**142,317,057**	**8,905,686**	**305,084**	**150,917,659**	**198,303,133**
WIP	2070	Other utility plant	0			0					0
WIP	2055	Work in Process	1,704,604	1,703,555	1,704,604	1,703,555	0			0	1,703,555
WIP	2040	Electric Plant Held for Future Use	834,656			834,656					834,656
		Total after Work in Process	**335,286,943**	**18,492,734**	**2,020,675**	**351,759,002**	**142,317,057**	**8,905,686**	**305,084**	**150,917,659**	**200,841,344**

0

Less: Fully Allocated Depreciation	
Transportation	589,154
Truck Tools	117,919
Stores	46,942
Net Depreciation	**8,151,672**

Fixed Asset Continuity Schedules, Excluding Work in Progress

Table 2-12 through Table 2-18 below provide the Fixed Asset Continuity Schedules excluding WIP for each of 2011 Actual, 2012 Actual, 2013 Actual, 2014 Actual, 2015 Bridge Year, and 2016 Test Year and are consistent with Appendix 2-BA as required in the Filing Requirements.

As discussed above, WNH implemented changes to its capitalization and depreciation policies in 2013, therefore a Continuity Schedule as at December 31, 2013 is provided for both before and after the policy changes. Table 2-14 provides the Comparative Continuity Schedule assuming no changes to accounting policy ("Old CGAAP") and Table 2-15 provides the Revised CGAAP Continuity Schedule used for Rate Base purposes. For WNH's MIFRS transition year, as at December 31, 2014, WNH does not have any material differences, thus, no additional tables are presented. WNH also investigated the retirement of grouped distribution assets in 2015 and did not find any material amounts to be recorded, thus, no information is included in this Application.

The "CCA Class" for fixed assets agrees with the CCA Class used for tax purposes in WNH's tax returns. WNH has two asset classes that were different from those shown in Appendix 2-BA as provided by the Board. For tax purposes WNH has classified Computer Software and Computer Hardware as Class 50 with a CCA rate of 55%, incorporating a 50% rule in the year of acquisition.

Upon the date of IFRS adoption, Customer Contributions are no longer recorded in Account 1995 Contributions & Grants, but are recorded in Account 2440, Deferred Revenue and amortized to revenue over the service life of the related asset. In addition, historical amounts recorded in Account 1995 prior to the transition year are to be netted against the assets in PP&E that they relate to, no longer accounted separately as an offset to PP&E. For purposes of Cost Allocation, and continuity within this application, WNH has included Account 2440 in the Continuity Schedules to track Contributed Capital forecast for the 2015 Bridge Year and the 2016 Test Year. A breakdown of this account is provided in Table 2-19. WNH has included the amortization that is considered revenue for accounting periods as depreciation in 2440 in its continuity schedules.

Depreciation is explained in further detail in the “Capitalization Policy” section of this Exhibit and Exhibit 4 – Operating Costs.

For general financial reporting purposes under IFRS, WNH does not have any material retirement of assets that are not individually identified for both the 2015 Bridge Year and the 2016 Test Year.

As part of this application, WNH is requesting approval to recover its Stranded Meter Costs as at December 31, 2015. In order to establish proper PP&E continuity in the 2016 Test Year for rate base purposes, WNH has recorded the disposal in 2014 and has recorded depreciation for 2015 within USoA 1555. WNH has also segregated the NBV of Smart Meters from the Non-Smart Meters to comply with the requirements of Appendix 2-BA.

Table 2-12 - Fixed Asset Continuity Schedule as at December 31, 2011, CGAAP

			Cost				Accumulated Depreciation				
CCA Class	**OEB**	**Description**	**Opening Balance**	**Additions**	**Disposals**	**Closing Balance**	**Opening Balance**	**Additions**	**Disposals**	**Closing Balance**	**Net Book Value**
12	**1611**	Computer Software (Formally known as Account 1925)	3,916,791	658,023		4,574,813	(3,223,192)	(508,935)		(3,732,127)	842,686
CEC	**1612**	Land Rights (Formally known as Account 1806)	394,606	31,950		426,556	-	-		-	426,556
N/A	**1805**	Land	1,577,530	1,489,660		3,067,191	-	-		-	3,067,191
CEC	**1808**	Buildings	8,465,550	23,882,978		32,348,528	(2,555,754)	(198,587)		(2,754,342)	29,594,186
47	**1810**	Leasehold Improvements				-	-	-		-	-
13	**1815**	Transformer Station Equipment >50 kV	29,442,101	888,390		30,330,491	(8,028,692)	(709,961)		(8,738,653)	21,591,838
47	**1820**	Distribution Station Equipment <50 kV	4,657,396	2,220		4,659,616	(3,116,991)	(79,529)		(3,196,521)	1,463,096
47	**1825**	Storage Battery Equipment				-	-	-		-	-
47	**1830**	Poles, Towers & Fixtures	45,116,967	4,930,506		50,047,474	(19,036,299)	(1,852,736)		(20,889,035)	29,158,439
47	**1835**	Overhead Conductors & Devices	20,981,924	2,714,041		23,695,965	(7,388,990)	(895,887)		(8,284,877)	15,411,088
47	**1840**	Underground Conduit	13,839,928	917,661		14,757,589	(6,648,606)	(541,742)		(7,190,348)	7,567,241
47	**1845**	Underground Conductors & Devices	30,650,624	2,187,098		32,837,721	(15,193,535)	(1,199,287)		(16,392,823)	16,444,899
47	**1850**	Line Transformers	41,330,071	3,155,616		44,485,687	(17,625,971)	(1,700,667)		(19,326,639)	25,159,048
47	**1855**	Services (Overhead & Underground)	20,424,994	1,139,152		21,564,146	(10,227,278)	(768,485)		(10,995,762)	10,568,384
47	**1860**	Meters	9,379,724	384,912		9,764,636	(5,696,425)	(344,019)		(6,040,444)	3,724,192
47	**1860**	Meters (Smart Meters)				-	-	-		-	-
N/A	**1905**	Land				-	-	-		-	-
N/A	**1908**	Buildings & Fixtures				-	-	-		-	-
CEC	**1910**	Leasehold Improvements				-	-	-		-	-
47	**1915**	Office Furniture & Equipment (10 years)	812,409	674,564	(16,200)	1,470,774	(640,402)	(105,173)	12,960	(732,615)	738,159
13	**1915**	Office Furniture & Equipment (5 years)				-	-	-		-	-
8	**1920**	Computer Equipment - Hardware				-				-	-
10	**1920**	Computer Equip.-Hardware(Post Mar. 22/04)				-	-	-		-	-
12	**1920**	Computer Equip.-Hardware(Post Mar. 19/07)	3,035,778	354,469		3,390,247	(2,792,267)	(171,518)		(2,963,785)	426,462
10	**1930**	Transportation Equipment	6,874,924	851,227	(503,885)	7,222,266	(5,104,875)	(546,481)	514,311	(5,137,046)	2,085,220
8	**1935**	Stores Equipment	180,403	335,735		516,138	(105,001)	(44,715)		(149,717)	366,421
8	**1940**	Tools, Shop & Garage Equipment	831,341	204,266		1,035,607	(550,019)	(74,250)		(624,269)	411,339
8	**1945**	Measurement & Testing Equipment	685,917	115,101		801,018	(584,261)	(29,810)		(614,071)	186,947
8	**1950**	Power Operated Equipment				-	-	-		-	-
8	**1955**	Communications Equipment	446,091	418,652		864,743	(163,198)	(81,335)		(244,533)	620,209
8	**1955**	Communication Equipment (Smart Meters)				-	-	-		-	-
47	**1960**	Miscellaneous Equipment	678,460	679,368		1,357,827	(510,912)	(94,300)		(605,212)	752,615
47	**1970**	Load Management Controls Customer Premises				-	-	-		-	-
47	**1975**	Load Management Controls Utility Premises				-	-	-		-	-
47	**1980**	System Supervisor Equipment	2,861,401	738,065		3,599,466	(1,986,362)	(159,331)		(2,145,693)	1,453,773
47	**1985**	Miscellaneous Fixed Assets				-	-	-		-	-
47	**1990**	Other Tangible Property				-	-	-		-	-
47	**1995**	Contributions & Grants	(25,788,604)	(1,484,110)		(27,272,714)	5,928,431	1,090,909		7,019,339	(20,253,375)
47	**2440**	Deferred Revenue									
						-				-	-
		Sub-Total	**220,796,326**	**45,269,544**	**(520,085)**	**265,545,785**	**(105,250,602)**	**(9,015,840)**	**527,271**	**(113,739,171)**	**151,806,614**
		Less Socialized Renewable Energy Generation Investments (input as negative)				-				-	-
		Less Other Non Rate-Regulated Utility Assets (input as negative)				-				-	-
		Total PP&E	**220,796,326**	**45,269,544**	**(520,085)**	**265,545,785**	**(105,250,602)**	**(9,015,840)**	**527,271**	**(113,739,171)**	**151,806,614**
		Depreciation Expense adj. from gain or loss on the retirement of assets (pool of like assets), if applicable6									
		Total						**(9,015,840)**			

10		Transportation
10		Truck Tools
8		Stores Equipment
50		Engineering

Less: Fully Allocated Depreciation	
Transportation	(546,481)
Truck Tools	(74,250)
Stores Equipment	(44,715)
Engineering	(140,688)
Net Depreciation	(8,209,705)

Table 2-13 - Fixed Asset Continuity Schedule as at December 31, 2012, CGAAP

			Cost				Accumulated Depreciation				
CCA Class	OEB	Description	Opening Balance	Additions	Disposals	Closing Balance	Opening Balance	Additions	Disposals	Closing Balance	Net Book Value
12	1611	Computer Software (Formally known as Account 1925)	4,574,813	832,820		5,407,634	(3,732,127)	(537,546)		(4,269,673)	1,137,960
CEC	1612	Land Rights (Formally known as Account 1806)	426,556	84,140		510,696	-	-		-	510,696
N/A	1805	Land	3,067,191		(743,394)	2,323,796	-	-		-	2,323,796
CEC	1808	Buildings	32,348,528	1,257,145	(4,618,012)	28,987,662	(2,754,342)	(571,560)	1,838,324	(1,487,578)	27,500,084
47	1810	Leasehold Improvements				-	-	-		-	-
13	1815	Transformer Station Equipment >50 kV	30,330,491	899,868		31,230,359	(8,738,653)	(732,198)		(9,470,851)	21,759,508
47	1820	Distribution Station Equipment <50 kV	4,659,616	152,180		4,811,797	(3,196,521)	(79,528)		(3,276,048)	1,535,748
47	1825	Storage Battery Equipment				-	-	-		-	-
47	1830	Poles, Towers & Fixtures	50,047,474	4,974,753		55,022,226	(20,889,035)	(2,024,926)		(22,913,961)	32,108,265
47	1835	Overhead Conductors & Devices	23,695,965	3,376,784		27,072,749	(8,284,877)	(1,022,110)		(9,306,987)	17,765,762
47	1840	Underground Conduit	14,757,589	753,185		15,510,774	(7,190,348)	(544,326)		(7,734,673)	7,776,101
47	1845	Underground Conductors & Devices	32,837,721	2,194,333		35,032,055	(16,392,823)	(1,251,831)		(17,644,654)	17,387,401
47	1850	Line Transformers	44,485,687	3,566,566		48,052,253	(19,326,639)	(1,790,257)		(21,116,896)	26,935,357
47	1855	Services (Overhead & Underground)	21,564,146	1,265,434		22,829,581	(10,995,762)	(794,482)		(11,790,245)	11,039,336
47	1860	Meters	9,764,636	2,389,390		12,154,026	(6,040,444)	(1,884,065)		(7,924,509)	4,229,517
47	1860	Meters (Smart Meters)		6,265,880		6,265,880	-	-		-	6,265,880
N/A	1905	Land				-	-	-		-	-
N/A	1908	Buildings & Fixtures				-	-	-		-	-
CEC	1910	Leasehold Improvements				-	-	-		-	-
47	1915	Office Furniture & Equipment (10 years)	1,470,774	286,774		1,757,548	(732,615)	(131,771)		(864,386)	893,162
13	1915	Office Furniture & Equipment (5 years)				-	-	-		-	-
8	1920	Computer Equipment - Hardware				-				-	-
10	1920	Computer Equip.-Hardware(Post Mar. 22/04)				-	-	-		-	-
12	1920	Computer Equip.-Hardware(Post Mar. 19/07)	3,390,247	425,135		3,815,382	(2,963,785)	(378,588)		(3,342,372)	473,010
10	1930	Transportation Equipment	7,222,266	885,871	(643,002)	7,465,135	(5,137,046)	(608,072)	523,687	(5,221,431)	2,243,703
8	1935	Stores Equipment	516,138	20,399	(2,612)	533,925	(149,717)	(46,084)	1,994	(193,806)	340,119
8	1940	Tools, Shop & Garage Equipment	1,035,607	160,116	(13,581)	1,182,142	(624,269)	(78,991)	10,865	(692,395)	489,747
8	1945	Measurement & Testing Equipment	801,018	90,263		891,281	(614,071)	(36,838)		(650,909)	240,372
8	1950	Power Operated Equipment				-	-	-		-	-
8	1955	Communications Equipment	864,743	37,716		902,458	(244,533)	(85,107)		(329,641)	572,817
8	1955	Communication Equipment (Smart Meters)				-	-	-		-	-
47	1960	Miscellaneous Equipment	1,357,827	1,205,849		2,563,676	(605,212)	(403,777)		(1,008,989)	1,554,687
47	1970	Load Management Controls Customer Premises				-	-	-		-	-
47	1975	Load Management Controls Utility Premises				-	-	-		-	-
47	1980	System Supervisor Equipment	3,599,466	349,669		3,949,135	(2,145,693)	(165,873)		(2,311,566)	1,637,568
47	1985	Miscellaneous Fixed Assets				-	-	-		-	-
47	1990	Other Tangible Property				-	-	-		-	-
47	1995	Contributions & Grants	(27,272,714)	(2,886,001)		(30,158,715)	7,019,339	1,206,727		8,226,066	(21,932,649)
47	2440	Deferred Revenue									
						-				-	-
		Sub-Total	**265,545,785**	**28,588,269**	**(6,020,600)**	**288,113,454**	**(113,739,171)**	**(11,961,203)**	**2,374,870**	**(123,325,504)**	**164,787,950**
		Less Socialized Renewable Energy Generation Investments (input as negative)				-				-	-
		Less Other Non Rate-Regulated Utility Assets (input as negative)				-				-	-
		Total PP&E	**265,545,785**	**28,588,269**	**(6,020,600)**	**288,113,454**	**(113,739,171)**	**(11,961,203)**	**2,374,870**	**(123,325,504)**	**164,787,950**
		Depreciation Expense adj. from gain or loss on the retirement of assets (pool of like assets), if applicable6									
		Total						**(11,961,203)**			

10		Transportation
10		Truck Tools
8		Stores Equipment
50		Engineering

Less: Fully Allocated Depreciation	
Transportation	(608,072)
Truck Tools	(78,991)
Stores Equipment	(46,084)
Engineering	(126,938)
Net Depreciation	**(11,101,118)**

Table 2-14 - Fixed Asset Continuity Schedule as at December 31, 2013, CGAAP

		Cost				Accumulated Depreciation				
OEB	**Description**	**Opening Balance**	**Additions**	**Disposals**	**Closing Balance**	**Opening Balance**	**Additions**	**Disposals**	**Closing Balance**	**Net Book Value**
1611	Computer Software (Formally known as Account 1925)	5,407,634	342,714		5,750,348	(4,269,673)	(524,708)		(4,794,382)	955,966
1612	Land Rights (Formally known as Account 1806)	510,696	43,423		554,119	-	-		-	554,119
1805	Land	2,323,796			2,323,796	-	-		-	2,323,796
1808	Buildings	28,987,662	589,011		29,576,672	(1,487,578)	(594,767)		(2,082,345)	27,494,327
1810	Leasehold Improvements	-			-	-	-		-	-
1815	Transformer Station Equipment >50 kV	31,230,359	531,484		31,761,843	(9,470,851)	(772,626)		(10,243,477)	21,518,366
1820	Distribution Station Equipment <50 kV	4,811,797	425,404		5,237,201	(3,276,048)	(105,318)		(3,381,366)	1,855,835
1825	Storage Battery Equipment				-	-	-		-	-
1830	Poles, Towers & Fixtures	55,022,226	5,621,083		60,643,309	(22,913,961)	(2,110,312)		(25,024,273)	35,619,036
1835	Overhead Conductors & Devices	27,072,749	3,938,300		31,011,049	(9,306,987)	(1,116,444)		(10,423,431)	20,587,619
1840	Underground Conduit	15,510,774	1,053,089		16,563,863	(7,734,673)	(564,995)		(8,299,669)	8,264,195
1845	Underground Conductors & Devices	35,032,055	2,625,458		37,657,513	(17,644,654)	(1,323,625)		(18,968,279)	18,689,235
1850	Line Transformers	48,052,253	3,346,546		51,398,799	(21,116,896)	(1,793,180)		(22,910,076)	28,488,723
1855	Services (Overhead & Underground)	22,829,581	1,453,141		24,282,722	(11,790,245)	(808,933)		(12,599,178)	11,683,544
1860	Meters	12,154,026	809,494		12,963,520	(7,924,509)	(535,570)		(8,460,079)	4,503,441
1860	Meters (Smart Meters)	6,265,880			6,265,880	-	(505,137)		(505,137)	5,760,743
1905	Land				-	-	-		-	-
1908	Buildings & Fixtures				-	-	-		-	-
1910	Leasehold Improvements				-	-	-		-	-
1915	Office Furniture & Equipment (10 years)	1,757,548	19,537	(231,777)	1,545,307	(864,386)	(106,927)	170,500	(800,813)	744,494
1915	Office Furniture & Equipment (5 years)				-	-	2,500		2,500	2,500
1920	Computer Equipment - Hardware				-				-	-
1920	Computer Equip.-Hardware(Post Mar. 22/04)				-	-	-		-	-
1920	Computer Equip.-Hardware(Post Mar. 19/07)	3,815,382	112,736		3,928,118	(3,342,372)	(229,634)		(3,572,006)	356,112
1930	Transportation Equipment	7,465,135	911,991	(107,383)	8,269,742	(5,221,431)	(639,164)	107,383	(5,753,212)	2,516,530
1935	Stores Equipment	533,925	8,581		542,506	(193,806)	(46,942)		(240,748)	301,758
1940	Tools, Shop & Garage Equipment	1,182,142	81,737	(36,180)	1,227,700	(692,395)	(145,992)	19,113	(819,275)	408,425
1945	Measurement & Testing Equipment	891,281	4,726		896,007	(650,909)	(52,997)		(703,906)	192,102
1950	Power Operated Equipment				-	-	-		-	-
1955	Communications Equipment	902,458	8,031		910,489	(329,641)	(85,960)		(415,601)	494,888
1955	Communication Equipment (Smart Meters)				-		-		-	-
1960	Miscellaneous Equipment	2,563,676	17,608	(22,108)	2,559,176	(1,008,989)	(211,707)	16,788	(1,203,908)	1,355,268
1970	Load Management Controls Customer Premises				-	-	-		-	-
1975	Load Management Controls Utility Premises				-	-	-		-	-
1980	System Supervisor Equipment	3,949,135	465,383		4,414,517	(2,311,566)	(204,791)		(2,516,358)	1,898,160
1985	Miscellaneous Fixed Assets				-	-	-		-	-
1990	Other Tangible Property				-	-	-		-	-
1995	Contributions & Grants	(30,158,715)	(1,672,705)		(31,831,420)	8,226,066	1,273,635		9,499,701	(22,331,719)
2440	Deferred Revenue5									
					-				-	-
	Sub-Total	**288,113,454**	**20,736,771**	**(397,448)**	**308,452,778**	**(123,325,504)**	**(11,203,595)**	**313,783**	**(134,215,316)**	**174,237,462**
	Less Socialized Renewable Energy Generation Investments (input as negative)				-				-	-
	Less Other Non Rate-Regulated Utility Assets (input as negative)				-				-	-
	Total PP&E	**288,113,454**	**20,736,771**	**(397,448)**	**308,452,778**	**(123,325,504)**	**(11,203,595)**	**313,783**	**(134,215,316)**	**174,237,462**
	Depreciation Expense adj. from gain or loss on the retirement of assets (pool of like assets), if applicable6									
	Total						**(11,203,595)**			

	Transportation
	Truck Tools
	Stores Equipment

Less: Fully Allocated Depreciation	
Transportation	(368,941)
Truck Tools	(196,252)
Stores Equipment	(46,942)
Net Depreciation	**(10,591,460)**

Table 2-15 - Fixed Asset Continuity Schedule as at December 31, 2013, Revised CGAAP

			Cost				Accumulated Depreciation				
CCA Class	**OEB**	**Description**	**Opening Balance**	**Additions**	**Disposals**	**Closing Balance**	**Opening Balance**	**Additions**	**Disposals**	**Closing Balance**	**Net Book Value**
12	1611	Computer Software (Formally known as Account 1925)	5,407,634	342,714		5,750,348	(4,269,673)	(535,469)		(4,805,143)	945,205
CEC	1612	Land Rights (Formally known as Account 1806)	510,696	43,423		554,119	-	-		-	554,119
N/A	1805	Land	2,323,796			2,323,796	-	-		-	2,323,796
CEC	1808	Buildings	28,987,662	589,011		29,576,672	(1,487,578)	(819,730)		(2,307,308)	27,269,365
47	1810	Leasehold Improvements	-			-	-	-		-	-
13	1815	Transformer Station Equipment >50 kV	31,230,359	531,484		31,761,843	(9,470,851)	(1,307,488)		(10,778,339)	20,983,504
47	1820	Distribution Station Equipment <50 kV	4,811,797	425,404		5,237,201	(3,276,048)	(132,757)		(3,408,805)	1,828,396
47	1825	Storage Battery Equipment				-	-	-		-	-
47	1830	Poles, Towers & Fixtures	55,022,226	4,855,044		59,877,270	(22,913,961)	(946,536)		(23,860,497)	36,016,773
47	1835	Overhead Conductors & Devices	27,072,749	3,401,590		30,474,339	(9,306,987)	(579,778)		(9,886,765)	20,587,575
47	1840	Underground Conduit	15,510,774	909,575		16,420,349	(7,734,673)	(205,572)		(7,940,245)	8,480,104
47	1845	Underground Conductors & Devices	35,032,055	2,267,662		37,299,717	(17,644,654)	(798,336)		(18,442,990)	18,856,727
47	1850	Line Transformers	48,052,253	2,890,480		50,942,733	(21,116,896)	(897,220)		(22,014,116)	28,928,617
47	1855	Services (Overhead & Underground)	22,829,581	1,255,108		24,084,688	(11,790,245)	(304,826)		(12,095,071)	11,989,618
47	1860	Meters	12,154,026	809,494		12,963,520	(7,924,509)	(535,570)		(8,460,079)	4,503,441
47	1860	Meters (Smart Meters)	6,265,880			6,265,880	-	(541,656)		(541,656)	5,724,224
N/A	1905	Land				-	-	-		-	-
N/A	1908	Buildings & Fixtures				-	-	-		-	-
CEC	1910	Leasehold Improvements				-	-	-		-	-
47	1915	Office Furniture & Equipment (10 years)	1,757,548	19,537	(231,777)	1,545,307	(864,386)	(106,927)	170,500	(800,813)	744,494
13	1915	Office Furniture & Equipment (5 years)				-	-	-		-	-
8	1920	Computer Equipment - Hardware				-				-	-
10	1920	Computer Equip.-Hardware(Post Mar. 22/04)				-	-	-		-	-
12	1920	Computer Equip.-Hardware(Post Mar. 19/07)	3,815,382	112,736		3,928,118	(3,342,372)	(200,839)		(3,543,212)	384,907
10	1930	Transportation Equipment	7,465,135	911,991	(107,383)	8,269,742	(5,221,431)	(368,941)	107,383	(5,482,989)	2,786,753
8	1935	Stores Equipment	533,925	8,581		542,506	(193,806)	(46,942)		(240,748)	301,758
8	1940	Tools, Shop & Garage Equipment	1,182,142	81,737	(36,180)	1,227,700	(692,395)	(196,252)	19,113	(869,535)	358,165
8	1945	Measurement & Testing Equipment	891,281	4,726		896,007	(650,909)	(68,859)		(719,768)	176,239
8	1950	Power Operated Equipment				-	-	-		-	-
8	1955	Communications Equipment	902,458	8,031		910,489	(329,641)	(93,972)		(423,612)	486,877
8	1955	Communication Equipment (Smart Meters)				-				-	-
47	1960	Miscellaneous Equipment	2,563,676	17,608	(22,108)	2,559,176	(1,008,989)	(238,202)	16,788	(1,230,403)	1,328,773
47	1970	Load Management Controls Customer Premises				-	-	-		-	-
47	1975	Load Management Controls Utility Premises				-	-	-		-	-
47	1980	System Supervisor Equipment	3,949,135	465,383		4,414,517	(2,311,566)	(207,899)		(2,519,466)	1,895,052
47	1985	Miscellaneous Fixed Assets				-	-	-		-	-
47	1990	Other Tangible Property				-	-	-		-	-
47	1995	Contributions & Grants	(30,158,715)	(1,672,705)		(31,831,420)	8,226,066	741,216		8,967,282	(22,864,138)
47	2440	Deferred Revenue5									
						$ -				$ -	$ -
		Sub-Total	**288,113,454**	**18,278,612**	**(397,448)**	**305,994,618**	**(123,325,504)**	**(8,392,554)**	**313,783**	**(131,404,276)**	**174,590,342**
		Less Socialized Renewable Energy Generation Investments (input as negative)				$ -				$ -	$ -
		Less Other Non Rate-Regulated Utility Assets (input as negative)				$ -				$ -	$ -
		Total PP&E	**288,113,454**	**18,278,612**	**(397,448)**	**305,994,618**	**(123,325,504)**	**(8,392,554)**	**313,783**	**(131,404,276)**	**174,590,342**
		Depreciation Expense adj. from gain or loss on the retirement of assets (pool of like assets), if applicable6									
		Total						**(8,392,554)**			

10		Transportation
10		
8		Stores Equipment

Less: Fully Allocated Depreciation	
Transportation	(368,941)
Truck Tools	(196,252)
Stores Equipment	(46,942)
Net Depreciation	**(7,780,420)**

1 **Table 2-16 - Fixed Asset Continuity Schedule as at December 31, 2014, MIFRS**

			Cost				Accumulated Depreciation				
CCA Class	OEB	Description	Opening Balance	Additions	Disposals	Closing Balance	Opening Balance	Additions	Disposals	Closing Balance	Net Book Value
12	1611	Computer Software (Formally known as Account 1925)	5,750,348	362,002		6,112,349	(4,805,143)	(479,831)	-	(5,284,974)	827,375
CEC	1612	Land Rights (Formally known as Account 1806)	554,119	99,902		654,021	-	-	-	-	654,021
N/A	1805	Land	2,323,796			2,323,796	-	-	-	-	2,323,796
CEC	1808	Buildings	29,576,672	726,502		30,303,174	(2,307,308)	(834,772)	-	(3,142,079)	27,161,094
47	1810	Leasehold Improvements	-			-	-	-	-	-	-
13	1815	Transformer Station Equipment >50 kV	31,761,843	194,308		31,956,150	(10,778,339)	(1,298,965)	-	(12,077,303)	19,878,847
47	1820	Distribution Station Equipment <50 kV	5,237,201	160,850		5,398,050	(3,408,805)	(165,694)	-	(3,574,499)	1,823,551
47	1825	Storage Battery Equipment	-			-	-	-	-	-	-
47	1830	Poles, Towers & Fixtures	59,877,270	4,965,069		64,842,339	(23,860,497)	(1,056,871)	-	(24,917,368)	39,924,971
47	1835	Overhead Conductors & Devices	30,474,339	4,052,486		34,526,826	(9,886,765)	(711,784)	-	(10,598,549)	23,928,277
47	1840	Underground Conduit	16,420,349	949,493		17,369,842	(7,940,245)	(224,524)	-	(8,164,769)	9,205,073
47	1845	Underground Conductors & Devices	37,299,717	1,715,849		39,015,566	(18,442,990)	(809,522)	-	(19,252,512)	19,763,054
47	1850	Line Transformers	50,942,733	2,960,653		53,903,386	(22,014,116)	(1,005,298)	-	(23,019,414)	30,883,972
47	1855	Services (Overhead & Underground)	24,084,688	1,286,256		25,370,945	(12,095,071)	(331,589)	-	(12,426,660)	12,944,285
47	1860	Meters	12,963,520	569,728	(6,652,977)	6,880,271	(8,460,079)	(77,384)	5,287,642	(3,249,821)	3,630,450
47	1860	Meters (Smart Meters)	6,265,880			6,265,880	(541,656)	(541,563)	-	(1,083,219)	5,182,661
N/A	1905	Land	-			-	-	-	-	-	-
N/A	1908	Buildings & Fixtures	-			-	-	-	-	-	-
CEC	1910	Leasehold Improvements	-			-	-	-	-	-	-
47	1915	Office Furniture & Equipment (10 years)	1,545,307	22,322		1,567,630	(800,813)	(109,160)	-	(909,973)	657,657
13	1915	Office Furniture & Equipment (5 years)	-			-	-	-	-	-	-
8	1920	Computer Equipment - Hardware				-			-	-	-
10	1920	Computer Equip.-Hardware(Post Mar. 22/04)	-			-	-	-	-	-	-
12	1920	Computer Equip.-Hardware(Post Mar. 19/07)	3,928,118	127,191		4,055,309	(3,543,212)	(178,627)	-	(3,721,839)	333,470
10	1930	Transportation Equipment	8,269,742	1,032,897	(446,378)	8,856,261	(5,482,989)	(484,213)	439,069	(5,528,133)	3,328,128
8	1935	Stores Equipment	542,506	-		542,506	(240,748)	(46,942)	-	(287,690)	254,816
8	1940	Tools, Shop & Garage Equipment	1,227,700	116,661		1,344,361	(869,535)	(143,890)	-	(1,013,424)	330,937
8	1945	Measurement & Testing Equipment	896,007	36,197		932,204	(719,768)	(52,571)	-	(772,339)	159,865
8	1950	Power Operated Equipment	-			-	-	-	-	-	-
8	1955	Communications Equipment	910,489	19,274		929,763	(423,612)	(91,386)	-	(514,999)	414,764
8	1955	Communication Equipment (Smart Meters)				-			-	-	-
47	1960	Miscellaneous Equipment	2,559,176	35,224		2,594,400	(1,230,403)	(241,511)	-	(1,471,915)	1,122,485
47	1970	Load Management Controls Customer Premises	-			-	-	-	-	-	-
47	1975	Load Management Controls Utility Premises	-			-	-	-	-	-	-
47	1980	System Supervisor Equipment	4,414,517	261,141		4,675,659	(2,519,466)	(192,295)	-	(2,711,760)	1,963,898
47	1985	Miscellaneous Fixed Assets	-			-	-	-	-	-	-
47	1990	Other Tangible Property	-			-	-	-	-	-	-
47	1995	Contributions & Grants	(31,831,420)	(1,593,244)		(33,424,664)	8,967,282	780,539	-	9,747,822	(23,676,842)
47	2440	Deferred Revenue5									
						-				-	-
		Sub-Total	**305,994,618**	**18,100,762**	**(7,099,355)**	**316,996,025**	**(131,404,276)**	**(8,297,854)**	**5,726,711**	**(133,975,418)**	**183,020,607**
		Less Socialized Renewable Energy Generation Investments (input as negative)				-				-	-
		Less Other Non Rate-Regulated Utility Assets (input as negative)				-				-	-
		Total PP&E	**305,994,618**	**18,100,762**	**(7,099,355)**	**316,996,025**	**(131,404,276)**	**(8,297,854)**	**5,726,711**	**(133,975,418)**	**183,020,607**
		Depreciation Expense adj. from gain or loss on the retirement of assets (pool of like assets), if applicable6									
		Total						**(8,297,854)**			

10		Transportation
10		Truck Tools
8		Stores Equipment

Less: Fully Allocated Depreciation	
Transportation	(484,213)
Truck Tools	(143,890)
Stores Equipment	(46,942)
Net Depreciation	**(7,622,809)**

Table 2-17 - Fixed Asset Continuity Schedule as at December 31, 2015, MIFRS

			Cost				Accumulated Depreciation				
CCA Class	OEB	Description	Opening Balance	Additions	Disposals	Closing Balance	Opening Balance	Additions	Disposals	Closing Balance	Net Book Value
12	1611	Computer Software (Formally known as Account 1925)	6,112,349	711,366		6,823,715	(5,284,974)	(508,875)		(5,793,849)	1,029,866
CEC	1612	Land Rights (Formally known as Account 1806)	654,021	43,159		697,180	-	-		-	697,180
N/A	1805	Land	2,323,796			2,323,796	-	-		-	2,323,796
CEC	1808	Buildings	30,303,174	154,039		30,457,213	(3,142,079)	(841,280)		(3,983,359)	26,473,854
47	1810	Leasehold Improvements	-			-	-	-		-	-
13	1815	Transformer Station Equipment >50 kV	31,956,150	703,598		32,659,748	(12,077,303)	(1,319,243)		(13,396,546)	19,263,202
47	1820	Distribution Station Equipment <50 kV	5,597,083			5,597,083	(3,574,499)	(135,823)		(3,710,322)	1,886,761
47	1825	Storage Battery Equipment	-			-	-	-		-	-
47	1830	Poles, Towers & Fixtures	64,842,339	3,813,057		68,655,396	(24,917,368)	(1,141,605)		(26,058,973)	42,596,423
47	1835	Overhead Conductors & Devices	34,526,826	3,582,646		38,109,472	(10,598,549)	(843,466)		(11,442,015)	26,667,457
47	1840	Underground Conduit	17,369,842	1,418,703		18,788,545	(8,164,769)	(252,898)		(8,417,667)	10,370,879
47	1845	Underground Conductors & Devices	39,015,566	3,989,900		43,005,466	(19,252,512)	(913,797)		(20,166,309)	22,839,157
47	1850	Line Transformers	53,903,386	3,696,021		57,599,407	(23,019,414)	(1,097,078)		(24,116,492)	33,482,915
47	1855	Services (Overhead & Underground)	25,370,945	1,038,588		26,409,533	(12,426,660)	(353,256)		(12,779,915)	13,629,617
47	1860	Meters	6,681,238	662,062		7,343,300	(3,249,821)	(293,459)		(3,543,280)	3,800,020
47	1860	Meters (Smart Meters)	6,265,880			6,265,880	(1,083,219)	(541,563)		(1,624,782)	4,641,098
N/A	1905	Land	-			-	-	-		-	-
N/A	1908	Buildings & Fixtures	-			-	-	-		-	-
CEC	1910	Leasehold Improvements	-			-	-	-		-	-
47	1915	Office Furniture & Equipment (10 years)	1,567,630	9,500		1,577,130	(909,973)	(106,607)		(1,016,580)	560,550
13	1915	Office Furniture & Equipment (5 years)	-			-	-	-		-	-
8	1920	Computer Equipment - Hardware				-				-	-
10	1920	Computer Equip.-Hardware(Post Mar. 22/04)	-			-	-	-		-	-
12	1920	Computer Equip.-Hardware(Post Mar. 19/07)	4,055,309	179,480		4,234,789	(3,721,839)	(195,522)		(3,917,361)	317,428
10	1930	Transportation Equipment	8,856,261	912,044	(642,135)	9,126,170	(5,528,133)	(568,909)	624,772	(5,472,270)	3,653,900
8	1935	Stores Equipment	542,506			542,506	(287,690)	(46,942)		(334,631)	207,875
8	1940	Tools, Shop & Garage Equipment	1,344,361	103,000		1,447,361	(1,013,424)	(117,947)		(1,131,371)	315,990
8	1945	Measurement & Testing Equipment	932,204	14,000		946,204	(772,339)	(51,055)		(823,394)	122,810
8	1950	Power Operated Equipment	-			-	-	-		-	-
8	1955	Communications Equipment	929,763	14,500		944,263	(514,999)	(92,837)		(607,835)	336,428
8	1955	Communication Equipment (Smart Meters)	-			-	-	-		-	-
47	1960	Miscellaneous Equipment	2,594,400	31,500		2,625,900	(1,471,915)	(241,910)		(1,713,824)	912,076
47	1970	Load Management Controls Customer Premises	-			-	-	-		-	-
47	1975	Load Management Controls Utility Premises	-			-	-	-		-	-
47	1980	System Supervisor Equipment	4,675,659	231,448		4,907,107	(2,711,760)	(207,646)		(2,919,406)	1,987,701
47	1985	Miscellaneous Fixed Assets	-			-	-			-	-
47	1990	Other Tangible Property	-			-	-			-	-
47	1995	Contributions & Grants	(33,424,664)			(33,424,664)	9,747,822	779,728		10,527,550	(22,897,114)
47	2440	Deferred Revenue5		(4,914,818)		(4,914,818)		125,577		125,577	(4,789,241)
						-				-	-
		Sub-Total	**316,996,025**	**16,393,793**	**(642,135)**	**332,747,683**	**(133,975,418)**	**(8,966,411)**	**624,772**	**(142,317,057)**	**190,430,626**
		Less Socialized Renewable Energy Generation Investments (input as negative)				-				-	-
		Less Other Non Rate-Regulated Utility Assets (input as negative)				-				-	-
		Total PP&E	**316,996,025**	**16,393,793**	**(642,135)**	**332,747,683**	**(133,975,418)**	**(8,966,411)**	**624,772**	**(142,317,057)**	**190,430,626**
		Depreciation Expense adj. from gain or loss on the retirement of assets (pool of like assets), if applicable6									
		Total						**(8,966,411)**			

10		Transportation
10		Truck Tools
8		Stores Equipment

Less: Fully Allocated Depreciation	
Transportation	(568,909)
Truck Tools	(117,947)
Stores Equipment	(46,942)
Net Depreciation	**(8,232,613)**

1 **Table 2-18 - Fixed Asset Continuity Schedule as at December 31, 2016, MIFRS**

			Cost				Accumulated Depreciation				
CCA Class	**OEB**	**Description**	**Opening Balance**	**Additions**	**Disposals**	**Closing Balance**	**Opening Balance**	**Additions**	**Disposals**	**Closing Balance**	**Net Book Value**
12	1611	Computer Software (Formally known as Account 1925)	6,823,715	871,760		7,695,475	(5,793,849)	(476,948)		(6,270,797)	1,424,678
CEC	1612	Land Rights (Formally known as Account 1806)	697,180	43,259		740,439	-	-		-	740,439
N/A	1805	Land	2,323,796			2,323,796	-	-		-	2,323,796
CEC	1808	Buildings	30,457,213	128,050		30,585,263	(3,983,359)	(844,031)		(4,827,391)	25,757,873
47	1810	Leasehold Improvements				-	-	-		-	-
13	1815	Transformer Station Equipment >50 kV	32,659,748	516,518		33,176,266	(13,396,546)	(1,138,051)		(14,534,598)	18,641,668
47	1820	Distribution Station Equipment <50 kV	5,597,083	94,587		5,691,670	(3,710,322)	(137,510)		(3,847,832)	1,843,838
47	1825	Storage Battery Equipment				-	-	-		-	-
47	1830	Poles, Towers & Fixtures	68,655,396	3,732,213		72,387,609	(26,058,973)	(1,183,075)		(27,242,048)	45,145,562
47	1835	Overhead Conductors & Devices	38,109,472	3,640,323		41,749,795	(11,442,015)	(908,508)		(12,350,523)	29,399,272
47	1840	Underground Conduit	18,788,545	905,772		19,694,317	(8,417,667)	(261,956)		(8,679,622)	11,014,695
47	1845	Underground Conductors & Devices	43,005,466	2,460,395		45,465,861	(20,166,309)	(942,675)		(21,108,984)	24,356,877
47	1850	Line Transformers	57,599,407	3,872,425		61,471,832	(24,116,492)	(1,145,179)		(25,261,671)	36,210,161
47	1855	Services (Overhead & Underground)	26,409,533	1,044,553		27,454,086	(12,779,915)	(364,147)		(13,144,063)	14,310,024
47	1860	Meters	7,343,300	644,367		7,987,667	(3,543,280)	(314,832)		(3,858,111)	4,129,555
47	1860	Meters (Smart Meters)	6,265,880			6,265,880	(1,624,782)	(541,669)		(2,166,450)	4,099,430
N/A	1905	Land				-	-	-		-	-
N/A	1908	Buildings & Fixtures				-	-	-		-	-
CEC	1910	Leasehold Improvements				-	-	-		-	-
47	1915	Office Furniture & Equipment (10 years)	1,577,130	7,000		1,584,130	(1,016,580)	(106,957)		(1,123,536)	460,593
13	1915	Office Furniture & Equipment (5 years)				-	-	-		-	-
8	1920	Computer Equipment - Hardware				-				-	-
10	1920	Computer Equip.-Hardware(Post Mar. 22/04)				-	-	-		-	-
12	1920	Computer Equip.-Hardware(Post Mar. 19/07)	4,234,789	108,650		4,343,439	(3,917,361)	(132,136)		(4,049,497)	293,943
10	1930	Transportation Equipment	9,126,170	619,409	(316,071)	9,429,508	(5,472,270)	(589,154)	305,084	(5,756,340)	3,673,169
8	1935	Stores Equipment	542,506			542,506	(334,631)	(46,942)		(381,573)	160,933
8	1940	Tools, Shop & Garage Equipment	1,447,361	77,000		1,524,361	(1,131,371)	(117,919)		(1,249,290)	275,072
8	1945	Measurement & Testing Equipment	946,204	15,000		961,204	(823,394)	(45,677)		(869,071)	92,133
8	1950	Power Operated Equipment				-	-	-		-	-
8	1955	Communications Equipment	944,263			944,263	(607,835)	(92,368)		(700,203)	244,060
8	1955	Communication Equipment (Smart Meters)				-	-	-		-	-
47	1960	Miscellaneous Equipment	2,625,900	32,000		2,657,900	(1,713,824)	(243,393)		(1,957,217)	700,683
47	1970	Load Management Controls Customer Premises				-	-	-		-	-
47	1975	Load Management Controls Utility Premises				-	-	-		-	-
47	1980	System Supervisor Equipment	4,907,107	265,636		5,172,743	(2,919,406)	(206,447)		(3,125,853)	2,046,890
47	1985	Miscellaneous Fixed Assets				-	-	-		-	-
47	1990	Other Tangible Property				-	-	-		-	-
47	1995	Contributions & Grants	(33,424,664)			(33,424,664)	10,527,550	778,853		11,306,403	(22,118,261)
47	2440	Deferred Revenue	(4,914,818)	(2,289,738)		(7,204,556)	125,577	155,031		280,607	(6,923,949)
						-				-	-
		Sub-Total	**332,747,683**	**16,789,179**	**(316,071)**	**349,220,791**	**(142,317,057)**	**(8,905,686)**	**305,084**	**(150,917,658)**	**198,303,133**
		Less Socialized Renewable Energy Generation Investments (input as negative)				-				-	-
		Less Other Non Rate-Regulated Utility Assets (input as negative)				-				-	-
		Total PP&E	**332,747,683**	**16,789,179**	**(316,071)**	**349,220,791**	**(142,317,057)**	**(8,905,686)**	**305,084**	**(150,917,658)**	**198,303,133**
		Depreciation Expense adj. from gain or loss on the retirement of assets (pool of like assets), if applicable6									
		Total						**(8,905,686)**			

10		Transportation
10		Truck Tools
8		Stores Equipment

Less: Fully Allocated Depreciation	
Transportation	(589,154)
Truck Tools	(117,919)
Stores Equipment	(46,942)
Net Depreciation	**(8,151,672)**

As explained above, upon the date of IFRS adoption, Customer Contributions are no longer recorded in Account 1995 Contributions & Grants, but are recorded in Account 2440, Deferred Revenue. Historical contributions are netted against the assets they relate to. For purposes of Cost Allocation, and continuity within this application, WNH has included Account 2440 in the Continuity Schedules to track Contributed Capital forecast for the 2015 Bridge Year and the 2016 Test Year. A breakdown of this account is provided in Table 2-19 below. WNH has included the amortization that is considered revenue for accounting periods as depreciation in 2440 in its Continuity Schedules.

Table 2-19 – Account 1995 / 2440 Breakdown

USoA	Accounting 1995 / 2440 Breakdown For Financial Reporting Purposes	Cost			Accumulated Depreciation			Net Book Value
		Opening	Additions	Closing	Opening	Additions	Closing	
December 31, 2014 - 1995 - Revised CGAAP								
1806	Land Rights	(140,630)	-	(140,630)	39,976	5,625	45,601	(95,029)
1808	Buildings and Fixtures	(6,862)	-	(6,862)	1,962	274	2,236	(4,625)
1815	Transformer Station Equipment - Normally Primary above 50 kV	(8,088)	-	(8,088)	1,095	125	1,220	(6,867)
1830	Poles, Towers and Fixtures	(2,479,110)	(249,646)	(2,728,756)	708,869	52,496	761,365	(1,967,391)
1835	Overhead Conductors and Devices	(1,540,863)	(147,758)	(1,688,621)	417,905	32,521	450,426	(1,238,194)
1840	Underground Conduit	(2,831,377)	(75,390)	(2,906,767)	857,172	48,687	905,859	(2,000,908)
1845	Underground Conductors and Devices	(10,582,496)	(195,545)	(10,778,042)	3,600,508	274,230	3,874,738	(6,903,303)
1850	Line Transformers	(9,797,112)	(638,596)	(10,435,707)	2,744,779	270,507	3,015,287	(7,420,421)
1855	Services	(4,327,080)	(261,041)	(4,588,122)	566,857	88,852	655,709	(3,932,413)
1860	Meters	(127,252)	(15,819)	(143,071)	28,160	7,221	35,380	(107,690)
Total		**(31,840,871)**	**(1,583,794)**	**(33,424,664)**	**8,967,284**	**780,539**	**9,747,823**	**(23,676,841)**
December 31, 2015 - 1995 / 2440 - MIFRS								
1612	Land Rights	(140,630)	-	(140,630)	45,601	5,625	51,226	(89,404)
1808	Buildings and Fixtures	(6,862)	-	(6,862)	2,236	274	2,511	(4,351)
1815	Transformer Station Equipment - Normally Primary above 50 kV	(8,088)	-	(8,088)	1,220	125	1,345	(6,742)
1830	Poles, Towers and Fixtures	(2,728,756)	(405,018)	(3,133,774)	761,365	61,496	822,861	(2,310,912)
1835	Overhead Conductors and Devices	(1,688,621)	(229,770)	(1,918,390)	450,426	37,627	488,053	(1,430,337)
1840	Underground Conduit	(2,906,767)	(769,151)	(3,675,918)	905,859	64,070	969,930	(2,705,988)
1845	Underground Conductors and Devices	(10,778,042)	(2,086,346)	(12,864,388)	3,874,738	333,029	4,207,768	(8,656,620)
1850	Line Transformers	(10,435,707)	(1,087,302)	(11,523,009)	3,015,287	300,121	3,315,407	(8,207,602)
1855	Services	(4,588,122)	(337,232)	(4,925,353)	655,709	95,716	751,425	(4,173,928)
1860	Meters	(143,071)	-	(143,071)	35,380	7,221	42,601	(100,469)
Total		**(33,424,664)**	**(4,914,818)**	**(38,339,482)**	**9,747,823**	**905,305**	**10,653,128**	**(27,686,354)**
December 31, 2016 - 1996 / 2440 - MIFRS								
1612	Land Rights	(140,630)	-	(140,630)	51,226	5,625	56,851	(83,779)
1808	Buildings and Fixtures	(6,862)	-	(6,862)	2,511	274	2,785	(4,075)
1815	Transformer Station Equipment - Normally Primary above 50 kV	(8,088)	-	(8,088)	1,345	125	1,470	(6,618)
1830	Poles, Towers and Fixtures	(3,133,774)	(56,568)	(3,190,342)	822,861	62,125	884,986	(2,305,356)
1835	Overhead Conductors and Devices	(1,918,390)	(32,092)	(1,950,482)	488,053	37,984	526,037	(1,424,445)
1840	Underground Conduit	(3,675,918)	(289,839)	(3,965,757)	969,930	66,969	1,036,898	(2,928,859)
1845	Underground Conductors and Devices	(12,864,388)	(791,053)	(13,655,440)	4,207,768	343,455	4,551,222	(9,104,218)
1850	Line Transformers	(11,523,009)	(781,371)	(12,304,381)	3,315,407	310,941	3,626,348	(8,678,033)
1855	Services	(4,925,353)	(338,815)	(5,264,169)	751,425	99,166	850,590	(4,413,579)
1860	Meters	(143,071)	-	(143,071)	42,601	7,221	49,822	(93,248)
Total		**(38,339,482)**	**(2,289,738)**	**(40,629,220)**	**10,653,128**	**933,884**	**11,587,010**	**(29,042,209)**
Balance December 31, 2016								
1995	Contributions and Grants			(33,424,664)			11,306,403	(22,118,261)
2440	Deferred Revenue - Contributed Capital			(7,204,556)			280,607	(6,923,949)
Total				**(40,629,220)**			**11,587,011**	**(29,042,209)**

2.5.1.2 Gross Assets – Property Plant and Equipment and Accumulated Depreciation

Breakdown by Function

Table 2-20 below categorizes WNH's assets into four categories; Distribution Plant, General Plant, Contributions and Grants, and WIP. In accordance with the Uniform System of Accounts ("USoA"), WNH has included Gross Assets as follows:

- Distribution Plant Asset Accounts include USoA 1805 to 1860 and USoA 1612 - this account includes assets such as substation equipment, poles, wires, transformers and meters
- General Plant Asset Accounts include USoA 1915 to 1980 and USoA 1611 - this account includes assets such as buildings, computer software and hardware, transportation equipment, and tools
- Contributions and Grants includes USoA accounts 1995 and 2440 – this account includes all contributions in aid of capital that WNH has received or forecasted to be received as per the Distribution System Code ("DSC") and
- WIP – this account includes all costs related to assets that are not considered in-service as of December 31st of the applicable fiscal year. Costs are transferred out of WIP and into the appropriate category above once designated in-service in the field.

Table 2-20 – Gross Asset Breakdown by Function

Description	2011 Board Approved	2011 Actual	2012 Actual	2013 Actual	2014 Actual	2015 Bridge Year	2016 Test Year
Reporting Basis	**CGAAP**	**CGAAP**	**CGAAP**	**RCGAAP**	**MIFRS**	**MIFRS**	**MIFRS**
Distribution Plant	235,942,785	235,742,792	261,930,834	279,742,057	290,204,914	309,340,937	326,517,726
General Plant	52,314,532	57,075,708	56,341,335	58,083,981	60,215,775	61,746,228	63,332,285
Contributions and Grants	(27,931,213)	(27,272,714)	(30,158,715)	(31,831,420)	(33,424,664)	(38,339,482)	(40,629,220)
Total Excluding WIP	**260,326,104**	**265,545,785**	**288,113,454**	**305,994,618**	**316,996,025**	**332,747,683**	**349,220,792**
WIP	2,463,788	2,476,939	9,341,048	3,027,484	3,744,173	2,539,260	2,538,211
Total Including WIP	**262,789,892**	**268,022,724**	**297,454,502**	**309,022,102**	**320,740,198**	**335,286,943**	**351,759,002**

Detailed Breakdown by Major Plant Account

Table 2-21 below provides a detailed breakdown by Major Plant account for each functionalized plant item. Each plant item is accompanied by a description in accordance with the Board's USoA, including the 2016 Test Year. WNH has also included a breakdown of Accumulated Amortization in the same format in Table 2-22.

Table 2-21 - Gross Assets - Detailed Breakdown by Major Plant Function

Description	2011 Board Approved	2011 Actual	Variance from 2011 Board Approved	2012 Actual	Variance from 2011 Actual	2013 Actual	Variance from 2012 Actual	2014 Actual	Variance from 2013 Actual	2015 Bridge Year	Variance from 2014 Actual	2016 Test Year	Variance from 2015 Forecast
Reporting Basis	**CGAAP**	**CGAAP**		**CGAAP**		**CGAAP**		**MIFRS**		**MIFRS**		**MIFRS**	
Land & Buildings													
1805 - Land	2,307,041	3,067,191	760,150	2,323,796	(743,394)	2,323,796	-	2,323,796	-	2,323,796	-	2,323,796	-
1806/1612 - Land Rights	410,956	426,556	15,600	510,696	84,140	554,119	43,423	654,021	99,902	697,180	43,159	740,439	43,259
1808 - Buildings	27,974,709	32,348,528	4,373,818	28,987,662	(3,360,866)	29,576,672	589,011	30,303,174	726,502	30,457,213	154,039	30,585,263	128,050
Subtotal Land & Buildings	30,692,706	35,842,275	5,149,568	31,822,154	(4,020,121)	32,454,588	632,433	33,280,991	826,404	33,478,189	197,198	33,649,498	171,309
Transmission & Distribution Stations													
1815 - Transformer Station Equipment >50 kV	29,157,759	30,330,491	1,172,732	31,230,359	899,868	31,761,843	531,484	31,956,150	194,308	32,659,748	703,598	33,176,266	516,518
1820 - Distribution Station Equipment <50 kV	4,701,727	4,659,616	(42,111)	4,811,797	152,180	5,237,201	425,404	5,398,050	160,850	5,597,083	199,033	5,691,670	94,587
Subtotal Transmission & Distribution Stations	33,859,486	34,990,107	1,130,621	36,042,156	1,052,048	36,999,043	956,888	37,354,201	355,157	38,256,831	902,631	38,867,936	611,105
Poles & Wires													
1830 - Poles, Towers & Fixtures	49,211,771	50,047,474	835,702	55,022,226	4,974,753	59,877,270	4,855,044	64,842,339	4,965,069	69,063,678	4,221,339	72,387,609	3,323,931
1835 - Overhead Conductors & Devices	24,047,947	23,695,965	(351,982)	27,072,749	3,376,784	30,474,339	3,401,590	34,526,826	4,052,486	37,701,190	3,174,364	41,749,795	4,048,605
1840 - Underground Conduit	14,669,496	14,757,589	88,093	15,510,774	753,185	16,420,349	909,575	17,369,842	949,493	18,788,545	1,418,703	19,694,317	905,772
1845 - Underground Conductors & Devices	33,400,915	32,837,721	(563,194)	35,032,055	2,194,333	37,299,717	2,267,662	39,015,566	1,715,849	43,005,466	3,989,900	45,465,861	2,460,395
Subtotal Poles & Wires	121,330,130	121,338,749	8,619	132,637,804	11,299,055	144,071,675	11,433,870	155,754,572	11,682,898	168,558,880	12,804,307	179,297,583	10,738,703
Line Transformers													
1850 - Line Transformers	45,932,969	44,485,687	(1,447,282)	48,052,253	3,566,566	50,942,733	2,890,480	53,903,386	2,960,653	57,599,407	3,696,021	61,471,832	3,872,425
Subtotal Line Transformers	45,932,969	44,485,687	(1,447,282)	48,052,253	3,566,566	50,942,733	2,890,480	53,903,386	2,960,653	57,599,407	3,696,021	61,471,832	3,872,425
Services & Meters													
1855 - Services (Overhead & Underground)	21,215,393	21,564,146	348,753	22,829,581	1,265,434	24,084,688	1,255,108	25,370,945	1,286,256	26,409,533	1,038,588	27,454,086	1,044,553
1860 - Meters	9,694,974	9,764,636	69,662	12,154,026	2,389,390	12,963,520	809,494	6,880,271	(6,083,249)	7,343,300	463,029	7,987,667	644,367
1860 - Meters (Smart Meters)			-	6,265,880	6,265,880	6,265,880	-	6,265,880	-	6,265,880	-	6,265,880	-
Subtotal Services & Meters	30,910,367	31,328,782	418,415	41,249,487	9,920,704	43,314,088	2,064,602	38,517,096	(4,796,993)	40,018,713	1,501,617	41,707,633	1,688,920
IT Assets													
1920 - Computer Hardware	3,385,322	3,390,247	4,925	3,815,382	425,135	3,928,118	112,736	4,055,309	127,191	4,234,789	179,480	4,343,439	108,650
1925/1611 - Computer Software	4,780,152	4,574,813	(205,339)	5,407,634	832,820	5,750,348	342,714	6,112,349	362,002	6,823,715	711,366	7,695,475	871,760
Subtotal IT Assets	8,165,474	7,965,060	(200,414)	9,223,016	1,257,956	9,678,466	455,450	10,167,659	489,192	11,058,505	890,846	12,038,915	980,410
Equipment													
1915 - Office Furniture & Equipment	2,522,614	1,470,774	(1,051,840)	1,757,548	286,774	1,545,307	(212,240)	1,567,630	22,322	1,577,130	9,500	1,584,130	7,000
1930 - Transportation Equipment	7,780,710	7,222,266	(558,444)	7,465,135	242,869	8,269,742	804,608	8,856,261	586,519	9,126,170	269,909	9,429,508	303,338
1935 - Stores Equipment	233,903	516,138	282,234	533,925	17,787	542,506	8,581	542,506	-	542,506	-	542,506	-
1940 - Tools, Shop & Garage Equipment	993,379	1,035,607	42,229	1,182,142	146,535	1,227,700	45,557	1,344,361	116,661	1,447,361	103,000	1,524,361	77,000
1945 - Measurement & Testing Equipment	801,195	801,018	(176)	891,281	90,263	896,007	4,726	932,204	36,197	946,204	14,000	961,204	15,000
1955 - Communications Equipment	446,091	864,743	418,651	902,458	37,716	910,489	8,031	929,763	19,274	944,263	14,500	944,263	-
1960 - Miscellaneous Equipment	678,460	1,357,827	679,367	2,563,676	1,205,849	2,559,176	(4,500)	2,594,400	35,224	2,625,900	31,500	2,657,900	32,000
Subtotal Equipment	13,456,351	13,268,373	(187,979)	15,296,165	2,027,792	15,950,928	654,763	16,767,125	816,198	17,209,534	442,409	17,643,872	434,338
Other Distribution Assets													
1980 - System Supervisor Equipment	3,909,833	3,599,466	(310,367)	3,949,135	349,669	4,414,517	465,383	4,675,659	261,141	4,907,107	231,448	5,172,743	265,636
1995 - Contributions & Grants	(27,931,213)	(27,272,714)	658,499	(30,158,715)	(2,886,001)	(31,831,420)	(1,672,705)	(33,424,664)	(1,593,244)	(33,424,664)	-	(33,424,664)	-
2440 - Deferred Revenue			-		-		-		-	(4,914,818)	(4,914,818)	(7,204,556)	(2,289,738)
Subtotal Other Distribution Assets	(24,021,380)	(23,673,249)	348,132	(26,209,581)	(2,536,332)	(27,416,903)	(1,207,322)	(28,749,005)	(1,332,102)	(33,432,375)	(4,683,370)	(35,456,477)	(2,024,102)
Gross Assets for Rate Base	**260,326,104**	**265,545,785**	**5,219,681**	**288,113,454**	**22,567,669**	**305,994,618**	**17,881,164**	**316,996,025**	**11,001,407**	**332,747,683**	**15,751,658**	**349,220,791**	**16,473,108**
WIP													
2040 - Electric Plant Held for Future Use		834,656	834,656	834,656	-	834,656	-	834,656	-	834,656	-	834,656	-
2055 - Construction Work in Progress--Electric	2,463,788	1,642,283	(821,505)	1,724,715	82,432	2,192,828	468,113	2,909,517	716,689	1,704,604	(1,204,913)	1,703,555	(1,049)
2070 - Other Utility Plant			-	6,781,677	6,781,677		(6,781,677)		-		-		-
Subtotal WIP	2,463,788	2,476,939	13,151	9,341,048	6,864,109	3,027,484	(6,313,564)	3,744,173	716,689	2,539,260	(1,204,913)	2,538,211	(1,049)
Total Assets Including WIP	**262,789,892**	**268,022,724**	**5,232,832**	**297,454,502**	**29,431,778**	**309,022,102**	**11,567,600**	**320,740,198**	**11,718,096**	**335,286,943**	**14,546,745**	**351,759,002**	**16,472,059**

Table 2-22 – Accumulated Amortization - Detailed Breakdown by Major Plant Function

Description	2011 Board Approved	2011 Actual	Variance from 2011 Board Approved	2012 Actual	Variance from 2011 Actual	2013 Actual	Variance from 2012 Actual	2014 Actual	Variance from 2013 Actual	2015 Bridge Year	Variance from 2014 Actual	2016 Test Year	Variance from 2015 Forecast
Reporting Basis	**CGAAP**	**CGAAP**		**CGAAP**		**CGAAP**		**MIFRS**		**MIFRS**		**MIFRS**	
Land & Buildings													
1805 - Land	-	-	-	-	-	-	-	-	-	-	-	-	-
1806/1612 - Land Rights	-	-	-	-	-	-	-	-	-	-	-	-	-
1808 - Buildings	1,108,668	2,754,342	1,645,674	1,487,578	(1,266,764)	2,307,308	819,730	3,142,079	834,772	3,983,359	841,280	4,827,391	844,031
Subtotal Land & Buildings	1,108,668	2,754,342	1,645,674	1,487,578	(1,266,764)	2,307,308	819,730	3,142,079	834,772	3,983,359	841,280	4,827,391	844,031
Transmission & Distribution Stations													
1815 - Transformer Station Equipment >50 kV	8,719,509	8,738,653	19,144	9,470,851	732,198	10,778,339	1,307,488	12,077,303	1,298,965	13,396,546	1,319,243	14,534,598	1,138,051
1820 - Distribution Station Equipment <50 kV	3,212,318	3,196,521	(15,797)	3,276,048	79,528	3,408,805	132,757	3,574,499	165,694	3,710,322	135,823	3,847,832	137,510
Subtotal Transmission & Distribution Stations	11,931,827	11,935,174	3,347	12,746,899	811,725	14,187,144	1,440,244	15,651,803	1,464,659	17,106,868	1,455,066	18,382,430	1,275,561
Poles & Wires													
1830 - Poles, Towers & Fixtures	21,056,449	20,889,035	(167,414)	22,913,961	2,024,926	23,860,497	946,536	24,917,368	1,056,871	26,058,973	1,141,605	27,242,048	1,183,075
1835 - Overhead Conductors & Devices	8,235,382	8,284,877	49,496	9,306,987	1,022,110	9,886,765	579,778	10,598,549	711,784	11,442,015	843,466	12,350,523	908,508
1840 - Underground Conduit	7,171,681	7,190,348	18,666	7,734,673	544,326	7,940,245	205,572	8,164,769	224,524	8,417,667	252,898	8,679,622	261,956
1845 - Underground Conductors & Devices	16,337,020	16,392,823	55,803	17,644,654	1,251,831	18,442,990	798,336	19,252,512	809,522	20,166,309	913,797	21,108,984	942,675
Subtotal Poles & Wires	52,800,532	52,757,083	(43,450)	57,600,275	4,843,192	60,130,497	2,530,222	62,933,198	2,802,701	66,084,964	3,151,766	69,381,177	3,296,213
Line Transformers													
1850 - Line Transformers	19,313,159	19,326,639	13,479	21,116,896	1,790,257	22,014,116	897,220	23,019,414	1,005,298	24,116,492	1,097,078	25,261,671	1,145,179
Subtotal Line Transformers	19,313,159	19,326,639	13,479	21,116,896	1,790,257	22,014,116	897,220	23,019,414	1,005,298	24,116,492	1,097,078	25,261,671	1,145,179
Services & Meters													
1855 - Services (Overhead & Underground)	10,972,447	10,995,762	23,315	11,790,245	794,482	12,095,071	304,826	12,426,660	331,589	12,779,915	353,256	13,144,063	364,147
1860 - Meters	6,025,730	6,040,444	14,714	7,924,509	1,884,065	8,460,079	535,570	3,249,821	(5,210,258)	3,543,280	293,459	3,858,111	314,832
1860 - Meters (Smart Meters)			-		-	541,656	541,656	1,083,219	541,563	1,624,782	541,563	2,166,450	541,669
Subtotal Services & Meters	16,998,177	17,036,206	38,029	19,714,753	2,678,547	21,096,806	1,382,053	16,759,700	(4,337,106)	17,947,977	1,188,277	19,168,624	1,220,648
IT Assets													
1920 - Computer Hardware	2,929,523	2,963,785	34,262	3,342,372	378,588	3,543,212	200,839	3,721,839	178,627	3,917,361	195,522	4,049,497	132,136
1925/1611 - Computer Software	3,665,900	3,732,127	66,227	4,269,673	537,546	4,805,143	535,469	5,284,974	479,831	5,793,849	508,875	6,270,797	476,948
Subtotal IT Assets	6,595,423	6,695,912	100,489	7,612,046	916,134	8,348,354	736,309	9,006,813	658,459	9,711,210	704,397	10,320,294	609,084
Equipment													
1915 - Office Furniture & Equipment	765,242	732,615	(32,627)	864,386	131,771	800,813	(63,573)	909,973	109,160	1,016,580	106,607	1,123,536	106,957
1930 - Transportation Equipment	5,868,469	5,137,046	(731,423)	5,221,431	84,386	5,482,989	261,558	5,528,133	45,144	5,472,270	(55,863)	5,756,340	284,070
1935 - Stores Equipment	118,818	149,717	30,899	193,806	44,089	240,748	46,942	287,690	46,942	334,631	46,942	381,573	46,942
1940 - Tools, Shop & Garage Equipment	611,945	624,269	12,324	692,395	68,126	869,535	177,139	1,013,424	143,890	1,131,371	117,947	1,249,290	117,919
1945 - Measurement & Testing Equipment	608,325	614,071	5,746	650,909	36,838	719,768	68,859	772,339	52,571	823,394	51,055	869,071	45,677
1955 - Communications Equipment	202,668	244,533	41,865	329,641	85,107	423,612	93,972	514,999	91,386	607,835	92,837	700,203	92,368
1960 - Miscellaneous Equipment	537,274	605,212	67,938	1,008,989	403,777	1,230,403	221,414	1,471,915	241,511	1,713,824	241,910	1,957,217	243,393
Subtotal Equipment	8,712,741	8,107,463	(605,278)	8,961,557	854,094	9,767,868	806,311	10,498,472	730,604	11,099,906	601,434	12,037,230	937,324
Other Distribution Assets													
1980 - System Supervisor Equipment	2,145,361	2,145,693	332	2,311,566	165,873	2,519,466	207,899	2,711,760	192,295	2,919,406	207,646	3,125,853	206,447
1995 - Contributions & Grants	(7,005,155)	(7,019,339)	(14,185)	(8,226,066)	(1,206,727)	(8,967,282)	(741,216)	(9,747,822)	(780,539)	(10,527,550)	(779,728)	(11,306,403)	(778,853)
2440 - Deferred Revenue	-	-	-	-	-	-	-	-	-	(125,577)	(125,577)	(280,607)	(155,031)
Subtotal Other Distribution Assets	(4,859,793)	(4,873,646)	(13,853)	(5,914,500)	(1,040,853)	(6,447,817)	(533,317)	(7,036,061)	(588,245)	(7,733,721)	(697,659)	(8,461,158)	(727,437)
Accumulated Depreciation for Rate Base	**112,600,734**	**113,739,171**	**1,138,437**	**123,325,504**	**9,586,333**	**131,404,276**	**8,078,772**	**133,975,418**	**2,571,143**	**142,317,057**	**8,341,639**	**150,917,658**	**8,600,602**
WIP													
2040 - Electric Plant Held for Future Use	-	-	-	-	-	-	-	-	-	-	-	-	-
2055 - Construction Work in Progress--Electric	-	-	-	-	-	-	-	-	-	-	-	-	-
2070 - Other Utility Plant	-	-	-	1,838,324	1,838,324	-	(1,838,324)	-	-	-	-	-	-
Subtotal WIP	-	-	-	1,838,324	1,838,324	-	(1,838,324)	-	-	-	-	-	-
Total Accumulated Depreciation Including WIP	**112,600,734**	**113,739,171**	**1,138,437**	**125,163,828**	**11,424,657**	**131,404,276**	**6,240,447**	**133,975,418**	**2,571,143**	**142,317,057**	**8,341,639**	**150,917,658**	**8,600,602**

Variance Analysis on Gross Assets

Table 2-23 below provides the same level of detail as Table 2-20, however, for the purposes of the Variance Analysis, assets are categorized as Distribution Assets and General Plant and explanations on variances are explained following the table.

Table 2-23 – Variance on Gross Assets

Description	2011 Board Approved	2011 Actual	Variance from 2011 Board Approved	2012 Actual	Variance from 2011 Actual	2013 Actual	Variance from 2012 Actual	2014 Actual	Variance from 2013 Actual	2015 Bridge Year	Variance from 2014 Actual	2016 Test Year	Variance from 2015 Forecast
Reporting Basis	**CGAAP**	**CGAAP**		**CGAAP**		**CGAAP**		**MIFRS**		**MIFRS**		**MIFRS**	
Distribution Assets													
1815 - Transformer Station Equipment >50 kV	29,157,759	30,330,491	1,172,732	31,230,359	899,868	31,761,843	531,484	31,956,150	194,308	32,659,748	703,598	33,176,266	516,518
1820 - Distribution Station Equipment <50 kV	4,701,727	4,659,616	(42,111)	4,811,797	152,180	5,237,201	425,404	5,398,050	160,850	5,597,083	199,033	5,691,670	94,587
1830 - Poles, Towers & Fixtures	49,211,771	50,047,474	835,702	55,022,226	4,974,753	59,877,270	4,855,044	64,842,339	4,965,069	68,655,396	3,813,057	72,387,609	3,732,213
1835 - Overhead Conductors & Devices	24,047,947	23,695,965	(351,982)	27,072,749	3,376,784	30,474,339	3,401,590	34,526,826	4,052,486	38,109,472	3,582,646	41,749,795	3,640,323
1840 - Underground Conduit	14,669,496	14,757,589	88,093	15,510,774	753,185	16,420,349	909,575	17,369,842	949,493	18,788,545	1,418,703	19,694,317	905,772
1845 - Underground Conductors & Devices	33,400,915	32,837,721	(563,194)	35,032,055	2,194,333	37,299,717	2,267,662	39,015,566	1,715,849	43,005,466	3,989,900	45,465,861	2,460,395
1850 - Line Transformers	45,932,969	44,485,687	(1,447,282)	48,052,253	3,566,566	50,942,733	2,890,480	53,903,386	2,960,653	57,599,407	3,696,021	61,471,832	3,872,425
1855 - Services (Overhead & Underground)	21,215,393	21,564,146	348,753	22,829,581	1,265,434	24,084,688	1,255,108	25,370,945	1,286,256	26,409,533	1,038,588	27,454,086	1,044,553
1860 - Meters	9,694,974	9,764,636	69,662	12,154,026	2,389,390	12,963,520	809,494	6,880,271	(6,083,249)	7,343,300	463,029	7,987,667	644,367
1860 - Meters (Smart Meters)			-	6,265,880	6,265,880	6,265,880	-	6,265,880	-	6,265,880	-	6,265,880	-
1980 - System Supervisor Equipment	3,909,833	3,599,466	(310,367)	3,949,135	349,669	4,414,517	465,383	4,675,659	261,141	4,907,107	231,448	5,172,743	265,636
1995 - Contributions & Grants	(27,931,213)	(27,272,714)	658,499	(30,158,715)	(2,886,001)	(31,831,420)	(1,672,705)	(33,424,664)	(1,593,244)	(33,424,664)	-	(33,424,664)	-
2440 - Deferred Revenue			-		-		-		-	(4,914,818)	(4,914,818)	(7,204,556)	(2,289,738)
Subtotal Distribution Assets	**208,011,572**	**208,470,078**	**458,505**	**231,772,119**	**23,302,041**	**247,910,636**	**16,138,517**	**256,780,250**	**8,869,613**	**271,001,455**	**14,221,205**	**285,888,506**	**14,887,051**
General Plant													
1805 - Land	2,307,041	3,067,191	760,150	2,323,796	(743,394)	2,323,796	-	2,323,796	-	2,323,796	-	2,323,796	-
1806/1612 - Land Rights	410,956	426,556	15,600	510,696	84,140	554,119	43,423	654,021	99,902	697,180	43,159	740,439	43,259
1808 - Buildings	27,974,709	32,348,528	4,373,818	28,987,662	(3,360,866)	29,576,672	589,010	30,303,174	726,502	30,457,213	154,039	30,585,263	128,050
1915 - Office Furniture & Equipment	2,522,614	1,470,774	(1,051,840)	1,757,548	286,774	1,545,307	(212,240)	1,567,630	22,322	1,577,130	9,500	1,584,130	7,000
1920 - Computer Hardware	3,385,322	3,390,247	4,925	3,815,382	425,135	3,928,118	112,736	4,055,309	127,191	4,234,789	179,480	4,343,439	108,650
1925/1611 - Computer Software	4,780,152	4,574,813	(205,339)	5,407,634	832,820	5,750,348	342,714	6,112,349	362,002	6,823,715	711,366	7,695,475	871,760
1930 - Transportation Equipment	7,780,710	7,222,266	(558,444)	7,465,135	242,869	8,269,742	804,608	8,856,261	586,519	9,126,170	269,909	9,429,508	303,338
1935 - Stores Equipment	233,903	516,138	282,234	533,925	17,787	542,506	8,581	542,506	-	542,506	-	542,506	-
1940 - Tools, Shop & Garage Equipment	993,379	1,035,607	42,229	1,182,142	146,535	1,227,700	45,557	1,344,361	116,661	1,447,361	103,000	1,524,361	77,000
1945 - Measurement & Testing Equipment	801,195	801,018	(176)	891,281	90,263	896,007	4,726	932,204	36,197	946,204	14,000	961,204	15,000
1955 - Communications Equipment	446,091	864,743	418,651	902,458	37,716	910,489	8,031	929,763	19,274	944,263	14,500	944,263	-
1960 - Miscellaneous Equipment	678,460	1,357,827	679,367	2,563,676	1,205,849	2,559,176	(4,500)	2,594,400	35,224	2,625,900	31,500	2,657,900	32,000
Subtotal General Plant	**52,314,532**	**57,075,708**	**4,761,176**	**56,341,335**	**(734,373)**	**58,083,981**	**1,742,646**	**60,215,775**	**2,131,794**	**61,746,228**	**1,530,453**	**63,332,285**	**1,586,057**
Gross Asset Total	**260,326,104**	**265,545,785**	**5,219,681**	**288,113,454**	**22,567,669**	**305,994,618**	**17,881,163**	**316,996,025**	**11,001,407**	**332,747,683**	**15,751,658**	**349,220,791**	**16,473,108**

2011 Board Approved vs. 2011 Actual:

<u>Distribution Assets –$458,505 Variance</u>

2011 Actual Distribution Assets are higher than the 2011 Board Approved amounts by $458,505. The items primarily related to this variance include:

- Transformer Equipment was $1.2M higher than the 2011 Budget, which was a difference in the Closing 2010 Balance of $.55M and an increase of $.62M over the 2011. WNH notes that its 2011 COS was settled on Preliminary 2010 Data. The increase was due to Protection Upgrades installed at two Transformer Stations.
- Some of the activity that was budgeted in the 2011 COS was not able to proceed as three projects were appealed to the Ontario Municipal Board, two projects driven by a Developer was not ready although they had previously indicated a 2011 construction date. Another Developer chose to advance one project not budgeted in 2011 and reschedule another budgeted project beyond 2011. Since this resulted in additional resources being available, WNH was able to advance System Renewal Projects in 2011.
- In General Plant WNH capitalized $330,976 in interest on the building and $215,747 in ODS software.
- 2011 Capital Contributions were forecasted by job type; however actual contributions collected by WNH are in accordance with the DSC and the provisions of WNH's Conditions of Service and vary by individual job. WNH uses the Economic Evaluation Methodology from the DSC to determine the level of capital contribution for each project. Planned asset management activities as discussed above did not proceed until 2012 which also contributes to the variance.

Variances for 2011 Board Approved Capital Additions compared to 2011 Actual by material project can be found in Tables 2-32 and 2-33 including analysis for projects over WNH's materiality threshold.

General Assets - $4,761,176 Variance

General Assets are higher than the 2011 Board Approved amounts by $4,761,176 which is primarily related to the Disposal of the Previous Service Centre and Administration Building (Land $.75M and Building $4.7M) being reflected in the 2011 COS Filing, however, they were not transferred to WIP until 2012 and ultimately sold in 2013. Furniture and Fixtures were lower than budgeted by $1.05M as equipment other than furniture was included in this account in the 2011 COS. The Actual 2011 costs were allocated to their appropriate USoA including Communications Equipment, Stores Equipment and Miscellaneous Equipment. Further detail on the variance between 2011 Actual compared to 2011 Board Approved amounts by material project can be found in Table 2-36.

2012 Actual vs. 2011 Actual:

Distribution Assets –$23,302,041 Variance

2012 Actual Distribution Assets are higher than the 2011 Actual amounts by $23,302,041. The items primarily related to this variance include:

- WNH received approval for its Smart Meter Disposition on October 4, 2012 (corrected October 12, 2012), *EB-2012-0266,* regarding the disposition and recovery of costs related to the Smart Meter deployment initiated in 2008 by WNH. The Board granted its approval of historically incurred costs and as such WNH recorded these costs in its Gross Fixed Assets in 2012. The Gross Fixed Meter Assets recorded in 2012 was $7.79M.
- Increase in new subdivision activity and the related system expansions required to connect new customers. Development of the Waterloo west side lands had been delayed for several years prior. These delays were overcome and development moved forward in 2012.
- A marked increase in brownfield redevelopment in Waterloo occurred, especially in the neighborhood near the two local universities and the uptown core of

Waterloo. Expansions and connections to new high density condominiums and apartment buildings began to increase.

- Contributed Capital offset Distribution Assets by ($2.9M)

General Assets - $734,373 Variance

General Assets are lower than the 2011 Actual amounts by $734,373 which is primarily related to:

- WNH transferred its previous Service Centre and Administration Land and Building to USoA 2070 Other Utility Plant in WIP in the amount of ($5.3M). Additional Building Costs were $1.3M.

- WNH received approval for its Smart Meter Disposition on October 4, 2012 (corrected October 12, 2012), *EB-2012-0266,* regarding the disposition and recovery of costs related to the Smart Meter deployment initiated in 2008 by WNH. The Board granted its approval of historically incurred costs and as such WNH recorded these costs in its Gross Fixed Assets in 2012. The Gross Fixed Assets recorded in 2012 were $1.18M in Other Equipment, $.22M Computer Hardware, $.31M Computer Software and $.82M Appliance Software.
- Additional Computer Software in 2012 for GIS Mapping and ODS Software of $.21M.
- Various General Plant Additions of $.67M were added.
- Vehicle Additions of $.89M were offset by Disposals of $(.63M).

2013 Actual vs. 2012 Actual:

<u>Distribution Assets –$16,138,518 Variance</u>

2013 Actual Distribution Assets are higher than the 2012 Actual amounts by $16,138,518. The items primarily related to this variance include:

- Increased municipal roadway relocation activity of $2.0M.
- Replacement of lines due to age and condition of $4.99M which included $2.6M that upgraded the 8kV and 4kV systems.
- Contributed Capital offset Distribution Assets by ($1.7M).

<u>General Assets - $1,742,646 Variance</u>

2013 General Assets are higher than the 2012 Actual amounts by $1,742,646 which is primarily related to:

- Building Additions of $.59M
- Vehicle Additions of $.91M which included 1 RBD Platform Vehicle, 2 Electric Tension Stringers, Hybrid Conversions for 2 bucket trucks and 1 Cargo Van. In addition dual fuel propane systems were added to 5 vehicles. These additions were offset by Vehicle Disposal of ($.11M)

2014 Actual vs. 2013 Actual:

<u>Distribution Assets –$8,869,613 Variance</u>

2014 Actual Distribution Assets are higher than the 2013 Actual amounts by $8,869,613. The items primarily related to this variance include:

- Removal of Stranded Meters in 2014. The Gross Cost removed was $6.65M. The treatment and detailed calculation of the Stranded Meter Assets related to Smart Meter deployment can be found in section 2.5.1.4 "Treatment of Stranded Assets Related to Smart Meter Deployment" further below within this Exhibit.
- Replacement of lines due to age and condition of $5.4M which included $2.9M that upgraded the 8kV and 4kV systems.
- Increase in reliability centric investments, namely the deployment of SCADA controlled Electronic Reclosers and Fault indicators.
- Contributed Capital offset Distribution Assets by ($1.6M).

<u>General Assets - $2,131,794 Variance</u>

2014 General Assets are higher than the 2013 Actual amounts by $2,131,794 which is primarily related to:

- Building Additions of $.73M included additions to WNH's TS buildings, including site security, paving and a new roof
- Vehicle Additions of $1.03m were offset by Vehicle Disposals of $.45m. Additions included two single bucket trucks and an underground workbody/step van

2015 Forecast vs. 2014 Actual:

<u>Distribution Assets –$14,221,205 Variance</u>

2015 Forecast Distribution Assets are forecast to be higher than the 2014 Actual amounts by $14,221,205. The items primarily related to this variance include:

- Transformer Equipment Additions of $.70M are forecast. These include breaker refurbishments and protection upgrades.
- Major relocations of $2.9M due to roadway widenings, these were deferred by the municipalities from 2014 are expected to materialize in 2015.
- Relocations due to the LRT project of $4.13M are significant in 2015. Many of these relocations are required to occur ahead of the Region of Waterloo Light Rail Transit (LRT) construction and their timing is not at the discretion of WNH.
- Contributed Capital offset Distribution Assets by ($4.9m).

<u>General Assets - $1,530,453 Variance</u>

2015 General Assets are forecast to be higher than the 2014 Actual amounts by $1,530,453 which is primarily related to:

- Computer Software Additions of $.71m are forecast, these include GIS Software, Outage Management Software, Health and Safety Training Software and various computer software
- Purchase of two replacement bucket trucks, offset by disposal of one large vehicle

2016 Forecast vs. 2015 Forecast:

<u>Distribution Assets –$14,887,051 Variance</u>

2016 Forecast Distribution Assets are forecast to be higher than the 2015 Forecast amounts by $14,887,051. The items primarily related to this variance include:

- The LRT project still comprises a significant portion of the expected 2016 work program. The forecasted spending is $2.1M
- Increase in expenditures due to 2 reliability centric overhead line construction projects required to improve localized capacity under certain abnormal system conditions. The expected outcome will reduce prolonged outages experienced by a large group of customers
- Reclosers of $1.0M will be installed
- Replacement of lines due to age and condition of $5.0M which included $3.8M that upgraded the 8kV and 4kV systems
- Contributed Capital offset Distribution Assets by ($2.3M)

<u>General Assets - $1,586,057 Variance</u>

2016 General Assets are forecast to be higher than the 2015 Forecast amounts by $1,586,057 which is primarily related to:

- Computer Software Additions of $.87M are forecast, these include implementation of a new Customer Information System of $.34M, an Asset Management System of $.28M and various software
- Vehicle Additions of $.62M for a radial boom derrick truck were offset by Vehicle Disposals of $.32M

Summary of Incremental Capital Module Adjustment

WNH confirms that it has not applied for nor received any ICM adjustments as part of a previous IRM application.

Reconciliation of Continuity Statements to Calculated Depreciation Expenses

WNH confirms that the depreciation expenses in the Fixed Asset Continuity Statements reconcile to the calculated depreciation expenses under Exhibit 4 – Operating Costs and are presented by account. As such there are no reconciling items between the fixed asset continuity statements in this Exhibit and the calculated Depreciation Expense in Exhibit 4.

2.5.1.3 Allowance for Working Capital

Overview

The Filing Requirements permit applicants to take one of two approaches for the calculation of the Allowance for Working Capital; the 13% Allowance Approach or the filing of a lead/lag study. Using the 13% Allowance Approach, the Working Capital Allowance is calculated to be 13% of the sum of Cost of Power (“COP”) and Controllable Expenses (Operations, Maintenance, Billing and Collecting, Community Relations, Administration and General). WNH did not conduct a lead lag study and is using the 13% Allowance Approach in accordance with the Filing Requirements.

The Working Capital Allowance for the 2016 Test Year is based upon 13% of the COP and Controllable Expenses. In calculating the Working Capital Allowance for 2011 to 2014 Actual and for the 2015 Bridge Year, WNH used the Board's historical 15% Allowance Approach.

Table 2-24 provides a summary of WNH's COP and Controllable Expenses used to calculate the Working Capital Allowance for 2011 Board Approved, 2011 Actual, 2012 Actual, 2013 Actual, 2014 Actual, 2015 Bridge Year and the 2016 Test Year.

Table 2-24 - Summary of Working Capital Allowance

Description	2011 Board Approved	2011 Actual	2012 Actual	2013 Actual	2014 Actual	2015 Bridge	2016 Test
Cost of Power Expenses	**116,489,872**	**125,507,981**	**133,881,400**	**146,930,128**	**155,508,973**	**165,490,745**	**164,326,495**
Controllable Expenses							
Distribution Expenses - Operation	3,877,534	3,567,713	4,464,684	6,122,581	6,246,577	5,876,324	5,799,381
Distribution Expenses - Maintenance	1,559,180	1,287,857	1,266,289	1,283,983	1,845,659	1,607,062	1,613,140
Billing and Collecting	2,075,189	2,208,871	2,940,036	2,632,182	2,615,114	2,702,873	2,902,731
Community Relations	236,777	164,146	202,478	193,918	163,854	147,200	142,200
Administrative and General Expenses	2,255,657	2,421,554	2,125,788	2,682,238	2,795,055	3,042,602	3,221,882
Donations - LEAP	34,944	102,925	69,244	46,179	35,044	35,000	42,000
Taxes Other than Income Taxes	-	223,281	704,659	353,440	469,952	480,131	489,734
Less Allocated Depreciation	-	(806,135)	(860,085)	(612,134)	(675,045)	(733,797)	(754,014)
Total Controllable Expenses	**10,039,282**	**9,170,212**	**10,913,092**	**12,702,387**	**13,496,209**	**13,157,395**	**13,457,054**
Working Capital	**126,529,154**	**134,678,193**	**144,794,492**	**159,632,515**	**169,005,182**	**178,648,140**	**177,783,549**
Working Capital Allowance Rates	15%	15%	15%	15%	15%	15%	13%
Working Capital Allowance	**18,979,373**	**20,201,729**	**21,719,174**	**23,944,877**	**25,350,777**	**26,797,221**	**23,111,861**

As shown in Table 2-25, the 2016 Working Capital Allowance has increased $4,132,488 or 21.8% in comparison to the 2011 Board Approved Year. The change between the 2016 Test Year and 2011 Board Approved Year is a result of increased working capital requirements due to increased Cost of Power costs and increased Controllable Expenses, less the decrease in percentage rate applied in the computation of the Working Capital Allowance from 15% to 13%. Table 2-25 provides a summary of the increase between the 2016 Test Year and 2011 Board Approved Working Capital Allowance.

Table 2-25 - Summary of Changes in Working Capital Allowance

Description	2011 Board Approved	2016 Test Year	Change	Working Capital Allowance Factor	Working Capital Allowance
Cost of Power Expenses	116,489,872	164,326,495	47,836,623	15%	7,175,493
Total Controllable Expenses	10,039,282	13,457,054	3,417,772	15%	512,666
Working Capital	**126,529,154**	**177,783,549**	**51,254,395**		**7,688,159**
COP and Controllable Expenses		177,783,549		13%	23,111,861
		177,783,549		15%	26,667,532
Decrease in Working Capital Allowance					**(3,555,671)**
Net Change Working Capital Allowance					**4,132,488**

Approximately 93% of the working capital increase of $51,254,395, which translates to an increased Working Capital Allowance for Rate Base purposes of $4,132,488, is related to Cost of Power. Controllable OM&A expenses represent 7% of the increase over the 2011 Board-Approved amounts for working capital and details on the expenses can be found in Exhibit 4 – Operating Costs.

COST OF POWER CALCULATIONS

WNH has calculated COP for the 2016 Test Year based upon the 2016 Load Forecast, adjusted for the impact of Conservation and Demand Management Activities and in accordance with the Board's Filing Requirements. A summary of the Total COP expenses is provided in Table 2-26.

Table 2-26 - Summary of Total Cost of Power Expenses

Description	2011 Board Approved	2011 Actual	2012 Actual	2013 Actual	2014 Actual	2015 Bridge	2016 Test
Power Purchased	95,326,406	105,489,725	113,129,095	125,574,419	133,278,477	142,917,950	141,659,003
Wholesale Market Service/Rural Rate Assistance	9,434,406	8,231,026	7,665,310	7,796,237	8,270,531	8,551,970	8,476,474
Network Charges	8,587,363	8,693,011	9,846,562	10,097,608	10,190,402	10,222,238	10,190,603
Connection Charges	2,976,698	2,945,575	3,070,324	2,956,166	3,103,703	3,020,758	3,222,585
Low Voltage Charges	165,000	148,644	170,109	169,009	166,755	272,000	272,000
Smart Metering Entity Charge	-	-	-	336,689	499,103	505,830	505,830
Total Cost of Power Expenses	**116,489,872**	**125,507,981**	**133,881,400**	**146,930,128**	**155,508,973**	**165,490,745**	**164,326,495**

Commodity Prices

In accordance with the Filing Requirements, the commodity price estimate used to calculate COP was determined in a way that bases the split between Regulated Price Plan ("RPP") and Non-RPP customers on 2014 actual data and uses the most current RPP price.

The RPP and Non-RPP price was obtained from the Regulated Price Plan Report for the period of November 1, 2014 through October 31, 2015 published by the Board October 16, 2014. For the purposes of calculating the 2016 Test Year, WNH has used an estimate of $.09496 per kWh for RPP customers. For Non-RPP customers, WNH has used $.09552 per kWh which includes $.02064 per kWh for the Wholesale Electricity Price and $.07488 per kWh for Global Adjustment Charges.

WNH understands that the commodity charge will be updated to reflect any changes to commodity prices that may become available prior to the approval of its Application.

Regulatory Charges

The Wholesale Market Service ("WMS") Charges for the 2016 Test Year were calculated based on the OEB Decision and Rate Order issued on December 19, 2014 (EB-2014-0347), which sets the Rural Rate Protection Charge to $0.0013 per kWh effective January 1, 2015 and does not amend the WMS Rate currently at $0.0044 per kWh. The Wholesale Market Service Costs have been very stable for a number of years so it was determined that no change is required for 2016. These rates were applied to the forecasted power purchases for the 2016 Test Year.

Network and Connection Charges

WNH pays Network and Connection charges from the IESO, Hydro One, Kitchener-Wilmot Hydro Inc. (KW) and Cambridge and North Dumfries Hydro Inc. (CND). WNH is embedded to Hydro One, KW and CND, thus, incurs charges.

WNH determined the kW billed by the IESO, Hydro One, KW and CND for 2014 actual Network and Connection costs. The 2014 kW was then utilized to estimate the monthly Network and Connection costs for the 2016 Test Year by applying the forecasted kW by the January 1, 2015 Uniform Transmission Rates (UTR) as approved by the Board (EB-2014-0357); KW and CND's 2015 Approved Rates and HONI's Interim Approved Rates as invoiced.

WNH understands that the transmission costs will be updated to reflect any new rates that may become available prior to the approval of its application.

Low Voltage Charges

WNH incurs low voltage charges from Hydro One, Kitchener-Wilmot Hydro Inc. (KW) and Cambridge and North Dumfries Hydro Inc. (CND). WNH is embedded to Hydro One, KW and CND, thus, incurs charges. In Exhibit 8 WNH proposes Low Voltage Service Rates, detailed calculations are provided in this Exhibit. WNH applied the 2014 kW each utility charged WNH for and applied each LDC's applicable rates and determined the Proposed 2016 Low Voltage Charges and Service Rates totalling $272,000.

Smart Meter Entity Charges

The Smart Meter Entity costs are calculated based on the rate of $0.788 per month for each Residential and General Service < 50 kW customer approved by the Board on March 28, 2014. The 2014 customer count has been utilized for the 2016 Test Year calculation.

Table 2-27 provides a summary of the COP calculation for the 2016 Test Year.

Table 2-27 - 2016 Cost of Power Calculation

Details	Metric	2016 Forecast kWh/kW	Loss Factor Proposed	2015 Uplifted kWh	2015 Rates	Forecast Costs	2015 Cost of Power
Electricity - Commodity RPP							
Residential	kWh	399,341,268	1.0362	413,797,422	0.09496		39,294,203
General Service < 50 kW	kWh	192,108,795	1.0362	199,063,133	0.09496		18,903,035
General Service > 50 to 4999 kW	kWh	75,298,616	1.0362	78,024,426	0.09496		7,409,199
Large User	kWh	-	1.0047	-	0.09496		-
Direct Market Participant	kWh	-	1.0362	-	0.00000		-
Street Lights	kWh	243,029	1.0362	251,827	0.09496		23,913
Unmetered Loads	kWh	3,140,372	1.0362	3,254,053	0.09496		309,005
Embedded Distributors	kWh	-	1.0047	-	0.09496		-
TOTAL		**670,132,079**		**694,390,860**			**65,939,356**
Electricity - Commodity Non-RPP							
Residential	kWh	-	1.0362	-	0.09552		-
General Service < 50 kW	kWh	-	1.0362	-	0.09552		-
General Service > 50 to 4999 kW	kWh	635,065,683	1.0362	658,055,061	0.09552		62,857,419
Large User	kWh	95,063,906	1.0047	95,510,706	0.09552		9,123,183
Direct Market Participant	kWh	6,823,514	1.0362	7,070,525	0.00000		-
Street Lights	kWh	7,351,630	1.0362	7,617,760	0.09552		727,648
Unmetered Loads	kWh	-	1.0362	-	0.09552		-
Embedded Distributors	kWh	31,378,863	1.0047	31,526,344	0.09552		3,011,396
TOTAL		**775,683,597**		**799,780,396**			**75,719,647**
Total Power - USoA 4705		**1,445,815,676**		**1,494,171,256**			**141,659,003**
Wholesale Market Service							
Residential	kWh	399,341,268	1.0362	413,797,422	0.0044		1,820,709
General Service < 50 kW	kWh	192,108,795	1.0362	199,063,133	0.0044		875,878
General Service > 50 to 4999 kW	kWh	710,364,299	1.0362	736,079,487	0.0044		3,238,750
Large User	kWh	95,063,906	1.0047	95,510,706	0.0044		420,247
Direct Market Participant	kWh	6,823,514	1.0362	7,070,525	0.0000		-
Street Lights	kWh	7,594,660	1.0362	7,869,586	0.0044		34,626
Unmetered Loads	kWh	3,140,372	1.0362	3,254,053	0.0044		14,318
Embedded Distributors	kWh	31,378,863	1.0047	31,526,344	0.0044		138,716
TOTAL		**1,445,815,676**		**1,494,171,256**			**6,543,243**
Rural Rate Assistance							
Residential	kWh	399,341,268	1.0362	413,797,422	0.0013		537,937
General Service < 50 kW	kWh	192,108,795	1.0362	199,063,133	0.0013		258,782
General Service > 50 to 4999 kW	kWh	710,364,299	1.0362	736,079,487	0.0013		956,903
Large User	kWh	95,063,906	1.0047	95,510,706	0.0013		124,164
Direct Market Participant	kWh	6,823,514	1.0362	7,070,525	0.0000		-
Street Lights	kWh	7,594,660	1.0362	7,869,586	0.0013		10,230
Unmetered Loads	kWh	3,140,372	1.0362	3,254,053	0.0013		4,230
Embedded Distributors	kWh	31,378,863	1.0047	31,526,344	0.0013		40,984
TOTAL		**1,445,815,676**		**1,494,171,256**			**1,933,231**
Total WMS/RRA - USoA 4708							**8,476,474**
Transmission - Network							
Based on 2014 kW - details in Exhibit 8	kW						
IESO	kW	2,495,978					9,434,797
Hydro One	kW	121,845					393,560
Kitchener Wilmot Hydro	kW	32,455					100,951
Cambridge & North Dumfries Hydro	kW	98,476					261,296
Total Network - USoA 4714		**2,748,754**					**10,190,603**
Transmission - Connection							
Based on 2014 kW - details in Exhibit 8							
IESO	kW	2,892,616					2,791,377
Hydro One	kW	185,015					209,992
Kitchener Wilmot Hydro	kW	32,611					23,314
Cambridge & North Dumfries Hydro	kW	107,131					197,903
Total Connection - USoA 4716		**3,217,373**					**3,222,585**
Low Voltage							
Based on 2014 kW - details in Exhibit 8							
Hydro One	kW	89,466					87,500
Kitchener-Wilmot Hydro	kW	51,660					116,400
Cambridge & North Dumfries Hydro	kW	107,131					68,100
Total Low Voltage - USoA 4750		**248,257**					**272,000**
Smart Meter Entity Charges							
Based on 2014 Customer Count				*# Cust*		*# Months*	
Residential	CX #			47,974	0.788	12	453,642.14
General Service < 50 kW	CX #			5,519	0.788	12	52,187.66
Total Smart Meter Entity - USoA 4751							**505,830**
Total Cost of Power Expenses							**164,326,495**

2.5.1.4 Treatment of Stranded Assets Related to Smart Meter Deployment

WNH is seeking disposition of the NBV of its Stranded Meters as at December 31, 2014. In accordance with the Board's *Guideline G-2012-0001 Smart Meter Funding and Cost Recovery – Final Disposition* ("Guideline G-2012-0001"), whereby distributors are to be "held whole with respect to the cost recovery of stranded meters (i.e. conventional meters replaced as part of the smart meter initiative)", WNH seeks disposition of its Stranded Meter Costs as at December 31, 2015 in the amount of $1,301,593. This represents the amount of the pooled residual NBV of the meters removed from service, less any net proceeds from sales of the meters at December 31, 2015.

On May 31, 2012, WNH filed an Application (*EB-2012-0266*) for the disposition and recovery of costs related to smart meter deployment (the "Smart Meter Application"). WNH did not seek recovery of its stranded meter costs at that time, but instead proposed to dispose of its Stranded Meters in its next Cost of Service Application. In the Decision and Order dated October 4, 2012 (Corrected October 12, 2012), the Board authorized WNH to continue to amortize the Stranded Meters until disposition and that the balance should be brought forward for disposition in WNH's next Cost of Service Application.

Stranded Meter Calculation and Cost Allocation Methodology

In accordance with the Board's *Guideline G-2009-0002, Smart Meter Funding and Cost Recovery*, WNH transferred the cost of Stranded Meters from Account 1860 - Meters to Account 1555 - Sub-account Stranded Meter Costs in 2014; the NBV of Stranded Meters is not included in the 2016 Test Year Revenue Requirement, not as a return on capital or as part of depreciation expenses. WNH has taken depreciation for 2015 within the USoA 1555 Sub-Account, thus, the balance it is seeking to recover is at December 31, 2015.

WNH tracked the costs of the meters separately by the rate classes Residential and General Service < 50 kW. Within WNH's Billing System the cost of the stranded meter and its installation date were recorded. Labour and Trucking charges were added to the meter cost and related Provincial Sales Tax (PST) for each meter in order to determine the stranded meter amount.

Table 2-28 provides a summary of the residual NBV calculation for the Stranded Assets in relation to the smart meter implementation at WNH. In accordance with the *Accounting Procedures Handbook*, no carrying charges were recorded for the Stranded Meter cost balances in the sub-account of Account 1555.

Table 2-28 - Net Book Value Calculation for Stranded Meters

Total Residential and GS < 50 kW Stranded Meters						
Year of Acquistion	Gross Asset	Accumulated Amortization	Net Asset	Proceeds on Dispostion	Contributed Capital	Residual Net Book Value
	(A)	(B)	(C=A-B)	(D)	(E)	(F=C-D-E)
To 2004	6,095,297	5,168,752	926,545			926,545
2005	175,068	67,388	107,681			107,681
2006	150,090	50,894	99,196			99,196
2007	120,560	36,769	83,790			83,790
2008	79,538	20,841	58,698			58,698
2009	22,918	4,782	18,136	269		17,867
2010	9,457	1,641	7,816			7,816
2011	-	-	-			-
2012	-	-	-			-
2013	-	-	-			-
Total	**6,652,929**	**5,351,067**	**1,301,862**	**269**	**-**	**1,301,593**

Residential Stranded Meters						
Year of Acquistion	Gross Asset	Accumulated Amortization	Net Asset	Proceeds on Dispostion	Contributed Capital	Residual Net Book Value
	(A)	(B)	(C=A-B)	(D)	(E)	(F=C-D-E)
To 2004	4,899,451	4,148,702	750,748			750,748
2005	142,924	55,427	87,496			87,496
2006	116,603	39,747	76,856			76,856
2007	94,893	29,226	65,668			65,668
2008	54,753	14,559	40,194			40,194
2009			-	269		(269)
2010	315	55	260			260
2011			-			-
2012			-			-
2013			-			-
Total	**5,308,939**	**4,287,716**	**1,021,222**	**269**	**-**	**1,020,953**

GS < 50 kW Stranded Meters						
Year of Acquistion	Gross Asset	Accumulated Amortization	Net Asset	Proceeds on Dispostion	Contributed Capital	Residual Net Book Value
	(A)	(B)	(C=A-B)	(D)	(E)	(F=C-D-E)
To 2004	$ 1,195,847	$ 1,020,050	175,797			175,797
2005	$ 32,145	$ 11,960	20,184			20,184
2006	$ 33,487	$ 11,147	22,340			22,340
2007	$ 25,666	$ 7,544	18,123			18,123
2008	$ 24,785	$ 6,282	18,503			18,503
2009	$ 22,918	$ 4,782	18,136			18,136
2010	$ 9,142	$ 1,586	7,556			7,556
2011			-			-
2012			-			-
2013			-			-
Total	**1,343,990**	**1,063,350**	**280,640**	**-**	**-**	**280,640**

Table 2-29 is consistent with Board Appendix 2-S, Stranded Meter Treatment and provides the Net Book Value of the Stranded Meters, reflecting Accumulated Depreciation to December 31, 2015. WNH transferred its Stranded Meters from USoA 1860 to USoA 1555 Sub-account Stranded Meters at December 31, 2014 and recorded depreciation for 2015 within the 1555 Sub-account. WNH did not collect Contributed Capital from customers as part of the Smart Meter implementation; there were Proceeds of Disposition of $269 for the sale of scrap meters. 2015 is presented on a forecast basis (see note 1 Appendix 2-S).

Table 2-29 – Stranded Meter Treatment

Appendix 2-S
Stranded Meter Treatment

Year	Notes	Gross Asset Value	Accumulated Amortization	Contributed Capital (Net of Amortization)	Net Asset	Proceeds on Disposition	Residual Net Book Value
		(A)	(B)	(C)	(D) = (A) - (B) - (C)	(E)	(F) = (D) - (E)
2006					$ -		$ -
2007					$ -		$ -
2008					$ -		$ -
2009					$ -		$ -
2010					$ -		$ -
2011					$ -		$ -
2012					$ -		$ -
2013					$ -		$ -
2014		$ 6,652,929	$ 5,288,663		$ 1,364,266	$ 269	$ 1,363,997
2015	**(1)**	**$ 6,652,929**	**$ 5,351,067**	**$ -**	**$ 1,301,862**	**$ 269**	**$ 1,301,593**

Stranded Meter Rate Riders

WNH is requesting the recovery of the NBV of the stranded meters of $1,301,593 as at December 31, 2015 through separate Stranded Meter Rate Riders for each of the Residential and General Service < 50 kW rate classes over a three year period. WNH is proposing a three year disposition period in order to smooth the rate increase for its customers. WNH proposes to recover the NBV of the Stranded Meters through a fixed monthly Stranded Meter Rate Rider for the Residential and General Service < 50kW rate classes. The proposed disposition is calculated based upon the NBV of Stranded

Meters by rate class as shown in Table 2-30 and the average number of customers as forecasted for the 2016 Test Year. WNH requests approval for a Stranded Meter Rate Rider $0.58 per month for each Residential customer and $1.38 per month for each metered customer in the General Service < 50 kW rate class. Table 2-30 summarizes the calculation of the proposed Stranded Meter Rate Rider.

Table 2-30 – Proposed Stranded Meter Rate Riders

Rate Class	Net Book Value	Sale of Scrap	Balance for Disposition	Recovery Period # Years	Annual $ Recovery	# Customers Forecast	Annual $ per Customer	Monthly $ per Customer
Residential	$ 1,021,222	$ (269)	$ 1,020,953	3	$ 340,318	49,305	$ 6.90	**$ 0.58**
GS < 50 kW	$ 280,640		$ 280,640	3	$ 93,547	5,632	$ 16.61	**$ 1.38**
Total	$ 1,301,862	$ (269)	$ 1,301,593		$ 433,864			

2.5.2 Capital Expenditures

2.5.2.1 Planning

Please note that when the term 'Capital Expenditures' is used, WNH has presented all information on the basis of Capital Additions and has not included Work In Process in its numbers, unless otherwise indicated.

In accordance with the Filing Requirements, WNH is filing its consolidated DSP as a stand-alone document which includes all elements of the DSP as Attachment 2-1 of this Exhibit. WNH has organized the information contained in the DSP using the headings indicated in Chapter Five of the Board's *Filing Requirements for Electricity Distribution and Transmission Applications*, *Consolidated Distribution System Plan Filing Requirements* dated March 28, 2013. The DSP incorporates matters pertaining to asset management, regional planning, and renewable energy generation.

All categories of system investments, including System Renewal, System Access, System Service, and General Plant have been addressed and consolidated in WNH's capital expenditure plan. WNH has provided historical spending by material capital project in the categories mentioned for 2011 Actual, 2012 Actual, 2013 Actual, 2014 Actual, 2015 Bridge and 2016 Test Year. WNH has assigned all historical and future construction projects to the new categories as required by the Board. WNH has leveled the plan to address pacing and affordability.

Information related to the Regional Planning Process is found in section 4.1.5 of the DSP.

Based on the evaluation of the distribution system WNH is not proposing any capital investments for capacity upgrades to accommodate applications for the connection of renewable energy generation plant for the 2016 Test Year.

2.5.2.2 Required Information

Summary of Capital Expenditures

Table 2-31 below provides a summary of historical capital expenditures for the past four historical years, 2011 through 2014, projections for the 2015 Bridge Year and 2016 Test Year, as well as projections for the period 2017 through 2020. This table is consistent with Board Appendix 2-AB. WNH has made its best efforts to categorize historical projects into the DSP categories. In 2012, WNH received approval for the disposition and recovery of its smart meter costs. As this was a distinct, discrete one-time project, WNH has not included these costs in the Capital Expenditure table. The annual capital expenditures include all new spending in the fiscal period that is in service. Costs for projects that are considered Work in Process (WIP) at the end of a fiscal year are not captured in the year spent; they are captured in the year capitalized. The variance between the annual capital expenditure totals in the table and the total 'additions' in the continuity schedules are applicable WIP, smart meter costs and contributed capital.

WNH’s main focus is the infrastructure relocation work associated with of the Region of Waterloo LRT during 2015 and 2016 and on renewal of aging assets which has been the driver of historical spending and is the driver of future spending.

Table 2-31 – Capital Expenditure Summary – 2011-2020 – Appendix 2-AB

OEB Investment Category	Historical Period								Bridge Year		Test Year	Forecast Period			
	2011		2012		2013		2014		2015		2016	2017	2018	2019	2020
	Plan	Actual	Plan	Actual	Plan	Actual	Plan	Actual	Plan	Actual					
System Access	(1)	5,616,458	(1)	7,835,847	(1)	8,667,885	(1)	5,625,933	(1)	11,084,508	6,622,858	5,892,104	6,020,046	5,946,859	6,085,796
System Renewal	(1)	9,731,967	(1)	9,253,544	(1)	7,569,002	(1)	9,711,737	(1)	6,465,106	8,181,031	8,545,000	9,438,200	8,800,764	8,975,779
System Service	(1)	1,832,799	(1)	1,649,794	(1)	1,573,868	(1)	2,311,676	(1)	1,526,548	2,405,950	1,680,000	1,725,200	1,175,404	1,175,612
General Plant	(1)	29,572,430	(1)	3,380,268	(1)	2,140,562	(1)	2,044,660	(1)	2,232,450	1,869,078	2,813,765	1,661,176	1,670,309	1,649,525
Totals		**46,753,654**		**22,119,452**		**19,951,316**		**19,694,006**		**21,308,612**	**19,078,917**	**18,930,869**	**18,844,622**	**17,593,336**	**17,886,712**
System Operations		3,567,713		4,464,684		6,122,581		6,246,577		6,018,379	5,934,832				
System Maintenace		1,287,857		1,266,289		1,283,983		1,845,659		1,607,062	1,613,140				
Total O&M		**4,855,570**		**5,730,973**		**7,406,564**		**8,092,236**		**7,625,441**	**7,547,972**				

(1) This is Waterloo North Hydro's first Distribution System Plan and as such planned expenditures are not provided.

Variance of Year over Year Category Spending

An analysis of year over year trending for historical costs within the DSP categories is as follows.

- ***2012 Actual vs. 2011 Actual***

Table 2-32 – 2012 Actual vs. 2011 Actual

Description	2011 Actual	2012 Actual	Variance from 2011 Actual
System Access	5,616,458	7,835,847	2,219,389
System Renewal	9,731,967	9,253,544	(478,423)
System Service	1,832,799	1,649,794	(183,005)
General Plant	29,572,430	3,380,268	(26,192,162)
Total Capital Expenditure	**46,753,654**	**22,119,453**	**(24,634,201)**

System Access (SA)

Expenditure increases for the most part were due to the increase in new subdivision activity and the related system expansions required to connect new customers. Development of the Waterloo west side lands had been delayed for several years prior and was finally completed in 2012.

In addition, a marked increase in brownfield redevelopment in Waterloo occurred, especially in a neighbourhood near the two local universities and the uptown core of Waterloo. Expansions and connections to new high density condominiums and apartment buildings began to increase.

System Renewal (SR)

Expenditures required in 2011 were higher than normal due to the advancement of underground system renewal projects to free up assets to help deal with ongoing reliability concerns with the overhead 44 kV supply circuit from Hydro One (73M7). This is a radial feeder which was supplying two WNH distribution stations (DS 30 & DS 31). It is also WNH’s only 44 kV supply.

WNH advanced the planned renewal of 8.32 kV distribution in the Heidelberg/ St Clements area with additional investments into renewal and voltage conversion of underground systems in 2011. This allowed for the decommissioning of the DS 33 (27.6 kV/8.32 kV). This would subsequently lead to DS 31 being converted from the 44 kV system to 27.6 kV system with the use of the DS33 transformer reducing the number of customers exposed to the 44 kV supply. Increased connectivity between the 8.32 kV stations would improve the reliability of those remaining on the 44 kV supply.

System Service (SS)

Expenditures in transformer station upgrades decreased slightly in 2012. This variance is well within the normal variability of expenditures in this category.

General Plant (GP)

The majority of the $26.2M decrease was due to the WNH's new Administration and Service Centre costs in the 2011 expenditures.

- ***2013 Actual vs. 2012 Actual***

Table 2-33 – 2013 Actual vs. 2012 Actual

Description	2012 Actual	2013 Actual	Variance from 2012 Actual
System Access	7,835,847	8,667,885	832,038
System Renewal	9,253,544	7,569,002	(1,684,542)
System Service	1,649,794	1,573,868	(75,926)
General Plant	3,380,268	2,140,562	(1,239,706)
Total Capital Expenditure	**22,119,453**	**19,951,317**	**(2,168,136)**

System Access (SA)

The increase in expenditures in 2013 was primarily due to increased municipal roadway relocation activity.

System Renewal (SR)

Expenditures in 2012 were higher than normal. Adjustments in the timing of overhead renewal investments were required to facilitate 2013 SA investments resulting in the completion of some projects in the next regulatory year.

System Service (SS)

This variance is well within the normal variability of expenditures in this category and below the materiality threshold level.

General Plant (GP)

Expenditures in 2012 still included carry over costs from WNH's new Administration and Service Centre. The decrease in 2012 represents a return to more historical levels of expenditures.

- ***2014 Actual vs. 2013 Actual***

Table 2-34 – 2014 Actual vs. 2013 Actual

Description	2013 Actual	2014 Actual	Variance from 2013 Actual
System Access	8,667,885	5,625,933	(3,041,952)
System Renewal	7,569,002	9,711,737	2,142,735
System Service	1,573,868	2,311,676	737,808
General Plant	2,140,562	2,044,660	(95,902)
Total Capital Expenditure	**19,951,317**	**19,694,006**	**(257,311)**

System Access (SA)

Expenditures in 2013 were higher than average due to increased municipal roadway relocation activity and a continuation of new subdivision connections and line expansions from 2012. The sharp drop in 2014 expenditures reflects the completion of a number of major projects by the end of 2013; a drop in subdivision activity and also delays in 3 major road relocation projects.

System Renewal (SR)

In 2013 WNH was forced to prioritize completion of SA investments due to an influx of nondiscretionary work such as customer connections and road relocations. To accomplish this, WNH was forced to reschedule the start of numerous 2013 SR projects till later in the year, which pushed the completion of these projects into early 2014 and the next regulatory year.

System Service (SS)

The expenditure increase in 2014 reflects an increase in reliability centric investments, namely the deployment of SCADA controlled Electronic Reclosers and Fault indicators.

General Plant (GP)

This variance is well within the normal variability of expenditures in this category and below the materiality threshold level.

- ***2015 Forecast vs. 2014 Actual***

Table 2-35– 2015 Forecast vs. 2014 Actual

Description	2014 Actual	2015 Actual	Variance from 2014 Actual
System Access	5,625,933	11,084,508	5,458,575
System Renewal	9,711,737	6,465,106	(3,246,631)
System Service	2,311,676	1,526,548	(785,128)
General Plant	2,044,660	2,232,450	187,790
Total Capital Expenditure	**19,694,006**	**21,308,612**	**1,614,606**

System Access (SA)

The large increase in expenditures in 2015 is twofold. Major relocations due to roadway widening, deferred by the municipalities from 2014 are expected to materialize in 2015. In addition, relocations due to the LRT project are significant in 2015. Many of these relocations are required to occur ahead of the Region of Waterloo Light Rail Transit (LRT) construction and their timing is not at the discretion of WNH.

System Renewal (SR)

Expenditures in 2014 were higher than average due to some projects initiated in 2013 not being completed until early 2014. The volume and nature of the 2015 LRT projects (high volume of work at multiple locations over a relatively short period of time in tight coordination with a multitude of stakeholders) requires careful planning and coordination which is complicating the scheduling of WNH's 2015 work program. In addition, the number of required circuit outages to complete the relocation work will be constraining portions of WNH's distribution system near the City's core. WNH examined the additional risk of having to coordinate circuit outages necessary to complete 2015 SR work, and determined that adjustments needed to be made to the 2015 program pace to closer reflect WNH's ability to complete these projects without placing unnecessary outage risk on our customers.

System Service (SS)

Expenditures in transformer station upgrades decreased in 2015.

General Plant (GP)

Increase in 2015 expenditures due to the acquisition and implementation of Outage Management System software.

- ***2016 Forecast vs. 2015 Forecast***

Table 2-36 – 2016 Forecast vs. 2015 Forecast

Description	2015 Actual	2016 Actual	Variance from 2015 Actual
System Access	11,084,508	6,622,858	(4,461,650)
System Renewal	6,465,106	8,181,031	1,715,925
System Service	1,526,548	2,405,950	879,402
General Plant	2,232,450	1,869,078	(363,372)
Total Capital Expenditure	**21,308,612**	**19,078,917**	**(2,229,695)**

System Access (SA)

Expenditures in 2015 are heavily weighted to relocations due to the Region of Waterloo Light Rail Transit Project. While the LRT project still comprises a significant portion of the expected 2016 SA work program, there is expected to be a large drop in these expenditures from 2015. WNH is also expecting a decrease in major line expansions required for new customer connections.

System Renewal (SR)

Expenditures in 2015 will be lower than average due to the sharp increase in LRT relocation work in 2015 SA. The impact of the outage requirements to complete the LRT work will limit WNH's ability to schedule renewal work in 2015 without placing unnecessary risk of power outages on our customers. This has resulted in WNH rescheduling the start of numerous 2015 SR projects till later in the year, which will push the completion of these projects into the early 2016 regulatory year.

System Service (SS)

The increase in expenditures is due to 2 reliability centric overhead line construction projects required to improve localized capacity under certain abnormal system conditions. The expected outcome will reduce prolonged outages experienced by a large group of customers.

General Plant (GP)

Expenditures in 2015 included the purchase of 2 replacement bucket trucks at the end of their useful lives. Expenditures in 2016 include only 1 large replacement vehicle.

- ***2017 Forecast vs. 2016 Forecast***

Table 2-37 – 2017 to 2020 Trending

Description	2017 Forecast	2018 Forecast	2019 Forecast	2020 Forecast
System Access	5,892,104	6,020,046	5,946,859	6,085,796
System Renewal	8,545,000	9,438,200	8,800,764	8,975,779
System Service	1,680,000	1,725,200	1,175,404	1,175,612
General Plant	2,813,765	1,661,176	1,670,309	1,649,525
Total Capital Expenditure	**18,930,869**	**18,844,622**	**17,593,336**	**17,886,712**

The key elements of WNH investment plans over the forecast period are in the areas of System Renewal and System Access. Over the entire forecast period these two categories account for 81% of total planned investments.

System Access (SA)

System Access investments over the forecast period represent the second largest group of investments. From **Table 4-12a&b** in Attachment 2-1, the DSP, in this Exhibit, it can be seen that investments are trending lower by an average of $1.65 million annually. This is mainly due to the completion of a number of major roadway relocation projects, the largest being the LRT.

Table 4-11a&b in Attachment 2-1, the DSP, provides SA investments over the forecast period by WNH Project Groups. Major investments are expected to be customer centric and are based on historical levels and municipal and developer consultation outcomes.

System Renewal (SR)

System Renewal investments over the forecast period represent the largest group of investments. From **Table 4-12a&b** in Attachment 2-1, the DSP, it can be seen that average annual investments in system renewal and SS are trending higher by an average of $240,000 annually from historical levels.

4-11a&b in Attachment 2-1, the DSP, provides SR investments over the forecast period by WNH Project Groups. Major investments are expected in overhead line, underground line and transformer station renewal.

System Service (SS)

System Service investments over the forecast period represent the smallest group of investments over the forecast period. From **Table 4-12a&b** in Attachment 2-1, the DSP, it can be seen that average annual investments in SS are trending lower by an average of $146,000 annually. **4-11a&b** in Attachment 2-1, the DSP, provides SS investments over the forecast period by WNH Project Groups. The majority of the investments are reliability centric in Distribution Automation and remotely controlled switching and fault indicating devices. Building and property upgrades at the transformer stations are also expected.

General Plant (GP)

General Plant investments over the forecast period represent the third largest group of investments over the forecast period. From **Table 4-12a&b** in Attachment 2-1, the DSP, it can be seen that average annual investments in GP are trending lower by an average of $523,000 annually. **4-11a&b** in Attachment 2-1, the DSP, provides GP investments over the forecast period by WNH Project Groups. By 2017, WNH will have upgraded or replaced a number of core information systems. This includes an Outage Management System, a Customer Information System, an Asset Management System and an ERP (Enterprise Resource Planning) System. WNH will also upgrade their existing SCADA system to achieve ‘Fault Detection Isolation & Restoration (FDIR) capability. Major investments in 2017 - 2020 are expected to include fleet replacement, control room electronic wall projection system and building sanitary sewer connection.

Capital Project Summary

Table 2-38 provides a summary of all capital projects for the years 2011 through 2014, the 2015 Bridge Year and the 2016 Test Year. All projects above WNH's materiality threshold of $175,000 have been listed individually within the DSP categories and all individual projects below the threshold have been grouped together as miscellaneous within the applicable category. WNH's DSP, found in Attachment 2-1, provides capital project summaries that provide a full description and justification of all individual material projects listed in the table for the 2016 Test Year. These summaries are found in Appendix G of Attachment 2-1. Table 2-38 is consistent with the Board's Appendix 2-AA, Capital Projects Table and, when Contributed Capital is removed, reconciles to Table 2-31 above.

Table 2-38 – Capital Projects Table – 2011 – 2016

Projects	2011 Board Approved	2011 Actual	2012 Actual	2013 Actual	2014 Actual	2015 Bridge	2016 Test
Reporting Basis	***CGAAP***	***CGAAP***	***CGAAP***	***RCGAAP***	***MIFRS***	***MIFRS***	***MIFRS***
System Access							
System Enhancements - Distribution Automation - 12							
Viper Recloser Installation				389,561			
Light Rail Transit Relocations - 21							
2015 - LRT - Caroline St, Allen St to Railway						215,149	
2015 - LRT - Erb St. FDB- Caroline St.						413,010	
2015 - LRT - Spur - Columbia St.						760,777	
2015 - LRT - 27.6 kV King St.- Northfield Dr.						242,336	
2015 - LRT - 13.8 kV King St.- Northfield Dr.						230,400	
2015 - LRT - 13.8 kV Northfield Dr. - Conestogo Rd.						280,221	
2015 - LRT - Allen St - King St to Caroline St						261,893	
2014 - LRT - King St. - Union St to Allen St						336,971	
2014 - LRT - Spur - Erb St.						214,739	
2014 - LRT - William St.- King St. to Caroline St.						471,290	
2016 - LRT - University Ave. Spur- Westmount Rd.							245,642
2016 - LRT - 27.6 kV - King St.- Northfield Dr.							221,444
2016 - LRT - 13.8 kV - King St.- Northfield Dr.							221,444
2016 - LRT - 13.8 kV - King St.- Conestogo Rd.							195,059
2016 - LRT - 13.8 kV - Northfield Dr. - Conestogo Rd.							460,277
2016 - LRT - Spur - Kumpf Dr.							222,154
2016 - LRT - Spur - Quiet Pl.							202,079
Municipal Relocations - 22							
Road Relocation Projects	293,382						
Park Street - Union St to Allen St	267,316	258,665					
Barrel Yards - Father David Bauer Dr.	640,439						
University Ave East, Regina St N to Conestoga Pkwy				942,944			
Lexington Rd-Davenport Rd to Bridge St,Waterloo				412,075			
Erb St Duct Bank from Menno to FDB Dr.				247,132			
Father David Bauer Drive Duct Bank Erb to Rec Centre				272,511			
Erb St W, Caroline to Avondale Ave-Waterloo					261,148		
King Street N.- Weber St to X-Way					182,461		
Weber St., Forwell Creek to Blythwood Rd						488,324	
King St., Printery Rd to Princess St., St Jacobs						209,785	

Projects	2011 Board Approved	2011 Actual	2012 Actual	2013 Actual	2014 Actual	2015 Bridge	2016 Test
Reporting Basis	***CGAAP***	***CGAAP***	***CGAAP***	***RCGAAP***	***MIFRS***	***MIFRS***	***MIFRS***
Sawmill Rd., Northfield Dr to Golf Course Rd., Conestogo						342,562	
Shantz Station Rd., Kossuth to Menno						422,354	
Columbia St - Erbsville to F-H Rd.						348,560	
Woolwich St S, Woolwich St N to Dolman Breslau						222,315	
Erb St. HONI ROW to Wilmot Ln						337,986	
Caroline St - Allen St to John St.						345,027	
Bridgeport Rd/Caroline St, King St to Erb St							237,956
Hutchinson Rd - Through Crosshill							179,643
Erb St. - HONI to Costco							286,095
Customer Connections - 23							
New Overhead Service Connections/Upgrades	864,042	654,973	702,432	439,474	729,068	724,981	727,131
New Underground Service Connections/Upgrades	870,995	638,985	582,982	696,555	454,003	1,413,455	1,429,245
Expansions (Subdivisions) - 24							
Vista Hills - Wilmot Line	344,309						
Galantai - Cook Homes - Woolwich St.	296,094						
Greyerbiehl Ph 2 - Wilmot Line	344,309						
Lunor Lands - Church St. - Elmira	344,309						
Activa - Rural East	256,741						
Carriage Crossing Subd U/G Dist. (Millenium Blvd)		311,871					
Riverland 2D Subdivision		199,687					
Vista Hills Subdivision, West End of Waterloo			228,172				
Clair Creek Meadows Subdivision, West End of Waterloo			268,079				
Clair Meadows Sub, Stg. 5			241,203				
Townline Estates Subdivision, West End of Waterloo			234,492				
Woolwich Estates Sub - Wat (Carriage Way, Pelham St & Preakness St)			271,897				
Country club Estates Sub-(Lunor Group) - Elmira				382,481			
Greyerbiehl Subdivision, West End of Waterloo				267,756			
Carriage Crossing - Stg2 Ph1 - Activa Holdings Inc.					181,834		
Galantai - Woolwich St. - 72 Lots						222,531	
Subdivisions - 200 lots							593,795

Projects	2011 Board Approved	2011 Actual	2012 Actual	2013 Actual	2014 Actual	2015 Bridge	2016 Test
Reporting Basis	***CGAAP***	***CGAAP***	***CGAAP***	***RCGAAP***	***MIFRS***	***MIFRS***	***MIFRS***
Expansions (Lines) - 25							
Cober Rd - New line for Airport supply (design only) 1	204,132						
Columbia St. Extension - Rhine Fall Dr. to Wilmot Line	316,016						
Conestoga Rd Feeder Egress/rebuild 2 of 2	446,308						
HAS (TS) New Feeder Cable Installation	334,359						
Greenwood Hill Rd- Weimar Line to Ferris Dr,Wellesley		212,503					
Columbia St. W. - UG Feeder		177,742					
Gerber Rd - Greenwood Hill to Nafziger,Wellesley		305,681					
Erb St W.-Erbsville to Wilmot Line - Duct Bank		179,883					
Allen St.West-Park St to Dunbar Rd,Waterloo			449,675				
Sawmill Road - Snyder Flats Rd to Bloomingdale DS.			367,489				
Albert Street, University Ave to Caroline St, Waterloo			598,444				
Sundew Drive 600A Feeder, West End of Waterloo			553,056				
Northfield Dr. - Conestogo town limits to University Ave				460,328			
West Side Subdivision Duct Bank Main Feeder				303,727			
Columbia St W under HONI - UG Feeders				210,887			
Gerber Rd, Nafzinger Rd to Hutchinson Rd					265,982		
LTLT - 26							
Wilmot Line - Wideman Rd to Erb St			395,449				
Perth Ln, Wilmot Easthope Rd to Rd 116					430,707		
Line 86, Manser Rd to 7810 Line 86						420,482	
Retail Meters - 28							
Residential Meters (Retail)						220,898	210,467
C&I Meters >50kW (Retail)	315,250			178,613		313,457	306,402
Various Projects Less Than Materiality (OEB Miscellaneous)	839,234	2,676,469	2,942,478	3,463,841	3,120,730	1,625,005	884,025
Sub-Total	**6,977,237**	**5,616,458**	**7,835,847**	**8,667,885**	**5,625,933**	**11,084,508**	**6,622,858**

Projects	2011 Board Approved	2011 Actual	2012 Actual	2013 Actual	2014 Actual	2015 Bridge	2016 Test
Reporting Basis	***CGAAP***	***CGAAP***	***CGAAP***	***RCGAAP***	***MIFRS***	***MIFRS***	***MIFRS***
System Renewal							
Overhead Line Renewal - 1							
44kV Ckt Rebuild, Bloomingdale to Zubers	413,195						
Conestoga Rd Rebuild - 1 of 2 stage	431,008						
Reid Woods Dr. - Rebuild, Elmira TS to Northfield 1 of 2	705,296						
William Hastings Line (Reg.#5) - Manser Rd. to Hutchinson Rd.		304,176					
Woolwich St. Reconductoring, Ebycrest to Menno		249,712					
King St N - Bridge to Farmer's Market Road		319,414					
Conestogo Road - Scheifele DS to Dotzert Ct,Waterloo		785,252					
Reid Woods Dr, E of Arthur St to Northfield Dr		278,149					
Northfield Dr-Conestogo Rd to King St N,Waterloo			390,068				
Northfield Drive E., Reid Woods Dr to Line 86				667,591			
Arthur St North, Elmira, Florapine Rd to Sandy Hills Dr				228,968			
Colby Drive					858,440		
William Hastings, Manser to Lichty							262,223
Underground Line Renewal - 2							
Bluevale T.H. Phase 1	452,207						
Heidelberg - Wellesley Side	446,658						
Heidelberg - Woolwich Side	551,674						
Underground Capital Operations Department	326,063						
Rebuild Lee Ave and Colonial Drive		467,822					
Heidelberg (Woolwich)U/G cable and transformer replacement		594,150					
Bluevale townhouses Phase 2 underground cable replacement		330,354					
Heidelberg I U/G cable and transformer replacement		235,629					
HSA Rehab - Replace Feeder Cables		239,061					
Mockingbird Dr, Elmira - Cable Replacement			236,501				
Tallman Drive Cable replacement			269,906				
Underground Cable replacement on Village Road in Wellesley			195,293				
Birdland Phase 1, Elmira Cable Replacement			180,826				
St Jacobs - Twp of Wool (Young St, Water St) Cable Repl.				228,278			
Birdland Phase 1 Cable Replacement, Elmira				204,666			
Sunset Pl, Elmira, Primary Cable and Transformer Replacement					301,143		
Elmira Birdlands Phase 3					698,160		

Projects	2011 Board Approved	2011 Actual	2012 Actual	2013 Actual	2014 Actual	2015 Bridge	2016 Test
Reporting Basis	***CGAAP***	***CGAAP***	***CGAAP***	***RCGAAP***	***MIFRS***	***MIFRS***	***MIFRS***
UG Rebuild Westmount Phase 3, Stanley & Forsyth					292,784		
2015 Fox Hunt Area - Davenport Rd.						248,863	
2015 Green Warbler - Elmira						333,833	
2015 Aspen Drive - Elmira						231,692	
2016 Lakeshore North Ph 8							250,824
2016 Lakeshore North Ph 9							558,293
Overhead Line Renewal - Failing Conductor - 3							
2011 City of Waterloo #6/4 Replacement	193,815						
2011 Elmira #6 Conductor Replacement	399,049						
Backlot Meadowlark Rd-Pole Line Rebuild (#6 primary)		214,530					
Ernst/Brubacher St, Elmira - #6 copper			204,453				
Stanley Dr. - 4kV Rebuild - #6 copper			360,588				
Park Ave., Elmira - Arthur St. to Centre St.				197,756			
Noecker Street, Brighton St to Elgin Cs					221,397		
Shantz Station Rd, Menno St to Victoria St, Woolwich					855,376		
Royal St., Waterloo - backlot pole line rebuild					474,064		
Buehler Line/Rd. 116 Pole Line Rebuild					359,253		
Duke Street backlot rebuild, Elmira					313,381		
#4/#6 Lichty Rd from Perth Line						187,366	
#6: Cardinal, Robin, Second, Bluebird, Backlot						549,328	
#6: Killdeer backlot from First St W.						320,347	
#6: Sawmill Rd, Conestogo - side streets							330,981
#6: Buehler Ln - Lavery Rd to Lichty Rd							578,988
Overhead Line Renewal (8kV) - 4							
27.6kV to Wellesley-Weimar Line-Moser Young to Bamburg Limits	296,478						
44 kV Circuit 1b. 27.6 Snyders Flats to Bloomingdale DS	280,765						
Greenwood Hill Rd, Gerber Rd to 2.1 km N.	231,603						
Greenwood Hill Rd, N of Weimar Line # 4 Rep. 2	291,618						
Kossuth Pole Line Rebuild		291,147					
Gerber Rd-Lawrence to Hutchison Rd, Wellesley		190,589					
Weimar Line - Moser-Young to Hutchison Rd,Wellesley		186,649					
Lobsinger Line - Rebuild, Town of Heidelberg		177,849					
Lobsinger Line, Herrgott Rd to 1km West, St Clements		431,522					

Projects	2011 Board Approved	2011 Actual	2012 Actual	2013 Actual	2014 Actual	2015 Bridge	2016 Test
Reporting Basis	***CGAAP***	***CGAAP***	***CGAAP***	***RCGAAP***	***MIFRS***	***MIFRS***	***MIFRS***
Lobsinger Line PH3 - St. Clements limit to Hergott Rd.		350,006					
Sawmill Road 2cct Rebuild - St. Jacobs to Conestogo			754,135				
Northfield Dr, Reid Woods Dr to Sandy Hills Dr, line rebuild			1,018,472				
Queen's Bush Rd-Greenwood to Molesworth,Wellesley			242,471				
Queen's Bush Rd-Greenwood Hill to Molesworth St,Wellesley				205,940			
Maplewood Rd, Paradise Lake, Phase 1				228,301			
Kennedy Rd. & Elroy Rd., Breslau				185,771			
Weimar Line, Paradise Lake to Maplewood Road				182,109			
Sawmill Rd and Northfield Dr, Conestogo					634,375		
Menno St-Lonsdale Rd to Shantz Station Rd, Woolwich					231,114		
Weimar Line Ph1, Maplewood to Kressler					342,805		
Kressler Rd - Hessen Strasse to Lobsinger Ln						282,755	
New Jerusalem Rd - Scotch Ln to Sawmill Rd						582,682	
Floradale Rd - from existing 27.6kV to Florapine Rd + 3ph Ruggles Rd						265,168	
Deborah Glaister Ln - Chalmers Forest to Rd 116							295,897
Woolwich/Guelph Townline - Victoria St to Chilligo Rd							199,335
Nafziger Rd - Gerber Rd to Queen's Bush Rd							268,740
Chilligo Rd - Kossuth Rd to Woolwich/Guelph Townline							692,257
Scotch Line, New Jerusalem Rd to Arthur St							385,294
Overhead Line Renewal (4kV) - 5							
2011 Overhead 4kV Conversions	465,919						
HS New 13.8 kV Feeder 3. - Parkside, Weber - Bearinger	330,416						
HS New 13.8 kV Feeder 4 - Quiet Pl., Parkside to Albert	314,625						
HS New 13.8 kV Feeder 5 - Albert, Quiet Pl to Columbia	261,845						
Phillip Street, Albert St to Columbia St		413,113					
Bluevale Street North, Lincoln Rd to 291 Bluevale St		176,916					
Quiet Place, Waterloo		202,927					
Albert Street - Quiet Pl to University Ave		701,114					
Keats Way - F-H Rd to University Ave			584,624				
Barnswallow, Elmira			292,942				
Bluevale St. / Erb St. E. / Goldbeck St			271,020				
University Ave - Regina to Albert St				255,842			
Phillip Street, Columbia St to University Ave				180,287			

Projects	2011 Board Approved	2011 Actual	2012 Actual	2013 Actual	2014 Actual	2015 Bridge	2016 Test
Reporting Basis	***CGAAP***	***CGAAP***	***CGAAP***	***RCGAAP***	***MIFRS***	***MIFRS***	***MIFRS***
Lodge Street, Regina St to Weber St				280,024			
Oriole - Arthur to Meadowlark, Bobolink & Goldfinch				203,617			
University Avenue - Regina to Albert					197,437		
Wissler Rd Ph1, Northfield to Bridge					408,356		
Lincoln Road, Bluevale St N to Mayfield Ave					198,660		
Birdland 4kV Rebuild - Whippoorwill Rd						220,914	
Roslin Ave - Erb St to Norman St - Uptown West						340,384	
City 4kV - John St - King St to Moore Ave							184,736
City 4kV - Allen St - Railway to Weber St and side streets							264,024
City 4kV - Union St - King St to Weber St							431,717
City 4kV - Weber St - Allen St to Hartwood Ave							271,184
City 4kV - William St & Willow Sts - Regina St to Allen St							210,022
Overhead Line Refurbishment (4kV)							
4kV OH Conversions							205,390
Reactive Renewal (Storms and Damage) - 7							
2013 - Ice Storm Capital Repairs April 11 and 12				341,385			
2013 - Wind and Rain Storm July 19 / 20, 2013				183,798			
2013 - Ice Storm December 21, 2013					276,422		
2015 Storm and Equipment Damage						190,963	
2016 Storm and Equipment Damage							228,539
Proactive Renewal (Inspection and Testing Outcomes) - 8							
2011 - Depreciated Pole Replacement	447,889	371,415	325,911				
2011 - Underground Distribution Replacement		181,505					
2011 - Loadbreak Replacement		178,308					
2011 - Designated Danger Poles		278,098					
2012 - Re-Insulating OH Lines			193,141		180,064		
2012 - PMH to Dielectric Switch			200,471				
2013 - Underground Transformer Replacement					228,387		
Station Breaker Renewal - 9							
HSB Breaker Refurbishment Option - 2 Buses						193,460	
HSB Breaker Refurbishment Option - 2 Buses, Phase 2 of 2							193,611
Envelope $400,000 Settlement Agreement Deduction to Move to WIP	(400,000)						
Various Projects Less Than Materiality (OEB Miscellaneous)	1,597,983	1,582,560	3,532,721	3,794,669	2,640,119	2,517,351	2,368,976
Sub-Total	**8,038,108**	**9,731,967**	**9,253,544**	**7,569,002**	**9,711,737**	**6,465,106**	**8,181,031**

1

Projects	2011 Board Approved	2011 Actual	2012 Actual	2013 Actual	2014 Actual	2015 Bridge	2016 Test
Reporting Basis	***CGAAP***	***CGAAP***	***CGAAP***	***RCGAAP***	***MIFRS***	***MIFRS***	***MIFRS***
System Service							
System Enhancements - Localized Capacity Deficiency - 11							
Huntsberger Rd - Katherine St to Golf Course Rd							407,011
Northfield Dr - Weber St to Westmount Rd							401,821
System Enhancements - Distribution Automation - 12							
2011 Distribution Automation	630,586						
2014 Tavrida's installation					(279,169)		
2014 Viper Installations					1,263,124		
2015 Viper Reclosers						1,107,418	
2016 Recloser Program							1,035,635
Stations Building Upgrades - 15							
HSTS Driveway Asphalt Paving					276,773		
Stations Equipment Upgrades - 16							
ERTS Rehab - Protection Upgrades		307,372					
HSB Rehab - Feeder Protection Upgrades		377,858					
Rush Feeder Prot. Upgrade			213,004				
HSA Transformer Bus Duct Retrofit			289,242				
HSA T1 Bus Duct Rebuild			261,617				
HSB Bulk Protection Engineering				848,345			
DS29 Rehab					240,173		
SCADA Upgrades - 17							
SCADA Master Replacement	834,356	572,058					
Dark Fibre IRU			240,879				
Various Projects Less Than Materiality (OEB Miscellaneous)	554,274	575,512	645,052	725,522	810,775	419,130	561,483
Sub-Total	**2,019,216**	**1,832,799**	**1,649,794**	**1,573,868**	**2,311,676**	**1,526,548**	**2,405,950**

Projects	2011 Board Approved	2011 Actual	2012 Actual	2013 Actual	2014 Actual	2015 Bridge	2016 Test
Reporting Basis	***CGAAP***	***CGAAP***	***CGAAP***	***RCGAAP***	***MIFRS***	***MIFRS***	***MIFRS***
General Plant							
Land - New Service Centre & Administration Building	1,483,905	1,489,660					
New Service Centre & Adminstration Building	23,556,990	18,007,516	635,404				
Roof - New Building		608,000					
Mechanical - New Building		3,639,359					
Parking Lot - New Building		581,259					
Communications Tower - New Building		218,009					
Furniture - New Building *	1,700,000	536,972					
Corporate Server Upgrade for ERP/CIS/Billing Legacy Systems	225,000	184,918					
2011 - R11 - 50' SIngle Bucket Material Handler Aerial Device	340,560	307,929					
Telephone System - New Building		199,696					
Generator - New Building		267,464					
Security Equipment - New Building		341,198					
Equipment - New Building		676,436					
Capitalized Interest on Building		330,976					
Operational Data Store System		215,747					
2012 - R12 Single Bucket			296,481				
2013 - R20 Radial Boom Derrick				395,692			
2014 - R41 Single Bucket Service Truck					307,292		
2014 - R42 NEW 55 ft Model 400 Single Bucket MHAD					391,103		
2014 - R43 New UG Workbody/Step Van					207,662		
Outage Mgmt System						193,000	
R53 - 68' Single Elevator Large Vehicle						424,349	
R52 - 55' SB MHAD Large Vehicle						405,071	
Asset Management Software Implementation							277,128
New Customer Information System Software							340,779
R60 - RBD Large Vehicle							454,513
Various Projects Less Than Materiality (OEB Miscellaneous)	1,300,279	1,967,291	2,448,383	1,744,870	1,138,603	1,210,030	796,658
Sub-Total	**28,606,734**	**29,572,430**	**3,380,268**	**2,140,562**	**2,044,660**	**2,232,450**	**1,869,078**
Miscellaneous							
Total	**45,641,297**	**46,753,654**	**22,119,452**	**19,951,316**	**19,694,006**	**21,308,612**	**19,078,917**
Less Renewable Generation Facility Assets and Other Non Rate-Regulated Utility Assets (input as negative)							
Total	**45,641,297**	**46,753,654**	**22,119,452**	**19,951,316**	**19,694,006**	**21,308,612**	**19,078,917**

** Furniture also included Equipment in 2011 Board Approved, 2011 Actual allocated to correct Capital Asset Account*

1

Capital Project Variance – 2011 Board Approved vs. 2011 Actual

Table 2-39 below provides a summary, by material capital project, of 2011 actual project costs compared to 2011 Board-Approved projects. An explanation of the material variances is as follows.

Table 2-39 2011 Approved vs 2011 Actual

Category	2011 Board Approved	2011 Actual	Difference
System Access	6,977,237	5,616,458	(1,360,780)
System Renewal	8,038,109	9,731,967	1,693,859
System Service	2,019,216	1,832,799	(186,417)
General Plant	28,606,734	29,572,430	965,696
Total	**45,641,297**	**46,753,654**	**1,112,358**

Some of the activity in System Access that was budgeted in the 2011 COS was not able to proceed as 3 Projects had been appealed to the Ontario Municipal Board, 2 Projects the Developer was not ready although they had previously indicated a 2011 construction date. Another Developer chose to advance one project not budgeted in 2011 and reschedule a budgeted project beyond 2011. As this resulted in additional resources being available, WNH was able to advance System Renewal Projects in 2011. In General Plant WNH capitalized $330,976 in interest on the building and $215,747 in ODS Computer Software.

Treatment of Projects

Life Cycle Greater than One Year

WNH's accounting policy is to include projects in Fixed Assets when they are completed. Capital projects which are not yet completed are included in WIP. Capital projects with a life cycle greater than one year will be carried over from one year to the next in WIP. Once completed, expenditures are removed from WIP and capitalized to fixed assets at which point they begin depreciating.

Treatment of Cost of Funds

WNH's accounting policy is to expense borrowing costs. It does not capitalize interest on capital projects unless they meet the IFRS criteria of a qualifying asset which is defined in the Board's *Report of the Board EB-2008-0408 Transition to International Financial Reporting Standards, June 28, 2009* as "an asset that necessarily takes a substantial period of time to get ready for its intended use or sale." WNH does not have any capitalized borrowing costs forecast in it 2015 Bridge or 2016 Test Years, $330,976 was capitalized in the 2011 Historical Year on the construction of WNH's new Service Centre and Administration Building.

Components of Other Capital Expenditures

WNH does not have other capital expenditures, such as non-distribution activities, for which it needs to provide components.

2.5.2.3 Capitalization Policy

Capitalization Policy Overview

WNH's current capitalization policies and principles are based on IFRS and guidelines set out by the Ontario Energy Board, where applicable. WNH converted to IFRS January 1, 2015 and as such the capitalization policy in effect for the 2015 Bridge Year and 2016 Test Year is compliant with MIFRS.

WNH reviewed its capitalization policy in anticipation of transitioning to IFRS; componentization of assets, depreciation changes and overheads were the focus of the review in light of the July 17, 2013 Board letter indicating that changes to depreciation expense and capitalization policies were required in 2013. WNH confirms that the changes to its capitalization policy are consistent with the Board's regulatory accounting policies as set out for MIFRS as contained in the *Report of the Board, Transition to International Financial Reporting Standards*, EB-2008-0408, the Kinectrics Report, and the APH, effective January 1, 2013. WNH's external auditors have also deemed WNH's capitalization policy, including the overhead policy, to align with IFRS standards.

PP&E include expenditures that are directly attributable to the acquisition of the asset. The cost of self-constructed assets includes the cost of materials, direct labour and other costs directly attributable to bringing the asset to a working condition for its intended use.

Assets with a cost in excess of $1,000 are expected to provide future economic benefit greater than one year will be capitalized. Expenditures that create a physical betterment or improvement of an asset will be capitalized.

Guidelines for Capitalization

Capital Assets include property, plant, and equipment that are held for use in the production or supply of goods and services and provide a benefit lasting beyond one year. Capital expenditures also include the improvement or "betterment" of existing assets. Intangible assets are also considered capital assets and are defined as assets that lack physical substance. They include goodwill, patents, copyrights and computer software.

Betterment – a "betterment" is a cost which enhances the service potential of a capital asset and/or increases its value, and is therefore capitalized. A betterment includes expenditures which increase the capacity of the asset, lower associated operating costs of the asset, improve the quality of output or extend the asset's useful life. A betterment does not include general maintenance-related actions that seek to sustain an asset's current value.

Repairs - a repair is a cost incurred to maintain the service potential of a capital asset. Expenditures for repairs are expensed to the current operating period. Expenditures for repairs and/or maintenance designed to maintain an asset in its original state are not capital expenditures and are charged to an operating account.

Capitalization by Component

When parts or components of an item of property, plant and equipment have different useful lives, they are accounted for as individual items (major components) of property, plant and equipment. Component costs must be significant in relation to the total cost of the item and depreciated separately over the component's useful life. Components are those which: a) are significant in relation to the total cost of the item and b) have different depreciation methods or useful life.

Components with similar useful lives and depreciation methods are grouped in determining the depreciation charge. Parts of the item that are not individually significant (remainder of the items) are combined and categorized as a single component best suited for the sum of the parts.

Depreciation

Depreciation is recognized on a straight-line basis over the estimated useful life of each significant identifiable component of an item of property, plant and equipment. Land and Land Rights are not depreciated. Construction in progress assets are not depreciated until the project is complete and in service.

WNH has used the principles in the Kinectrics Report as its basis for determining the estimated service life of assets. Any asset with deviations between WNH's Useful Life and the Kinectric's Report Useful Life Range have been identified and detailed in Exhibit 4 Table 4-46. Depreciation of an asset begins in the year when it is available for use, i.e. when it is in the location and condition necessary for it to be capable of operating in the manner intended. For rate setting purposes in the Historical Years 2011 to 2014 and the 2015 Bridge Year depreciation is calculated as a full year of depreciation in the year of acquisition and no depreciation in the year of disposal. 2016 Test Year Depreciation is calculated using the ½ year rule in accordance with the Board's Filing Requirements. Depreciation of an asset ceases when the asset is retired from active use, sold or is fully depreciated. Changes to WNH's depreciation policy are explained below under Changes to Capitalization Policy and in Exhibit 4 – Operating Costs.

Overhead Policy

WNH's overhead policy has been reviewed by its external auditors and has been deemed IFRS compliant.

WNH has reviewed and changed its overhead policy, including the capitalization component, to follow a more direct allocation of costs. WNH does not capitalize general administrative costs related to Administration or Finance.

Included in WNH's labour costs are those costs that are generally considered labour 'burden'. WNH's burden costs include vacation, statutory holidays, sick time, CPP, EI, OMERS contributions, health care and other employee benefits. Burden rates are forecasted by individual employee and are set-up in WNH's payroll system accordingly. Through the timesheet process, employees track their hours by work order or account number which designates whether the work is expensed or capitalized. Labour costs, including burden, are then directly charged to a specific project by employee based on the work executed in the field.

Facility - the costs to operate the building are charged out to the various functional departments based on the square footage of each department. Costs are allocated to Administration, Finance, Regulatory, CDM, Customer Service, Billing & Collections, IT, Engineering, Stations, Metering, Operations Administration, Operations-Line Department, Health & Safety, System Control, Stores, and Fleet.

Stores, Inventory and Purchasing – the costs of this function are related to the labour associated with employees issuing material and depreciation on Stores Equipment. As part of the budget process various departments determine the material that is forecasted to flow though the warehouse to capital projects and O&M. A rate is determined by Finance as a % of allowed labour cost and depreciation expense. This rate is applied directly to the materials issued by Stores to a specific capital or O&M work order through the automated inventory and work order system.

Fleet Costs - these costs include costs associated with maintaining WNH's fleet of pick-up trucks, bucket trucks with aerial devices, radial boom derrick trucks and trailers. These costs include fuel costs, repairs, parts, insurance, depreciation and all other items of expense necessary to keep the fleet in service and allowed to be recovered under IFRS. A fleet rate is determined on an annual basis for each vehicle group by using the hours determined in the budget process and allocation of the estimated budgeted allowable fleet costs. When a vehicle is used for a capital project, a fleet rate is charged based on the type of vehicle used multiplied by hourly usage of the vehicle. These costs are expensed or capitalized directly to the specific project through the timesheet process by work order.

Engineering & Operations Administration – Employees allocate their time directly to O&M and capital through the time sheet process by work order. Labour costs associated with capital must be directly attributable to a specific capital project. Recovery of Engineering & Plant Services (EPS) and Operations Administration are no longer part of burden accounts and subsequently not part of capital cost.

Changes to Capitalization Policy

Changes have been made to WNH's capitalization policy since the last rebasing application in 2011 as a result of the Board's letter dated July 17, 2013 and impacted overheads, componentization, depreciation and Contributed Capital. Changes made as a result of the direction provided by the Board in this letter have been tracked in Account 1576 and are explained in further detail in Exhibit 9 – Deferral and Variance Accounts.

Overhead Policy Changes

WNH retained the services of KPMG to assist with determining overhead policy changes required under IFRS. WNH's capitalization policy has been reviewed and approved as IFRS compliant by WNH's external auditors and as such costs have been recorded in Account 1576 for CGAAP changes with regards to capitalization policy changes. WNH no longer uses a burden account to capitalize Engineering, Operations Administration and Health, Safety and Environment costs, only costs directly attributable to a specific capital project are capitalized. The Stores Burden only captures a portion of the warehouse staff, namely those directly related to capital activities and depreciation expense on Stores Equipment. The Fleet Burden captures labour, inventory, fuel, truck tools, licenses, repairs and maintenance, contracted services and depreciation.

Componentization and Depreciation Changes

WNH retained the services of KPMG to assist with determining the level of PP&E componentization required under IFRS, establishing updated useful lives referencing the Kinectrics report and examining whether any changes to componentization and depreciation were required as part of the planned conversion to MIFRS. A significant amount of analysis was done with regards to asset componentization and the related impacts on depreciation.

In October 2011, the conversion to MIFRS was subsequently deferred to 2013. In March 2013, another IFRS deferral was granted to 2014 and on July 17, 2013 the Board issued a letter advising LDCs that changes to depreciation rates and capitalization policies that would have been implemented under IFRS could be made in 2012 under CGAAP (i.e. effective January 1, 2012), and must be made no later than 2013 (i.e. effective January 1, 2013), regardless of whether the AcSB permits further deferrals for the changeover to IFRS. WNH elected to make the depreciation rates and capitalization policy changes effective January 1, 2013.

KPMG and WNH worked together to determine an appropriate level of componentization on historical assets and an assessment of remaining useful lives that incorporated all material components of historical costs. WNH proceeded to incorporate historical assets from the analysis into its fixed asset sub ledger with depreciation calculating automatically by asset component within the sub ledger on a go-forward basis. The adjustments made to WNH's service lives had a significant impact on WNH's depreciation expense and this change which is recorded in Account 1576 is explained in detail in Exhibit 9 – Deferral and Variance Accounts.

WNH has used the principles in the Kinectrics Report as its basis for determining the estimated service life of assets. Any asset with deviations between WNH's Useful Life and the Kinectric's Useful Life Range have been identified and detailed in Exhibit 4 Table 4-46. Depreciation of an asset begins in the year when it is available for use, i.e. when it is in the location and condition necessary for it to be capable of operating in the manner intended. For rate setting purposes in the Historical Years 2011 to 2014 and the 2015 Bridge Year depreciation is calculated as a full year of depreciation in the year of acquisition and no depreciation in the year of disposal. 2016 Test Year Depreciation is calculated using the ½ year rule. Depreciation of an asset ceases when the asset is retired from active use, sold or is fully depreciated.

Customer Contributions Changes

Under CGAAP, WNH recorded customer contributions as an offset to the Cost of Capital Assets and amortized accordingly. Under MIFRS, WNH cannot capitalize these customer contributions as part of its net capital assets, but instead will classify the contributions as a deferred revenue liability and amortize the costs to revenue over the life of the asset the contribution relates to. For financial reporting purposes, WNH has classified forecasted Customer Contributions for the 2015 Bridge Year and 2016 Test Year as deferred revenue and amortized the contribution to revenue over the life of the related asset. For rate setting purposes, these costs are included as an offset to rate base and the related amortized revenue as an offset to depreciation expense. Historical Contributed Capital costs are included in Account 1995 and Forecasted Contributed Capital costs are included as Account 2440, however, both are included in the Fixed Asset Continuity Schedules and within the Rate Base calculation. Please see Table 2-19 - Account 1995 / 2440 Breakdown for the reconciliation between financial statement reporting and rate setting classification.

2.5.2.4 Capitalization of Overhead

Overview

WNH, along with its consultant KPMG, performed an analysis of all costs that were being capitalized under CGAAP in order to determine whether these costs were eligible for capitalization under IFRS. As discussed above in the “Capitalization Policy Overview” section, changes were required to the capitalization of overhead as a result of the transition to IFRS and that the policy as explained above is compliant with IFRS requirements.

Table 2-34 provided below, which is consistent with Board Appendix 2-D, has been completed to show WNH’s OM&A costs prior to, and after, the allocation of costs for the Engineering and Operations Administration Departments, Fleet Inventory (Stores) and Employee Benefits to capital construction projects.

Burden Rates

Table 2-35 below summarizes the historical and forecasted overhead rates related to the capitalization of costs on self-constructed assets. The rates are changed and updated periodically to reflect actual costs or changed circumstances.

WNH has two types of overhead costs that are capitalized; (i) Fleet and (ii) Stores. WNH also capitalizes payroll benefits for applicable employees; however, these costs are directly allocated to capital through a burden rate in the payroll system. WNH has budgeted payroll benefits and a resulting overhead percentage and these are attached to the employee within the payroll system. Thus, the benefits are attached to each employee hour and directly charged to Capital, OM&A or recoverable as applicable.

As described previously, WNH does not allocate any indirect costs associated with Finance, Information Systems Technology, or the Administration department to capital.

Table 2-34 – Overhead Expense

Appendix 2-D
Overhead Expense

Applicants are to provide a breakdown of OM&A before capitalization in the below table. OM&A before capitalization may be broken down by cost center, program, drivers or another format best suited to focus on capitalized vs. uncapitalized OM&A.

OM&A Before Capitalization -	2011 Historical Year	2012 Historical Year	2013 Historical Year	2014 Historical Year	2015 Bridge Year	2016 Test Year
Distribution Expenses	$ 4,855,570	$ 5,730,973	$ 7,406,564	$ 8,092,236	$ 7,483,386	$ 7,412,521
Billing and Collecting	$ 2,208,871	$ 2,940,036	$ 2,632,182	$ 2,615,114	$ 2,702,873	$ 2,902,731
Community Relations	$ 164,146	$ 202,478	$ 193,918	$ 163,854	$ 147,200	$ 142,200
Administrative and General Expenses	$ 2,421,554	$ 2,125,788	$ 2,682,238	$ 2,795,055	$ 3,042,602	$ 3,221,882
Engineering	$ 1,169,879	$ 1,111,188	$ -	$ -	$ -	$ -
Operations Administration	$ 235,633	$ 228,692	$ -	$ -	$ -	$ -
Stores	$ 451,032	$ 425,166	$ 117,010	$ 132,862	$ 136,549	$ 137,154
Fleet	$ 1,269,967	$ 1,115,759	$ 1,363,866	$ 1,147,058	$ 1,140,141	$ 1,193,728
Loss Prevention	$ 94,979	$ 101,378	$ -	$ -	$ -	$ -
Total OM&A Before Capitalization (B)	**$ 12,871,631**	**$ 13,981,457**	**$ 14,395,778**	**$ 14,946,178**	**$ 14,652,751**	**$ 15,010,216**

Please note that any overhead costs expensed are included in their functional OM&A area above

Applicants are to provide a breakdown of capitalized OM&A in the below table. Capitalized OM&A may be broken down using the categories listed in the table below if possible. Otherwise, applicants are to provide its own break down of capitalized OM&A.

Capitalized OM&A	2011 Historical Year	2012 Historical Year	2013 Historical Year	2014 Historical Year	2015 Bridge Year	2016 Test Year	Directly Attributable? (Y/N)	Explanation for Change in Overhead Capitalized
Engineering	$ 1,169,879	$ 1,111,188	$ -	$ -	$ -	$ -	Y	MIFRS no longer allowed to capitalize these costs
Operations Administration	$ 235,633	$ 228,692	$ -	$ -	$ -	$ -	Y	MIFRS no longer allowed to capitalize these costs
Stores	$ 451,032	$ 425,166	$ 117,010	$ 132,862	$ 136,549	$ 137,154	Y	MIFRS restricted some of the costs able to capitalize
Fleet	$ 1,269,967	$ 1,115,759	$ 1,363,866	$ 1,147,058	$ 1,140,141	$ 1,193,728	Y	MIFRS restricted some of the costs able to capitalize
Loss Prevention	$ 94,979	$ 101,378	$ -	$ -	$ -	$ -	Y	MIFRS no longer allowed to capitalize these costs
Employee Benefits	$ 627,280	$ 562,805	$ 675,543	$ 649,970	$ 539,427	$ 577,615	Y	MIFRS no longer allows Employee Future Benefits to be capitalized
costs of site preparation								
initial delivery and handling costs								
costs of testing whether the asset is functioning properly								
professional fees								
costs of opening a new facility								
costs of introducing a new product or service (including costs of advertising and promotional activities)								
costs of conducting business in a new location or with a new class of customer (including costs of staff training)								
administration and other general overhead costs								
Insert description of additional item(s) and new rows if needed								
Total Capitalized OM&A (A)	**$ 3,848,770**	**$ 3,544,987**	**$ 2,156,419**	**$ 1,929,891**	**$ 1,816,117**	**$ 1,908,497**		
% of Capitalized OM&A (=A/B)	30%	25%	15%	13%	12%	13%		

OM&A After Capitalization -	2011 Historical Year	2012 Historical Year	2013 Historical Year	2014 Historical Year	2015 Bridge Year	2016 Test Year
Distribution Expenses	$ 4,855,570	$ 5,730,973	$ 7,406,564	$ 8,092,236	$ 7,483,386	$ 7,412,521
Billing and Collecting	$ 2,208,871	$ 2,940,036	$ 2,632,182	$ 2,615,114	$ 2,702,873	$ 2,902,731
Community Relations	$ 164,146	$ 202,478	$ 193,918	$ 163,854	$ 147,200	$ 142,200
Administrative and General Expenses	$ 2,421,554	$ 2,125,788	$ 2,682,238	$ 2,795,055	$ 3,042,602	$ 3,221,882
Total OM&A After Capitalization (C) = A - B	**$ 9,650,141**	**$ 10,999,275**	**$ 12,914,902**	**$ 13,666,258**	**$ 13,376,061**	**$ 13,679,334**

Table 2-35 – Overhead Rates

Description	Unit	2011 Board Approved	2011 Actual	2012 Actual	2013 Actual	2014 Actual	2015 Bridge Year	2016 Test Year
Burden Rates								
Payroll Benefits	Direct Labour		50.52%	50.48%	50.49%	50.21%	49.99%	50.75%
PP&E [1]	Direct Labour		-	-	2.20%	2.01%	2.31%	2.19%
Overhead Rates								
Engineering	Direct Labour	9.0%	9.0%	9.0%	-	-	-	-
Operations Adminstration	Direct Labour	21.4%	21.01%	22.7%	-	-	-	-
Stores	Material $	15.00%	15.00%	15.0%	2.0%	2.0%	2.0%	2.0%
Loss Control - Inside	Direct Labour	1.09%	1.16%	0.97%	-	-	-	-
Loss Control - Outside	Direct Labour	5.16%	5.57%	6.15%	-	-	-	-
Vehicle Rates								
Tension Stringer and puller	Direct Equipment Hour		$ 33	$ 55	$ 55	$ 55	$ 94	$ 94
Tension puller	Direct Equipment Hour		$ 33	$ 55	$ 55	$ 55	$ 94	$ 94
Small Truck	Direct Equipment Hour		$ 10	$ 18	$ 15	$ 15	$ 12	$ 12
Cube van/small dump	Direct Equipment Hour		$ 24	-	-	-	-	-
Service truck	Direct Equipment Hour		$ 35	-	-	-	-	-
Medium Truck	Direct Equipment Hour		-	$ 36	$ 29	-	-	
Single bucket - forestry	Direct Equipment Hour		$ 37	-	-	-	-	-
Single bucket - material handler	Direct Equipment Hour		$ 42	-	-	-	-	-
Crane/radial boom derrick	Direct Equipment Hour		$ 45	-	-	-	-	-
Double bucket elevator	Direct Equipment Hour		$ 48	-	-	-	-	-
Large Truck	Direct Equipment Hour			$ 65	$ 52	$ 52	$ 44	$ 44
Other								
Administration Charge[2]	$	15%	15%	15%	15%	15%	15%	15%

[1] Personal Protective Equipment only attached to outside personnel hours - previously these costs were included in Loss Control - Outside
2 WNH charges a 15% Administration Fee on all Billable Work, this income is recorded in USoA # 5625

2.5.2.5 Costs of Eligible Investments for the Connection of Qualifying Generation Facilities

Based on the evaluation of the distribution system to accept green energy generation connections WNH is not proposing any capital investments for capacity upgrades to accommodate applications for the connection of renewable energy generation plant for the 2016 Test Year.

Section 2.5.2.5 of the Board's 2015 Filing Requirements states: *"… the distributor must provide a proposal, where applicable, to divide the costs of eligible investments between the distributor's ratepayers and all Ontario ratepayers per Regulation 330/09, taking into account the Board's Report on the Framework for Determining Direct Benefits (EB-2009-0349) (the "Direct Benefits Report"). Where applicable, applicants* *must file a draft accounting order to establish a variance account tracking the IESO payment revenues against the actual spending."*

WNH has reflected the following proposed treatment for eligible investments of connecting qualifying generation facilities in this application:

- WNH invested in one qualifying expansion project in 2013 in the amount of $117,320
- WNH has left the above project in its Rate Base, completed the Board's Appendix 2 – FA and Appendix 2 - FC and recorded the resulting 2016 Provincial Rate Protection Amount of $7,776 as a Revenue Offset to its 2016 Revenue Requirement. In the Board's model 17% of the expansion costs are directly attributable to WNH's customers
- The Board's Appendix 2 – FA and Appendix 2 – FC are attached to this Exhibit as Attachment 2-2 and in Exhibit 9
- WNH is proposing in this Exhibit for the Board's approval for WNH to obtain payment from the IESO for Ratepayer Protection under O. Reg. 330/09 in the amount of $7,776 annually by payment of $648 monthly, the 2016 Provincial Rate Protection Amount as calculated by the Board's Appendix 2 – FA and Appendix 2 – FC.
- WNH is not proposing a variance account as the one project occurred in the historical year 2013 and no further eligible investments in connecting qualifying generation facilities has been forecast for the 2015 Bridge and 2016 Test Years
- WNH will update the Board's Appendix 2 – FA and Appendix 2 – FC, its resultant 2016 Provincial Rate Protection Amount and its 2016 Revenue Offset for any future Board issued cost of capital parameters for rates with effective dates in 2016 prior to the issuance of the Board's decisions for its Application

2.5.2.6 New Policy Options for the Funding of Capital

On September 18, 2014, the Board released *Report of the Board New Policy Options for the Funding of Capital Investments: The Advanced Capital Module* and in it the Board has established the following mechanism to assist distributors in aligning capital expenditure timing and prioritization with rate predictability and smoothing:

> The review and approval of business cases for incremental capital requests that are subject to the criteria of materiality, need and prudence are advanced to coincide with the distributor's cost of service application. To distinguish this from the Incremental Capital Module ("ICM"), this new mechanism will be named the Advanced Capital Module (or "ACM").
>
> Advancing the reviews of eligible discrete capital projects, included as part of a distributor's Distribution System Plan and scheduled to go into service during the IR term, is expected to facilitate enhanced pacing and smoothing of rate impacts, as the distributor, the Board and other stakeholders will be examining the capital projects over the five-year horizon of the DSP.

WNH does not have any discrete capital projects within the five-year horizon that it believes would require this new policy option. The capital investments required by WNH from 2017 through 2020 are relatively flat and WNH believes it can be managed through the rates proposed within this application.

2.5.2.7 Addition of ICM Assets to Rate Base

WNH has not applied for approval of ICM Assets and therefore has no such assets added to its rate base.

2.5.2.8 Service Quality and Reliability Performance

WNH follows the Board's Reporting and Record Keeping Requirements Guideline to report its Service Quality Indicators annually. In accordance with the Filing Requirements, Table 2-36 is provided below and is consistent with Board Appendix 2-G, Service Quality Indicators. The table provides the performance measurements for the last five (5) historical years – 2010 through 2014.

WNH's performance results over the 2010 to 2014 period exceed the Board's approved standards if 2012 and 2013 SAIDI and SAIFI are adjusted for Major Events and Exclusive of Supply.

It can be seen from Table 2-37 the major impacts that Supply Reliability and Major Events have had on WNH's SAIDI and SAIFI performance from 2011-2014. Exclusive of Major Events and Supply Reliability, WNH's 4 year average is within the OEB reliability target range. This is noteworthy as this represents the reliability of WNH's distribution system and events over which it has greatest control. WNH analyzes its reliability indices with and without the inclusion of Major Event data. WNH uses the Canadian Electrical Association (CEA) definition of Major Events, also known as Prominent Events, which is "*Major Events are events where 10% of a Distributor's customer base is out of power for more than 24 hours and caused by a storm or event impacting more than one Distributor*". This allows WNH to focus on chronic and acute reliability concerns separately as often they have different drivers and solutions.

2013 remains noteworthy as the worst year on record for WNH. The high customer outage minutes were attributable to 3 Major Events; an April ice storm, a July wind storm and a December ice storm. These 3 events contributed 24,960,714 customer outage minutes or 85% of the annual total. The storm events were so severe that many local municipalities exercised their Emergency Preparedness Plans during these events. All of the 2013 Major Events were weather related.

WNH has worked diligently on reduction of momentary outages. At the Mid-Market & Large Business Workshops two participants commented that their experience was that momentary outages had decreased and expressed their appreciation for WNH's efforts.

WNH's performance is, thus, within the range of acceptable performance over the previous five years, subject to the comments above, and no corrective action is required.

During the period 2011 and 2014 WNH had a decrease in staffing levels within the Customer Service group and no decrease in service level. This is supported by WNH's results of 96% in customer service from its customers in the UtilityPULSE survey which is in Exhibit 1, Appendix 1-7.

1 **Table 2-36 – Service Quality and Reliability Performance – Appendix 2-G**

Appendix 2-G
Service Reliability Indicators
2010 - 2014

Index	Includes outages caused by loss of supply					Excludes outages caused by loss of supply				
	2010	2011	2012	2013	2014	2010	2011	2012	2013	2014
SAIDI	0.79	1.04	3.37	9.08	0.97	0.76	0.75	1.66	5.17	0.81
SAIFI	0.91	0.94	2.10	3.95	1.71	0.85	0.85	1.39	3.14	1.21

5 Year Historical Average

	Includes outages caused by loss of supply	Excludes outages caused by loss of supply
SAIDI	3.049	1.830
SAIFI	1.922	1.488

SAIDI = System Average Interruption Duration Index
SAIFI = System Average Interruption Frequency Index

Indicator	OEB Minimum Standard	2010	2011	2012	2013	2014
Low Voltage Connections	90.0%	100.0%	100.0%	100.0%	100.0%	100.0%
High Voltage Connections	90.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Telephone Accessibility	65.0%	88.7%	91.5%	87.6%	95.1%	88.8%
Appointments Met	90.0%	96.9%	99.7%	100.0%	99.9%	99.6%
Written Response to Enquires	80.0%	100.0%	99.8%	100.0%	99.9%	100.0%
Emergency Urban Response	80.0%	89.5%	97.0%	98.6%	98.0%	93.0%
Emergency Rural Response	80.0%	100.0%	100.0%	100.0%	96.9%	100.0%
Telephone Call Abandon Rate	10.0%	3.4%	3.8%	4.1%	9.7%	4.6%
Appointment Scheduling	90.0%	100.0%	99.7%	100.0%	100.0%	100.0%
Rescheduling a Missed Appointment	100.0%	93.9%	100.0%	100.0%	100.0%	100.0%
Reconnection Performance Standard	85.0%		100.0%	100.0%	100.0%	100.0%

Table 2-37 – WNH Reliability Performance and Targets

	2011	2012	2012 EME	2013	2013 EME	2014	WNH TARGETS
Exclusive of Supply							
SAIDI (Duration)	0.75	1.66	0.79	5.19	0.88	0.81	0.75-1.66
SAIFI (Frequency)	0.85	1.39	1.16	3.16	1.86	1.21	0.85-1.39
	2011	**2012**	**2012 EME**	**2013**	**2013 EME**	**2014**	**2014**
Inclusive of Supply							
SAIDI (Duration)	1.06	3.37	0.82	9.13	1.36	0.97	0.75-1.66
SAIFI (Frequency)	0.96	2.1	1.18	3.97	2.23	1.71	0.85-1.39
ME = Major Events			2 ME		3 ME		
EME = Excluding Major Events							

		4 Year Average Indices	
	WNH TARGETS	Excluding ME	Including ME
Exclusive of Supply			
SAIDI (Duration)	0.75-1.66	0.81	2.1
SAIFI (Frequency)	0.85-1.39	1.27	1.65
2014			
Inclusive of Supply			
SAIDI (Duration)	0.75-1.66	1.05	3.63
SAIFI (Frequency)	0.85-1.39	1.52	2.18
EME = Excluding Major Events			

ATTACHMENT 2-1

DISTRIBUTION SYSTEM PLAN

Waterloo North Hydro Inc.

Distribution System Plan

April 30, 2015

Version 1.0

Contents

Table of Content for Tables

Table of Figures

Appendices

Appendix A: WNH Renewable Energy Generation Plan & IESO Letter of Comment

Appendix B: HONI Letter of Comment (IRRP)

Appendix C: Information Technology Strategy

Appendix D: Operations Annual Maintenance Summary

Appendix E: Table 2AE, Capital Expenditure Summary 2011 - 2020

Appendix F: 2014 Annual Service Continuity Report on Distribution System Performance

Appendix G: Material Capital Project Summaries

Appendix H: Photographs of Assets in Poor Condition

1.0 Executive Summary

1.1 Outline of Report

Waterloo North Hydro's (WNH) Distribution System Plan (DS Plan) has been organized according to the recommended format contained within the Ontario Energy Board's "Chapter 5 Consolidated Distribution System Plan Filing Requirements, March 28, 2013". Supplemental information has been provided in various subsections to enhance the understanding of WNH's DS Plan. This is WNH's first DS Plan.

This report is divided into the following sections;

- **Section 1** which provides an introduction to WNH's DS Plan including a description of the utility, background and drivers; and objectives and scope of work.
- **Section 2** which provides an overview of WNH's DS Plan and describes the process employed in its development, i.e. stakeholder consultations, collaboration with municipal/regional governments and transmitters, performance measurements and monitoring metrics.
- **Section 3** describes in detail WNH's asset management, prioritization and optimization process; and provides an overview of assets managed.
- **Section 4** documents the overall capital expenditure plan covering System Access, System Renewal, System Service and General Plant.
- **Appendices A through G** provide additional information that supports this DS Plan.

Cross references to the Ontario Energy Board's "Chapter 5 Consolidated Distribution System Plan Filing Requirements, March 28, 2013" are included in brackets () at all headings/subheadings within this report for ease of reference.

1.2 Description of the Utility Company

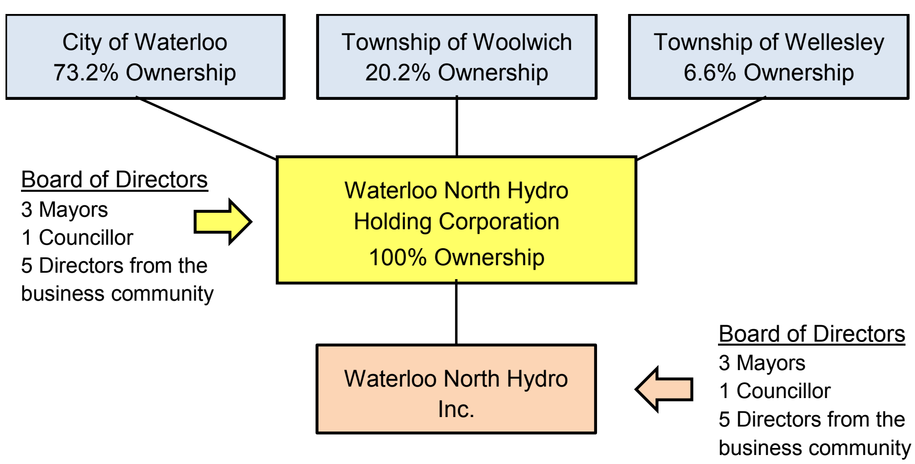
Waterloo North Hydro Inc. (WNH) is a medium sized Local Distribution Company (LDC) regulated and licensed by the Ontario Energy Board (OEB). With predecessors that date back to 1905, WNH was created in 1979 as a result of Bill 55. Waterloo Public Utilities Commission and four other utilities were amalgamated creating a contiguous service territory that even today is still one of the largest in the province at 672 sq. km. Located within the Region of Waterloo (Region), WNH provides all regulated electricity distribution services to the City of Waterloo, the Township of Woolwich and the Township of Wellesley.

Waterloo North Hydro Holding Corporation, incorporated under the Business Corporation Act (Ontario) is the parent holding company of Waterloo North Hydro Inc. The City of Waterloo, the Township of Woolwich and the Township of Wellesley are the shareholders of Waterloo North Hydro Holding Corporation, with ownership interests of 73.2%, 20.2% and 6.6%, respectively.

The business affairs of each corporation are managed by its respective Boards of Directors, each consisting of nine (9) Directors. The Shareholders appoint Waterloo North Hydro Holding Corporation directors. The Holding Company Board appoints directors for Waterloo North Hydro Inc.

The net assets and all employees of the former Hydro-Electric Commission of Waterloo, Wellesley & Woolwich were transferred to Waterloo North Hydro Inc. on incorporation March 1, 2000.

Figure 1-1: WNH Ownership Structure



WNH's Mission, Vision, Corporate values and Strategic Imperatives that define the organization and are considered in strategic planning:

Vision

To be a key partner in contributing to community prosperity and success.

Corporate Values

1. Respect - WNH is committed to treating others with respect and dignity
2. Commitment to Excellence - WNH strives for high reliability and quality through continuous improvement, leadership and excellence
3. Service - WNH recognizes its commitment to be of service to customers, employees and the community and its contribution to the success of each
4. Teamwork and Collaboration - WNH willingly shares information and best practices
5. Safety and Environmental Stewardship - WNH is committed to its responsibility for the health and safety of employees, the protection of the public and safeguarding of the environment
6. Responsible and Accountable - WNH takes responsibility for the quality, reliability and timelines of its work and the work of others

Strategic Imperatives

Each of the strategic imperatives is internally consistent with and contributes to achieving the corporate values outlined above.

1. Supply & Reliability
2. Health, Safety and Environment
3. Customer Service
4. Employee Relations and Development
5. Productivity and Cost Reduction
6. Organizational Effectiveness
7. Financial Performance
8. Shareholder and Community relations
9. System Aesthetics

As stated earlier, WNH has a large service area. The urban and rural component of WNH's service area is illustrated in **Table 1-1 and Fig 1-2**.

Table 1-1: WNH Service Area

AREA (sq km)	URBAN	RURAL	TOTAL	%
City of Waterloo	65	0	65	9.7%
Township of Woolwich	0	329	329	49.0%
Township of Wellesley	0	278	278	41.4%
Total	65	607	672	100%

WNH's Service Area current population and customers served are illustrated in **Tables 1-2 and Table 1-3**.

Table 1-2: WNH Service Area Population and Density

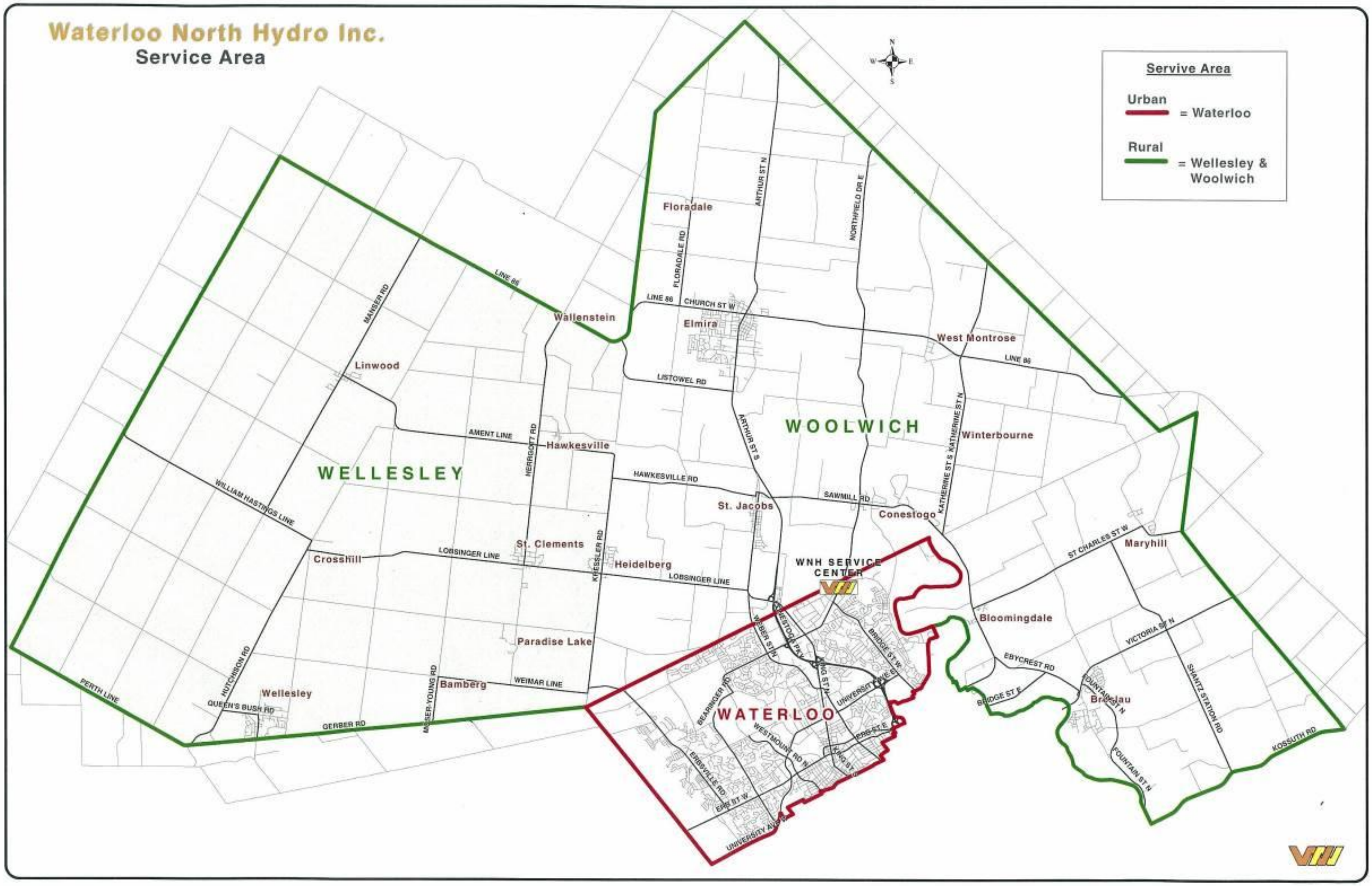
MUNICIPALITY	POPULATION	%	POPULATION DENSITY (per sq. km.)
City of Waterloo	98,870	75%	1,521
Township of Woolwich	22,000	17%	67
Township of Wellesley	10,500	8%	38
Total	131,370	100%	195

Table 1-3: WNH Customers and Density

MUNICIPALITY	CUSTOMERS	%	CUSTOMER DENSITY (per sq. km.)
City of Waterloo	41,991	77%	655
Township of Woolwich	9,451	17%	29
Township of Wellesley	3,002	6%	11
Total	54,444	100%	82

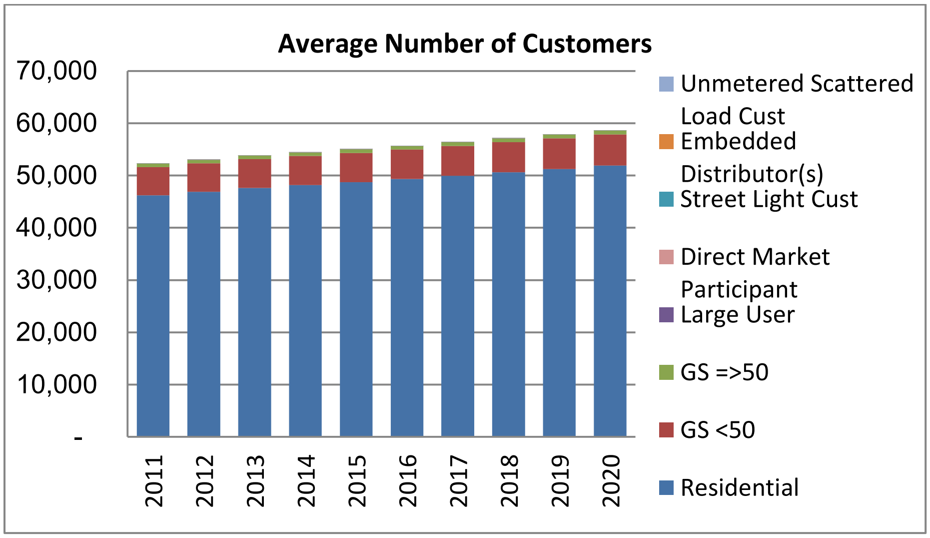
It is a significant consideration in WNH's DS Plan that the rural areas comprising the Townships of Woolwich and Wellesley comprise 90% of WNH's total service area however account for only 23% of its customer base.

Figure 1-2: Map of WNH Service Territory



As evident in **Figure 1-3** below, the size of WNH's customer base has experienced steady growth; 1.3% annually since 2011.

Figure 1-3: WNH Customer Growth



WNH has forecasted similar growth in customer base over the period 2016 – 2020. **Table 1-4** below, illustrates the historical and projected growth in customer base by Rate Class.

Table 1-4: WNH Average Number of Customers – Historical and Projected

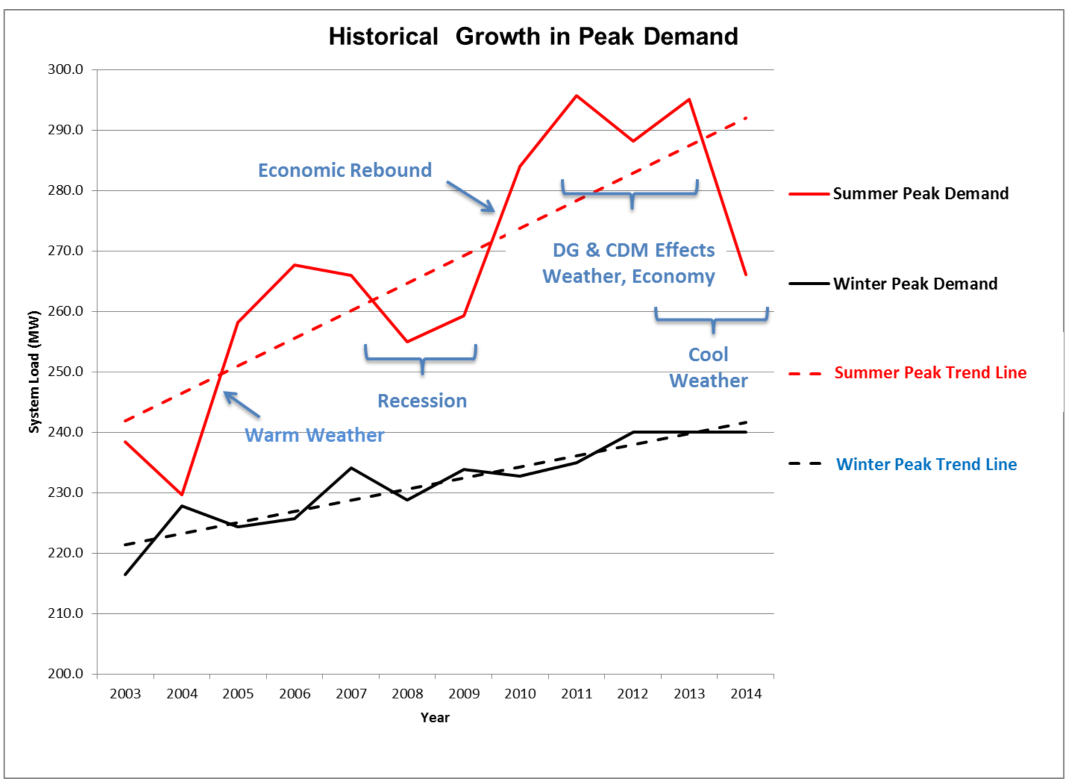
Customer Class	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Residential	46,194	46,877	47,602	48,191	48,705	49,305	49,946	50,595	51,253	51,919
GS <50	5,402	5,454	5,503	5,547	5,596	5,632	5,705	5,779	5,855	5,931
GS =>50	666	668	670	683	694	693	702	711	720	730
Large User	1	1	1	1	1	1	1	1	1	1
Direct Market Participant	-	2	2	2	2	2	2	2	2	2
Street Light Cust	6	6	6	6	6	6	6	6	6	6
Embedded Distributor(s)	1	1	1	1	1	1	1	1	1	1
Unmetered Scattered Load Cust	14	14	14	14	14	14	14	14	14	14
Total	52,284	53,022	53,799	54,444	55,019	55,654	56,377	57,110	57,852	58,604
% Increase	1.5%	1.4%	1.5%	1.2%	1.1%	1.2%	1.3%	1.3%	1.3%	1.3%

Home to three (3) prominent and growing educational institutions, and many high-tech and knowledge based businesses, WNH operates in a robust regional economy that has seen summer peak demand over the last 20 years grow at a rate over 2.5 times the provincial average. WNH's recent growth in electrical peak demand (kW) is illustrated in **Figure 1-4.** Due to the mix of the customer base, the system peak is affected to a higher degree by weather and local development conditions and to a lesser degree by provincial or global factors.

Since 1996, WNH has been a summer peaking utility. WNH's winter peak demand has also continued to grow but at a much slower and less volatile pace. These trends can be attributed to the increased prevalence of air conditioning in the summer and the loss of traditional electrical loads, such as space and hot water heating, to natural gas.

WNH's system peak demand has a tendency to rebound from recessions faster than other Ontario jurisdictions. Conservation and green power generation have recently slowed WNH's growth to 2%, still double the provincial average. WNH expects similar growth in electrical demand over the forecast period 2016 – 2020.

Figure 1-4: WNH Peak Demand



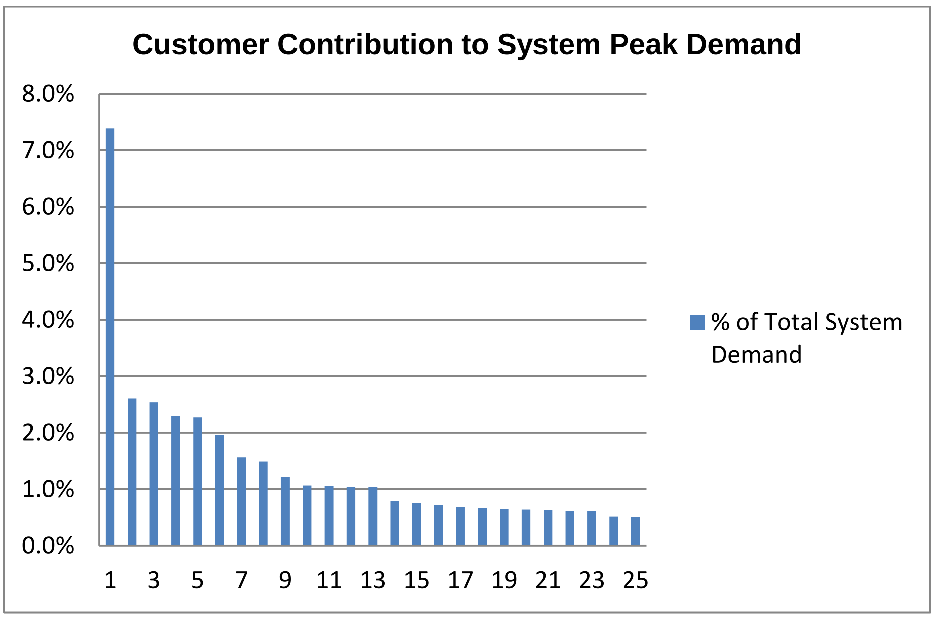
In addition to a history of long-term sustained growth, WNH's customer base is also relatively diverse. The largest sector that contributes to the peak load (kW) on the WNH distribution system is Government / Public Institutional comprised of 4 local municipal governments and 3 educational institutions. WNH's top 4 customers and 5 of the top 6 largest customers are in this category (**Table 1-5**). This sector contributes almost 17% to the system peak demand. The remaining five of WNH's top 10 customers only contribute approximately 8%. It can be seen in **Figure 1-5** that individual customer contributions to system demand diminish substantially beyond WNH's top 10 customers.

Table 1-5: WNH's 20 Largest Customers Peak kW

Customer #	Total KW Billed (Sept 2014)	Rank KW Billed (Sept)	% of Total System Demand	Institutional / Government
1	19580	1	7.4%	7.4%
2	6903	2	2.6%	2.6%
3	6726	3	2.5%	2.5%
4	6093	4	2.3%	2.3%
5	6027	5	2.3%	
6	5192	6	2.0%	2.0%
7	4139	7	1.6%	
8	3946	8	1.5%	
9	3211	9	1.2%	
10	2817	10	1.1%	
11	2813	11	1.1%	
12	2761	12	1.0%	
13	2749	13	1.0%	
14	2091	14	0.8%	
15	1994	15	0.8%	
16	1900	16	0.7%	
17	1810	17	0.7%	
18	1761	18	0.7%	
19	1732	19	0.7%	
20	1699	20	0.6%	
TOTAL (Top 20)	85,943		32.4%	16.8%

WNH believes that good planning and investment decisions require a thorough understanding of its customer base. The diverse nature of WNH's customer base indicates that the LDC is at very low risk of its largest customers discontinuing operations and stranding assets. The concentration of small and medium sized customers also provides stability in that no single customer in business sectors outside of Institutional / Government poses a material risk to revenue or stranded assets. Although having a diverse base of small and medium sized customers creates stability in asset use, it can also create challenges. For example, small and medium size customers are generally more costly to serve on a per MW basis as a result of the economies of scale in servicing costs for large customers that do not exist for small customers. WNH makes every effort to understand the benefits and challenges of its unique services area and integrate this information into its planning and investment decisions.

Figure 1-5: Customer Percentage Contribution to WNH System Peak Demand



WNH is connected to the Hydro One Networks Inc (HONI) Transmission System (HONI Tx) through 5 grid connected Dual Element Spot Network (DESN) Transformer Stations as illustrated in **Table 1-6**. Four (4) of these are owned and operated by WNH. One (1), Elmira Transformer Station (ELTS), is owned and operated by HONI and is embedded inside of WNH's service territory. WNH owns 2 feeders and portions of the third feeder emanating from the ELTS. Approximately 90% of the ELTS load is supplied to WNH customers with the remaining load supplied from HONI customers in nearby Wellington County.

Table 1-6: WNH Transmission Points of Supply

	Transformer Stations	Owned & Operated by	Supplied By	Station Location	HV (kV)	LV (kV)	Transformer Rating (MVA)
1	HMSTS “A”	WNH	HONI Tx	Waterloo	230	13.8	2 x 50
2	HMSTS “B”	WNH	HONI Tx	Waterloo	230	13.8	2 x 83
3	MTS #3	WNH	HONI Tx	Waterloo	230	27.6	2 x 67
4	ERTS	WNH	HONI Tx	Waterloo	115	13.8	2 x 50
5	ELTS	HONI	HONI Tx	Woolwich	115	27.6	2 x 42

WNH also receives electrical supply at < 50 kV (Dx) from 3 neighbouring LDCs; Hydro One Distribution (HONI Dx), Kitchener Wilmot Hydro (KWH) and Cambridge North Dumfries Hydro (CNDH); **Table 1-7**.

Table 1-7: WNH Points of Supply < 50 kV

	Feeders	Owned & Operated by	Supplied By	Station Location	HV (kV)	LV (kV)	Capacity at WNH Boundary (MVA)
1	73M7	HONI Tx	HONI Dx	Woolwich	N / A	44.0	8
2	9M4	KWH Dx	KWH Dx	Wellesley	N / A	27.6	6
3	21M25	CNDH Dx	CNDH Dx	Woolwich	N / A	27.6	8
4	33M1	WNH	HONI Tx	Woolwich	N / A	27.6	25
5	33M2	HONI Tx	HONI Tx	Woolwich	N / A	27.6	14
6	33M3	WNH	HONI Tx	Woolwich	N / A	27.6	25

In addition to the Transformer Stations noted in **Table 1-6**, WNH’s distribution network consists of the following Municipal and Distribution Stations operating at < 50 kV**; (Table 1-8). Figure 1-6** illustrates the locations of WNH stations.

Table 1-8: WNH Municipal and Distribution Stations

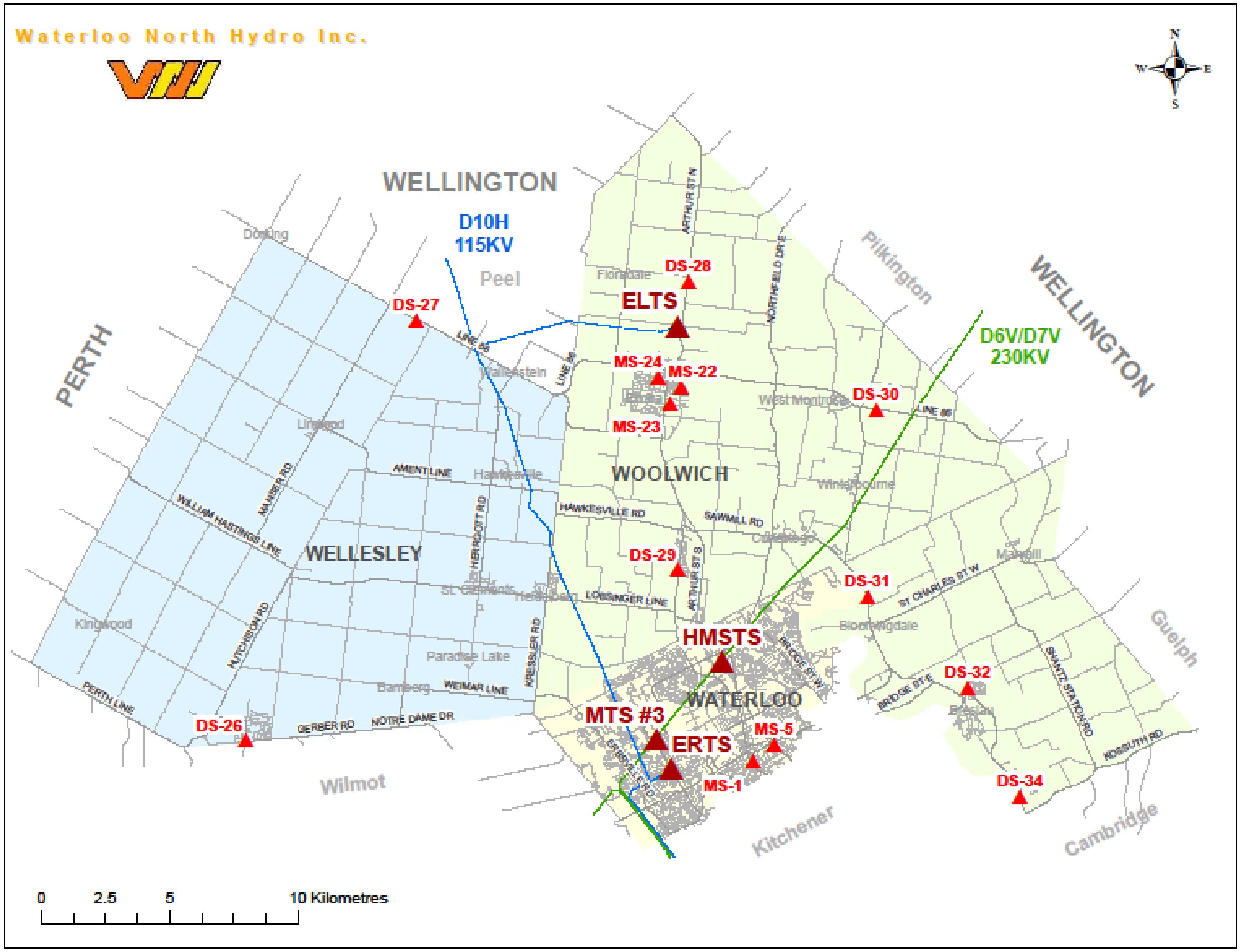
	MS/DS	Owned & Operated by	Supplied By	Location	HV (kV)	LV (kV)	Tx ID	Transformer Rating (MVA)
1	MS#1	WNH	WNH Dx	Waterloo	13.8	4.16	T1	3.0
					13.8	4.16	T2	3.0
2	MS#5	WNH	WNH Dx	Waterloo	13.8	4.16	T1	6.0
3	MS#22	WNH	WNH Dx	Elmira	27.6	4.16	T1	3.6
4	MS#23	WNH	WNH Dx	Elmira	27.6	4.16	T1	6.7
5	MS#24	WNH	WNH Dx	Elmira	27.6	4.16	T1	5.0
6	DS#26	WNH	WNH Dx	Wellesley	27.6	8.32	T1	5.0
7	DS#27	WNH	WNH Dx	Wallenstein	27.6	8.32	T1	3.6
8	DS#28	WNH	WNH Dx	Floradale	27.6	8.32	T1	5.0
9	DS#29	WNH	WNH Dx	St Jacobs	27.6	8.32	T1	3.6
					27.6	8.32	T2	3.6
10	DS#30	WNH	WNH Dx	Zubers Corners	44.0	8.32	T1	5.0
11	DS#31	WNH	WNH Dx	Bloomingdale	27.6	8.32	T1	5.0
12	DS#32	WNH	WNH Dx	Breslau	27.6	8.32	T1	5.0
13	DS#34	WNH	WNH Dx	South Woolwich	27.6	8.32	T1	2.0

In addition to the aforementioned transformer station assets, an overview of WNH's Distribution Assets is provided in **Table 1-9.** More detailed information regarding WNH's Distribution Assets are provided in **Section 3.2.**

Table 1-9: WNH Distribution Asset Summary

	Asset Group	Single Phase	Three Phase	Total
1	Overhead Primary Circuits (km)	385	704	1,089
2	Underground Primary Circuits (km)	477	40	517
3	Poles			21,229
4	Distribution Transformers	7,649	651	8,300
5	Revenue Meters	48528	6529	55,128
6	SCADA Integrated Reclosers (Lines)		36	36
7	SCADA Integrated Fault Indicators		12	12
8	Capacitor Banks		52	52
9	Load Break Switches		496	496
10	Electronic Reclosers Lines (no Scada)	7		7

Figure 1-6: Map of WNH Station Locations



WNH has a total of 371 Renewable Energy Generators (REG) totaling 8.2 MW connected to its distribution system.

Table 1-10: WNH Total Connected Renewable Generation

TOTAL CONNECTED RENEWABLE ENERGY GENERATORS (REG)					
Number of Connected REG > 10 kW	Connected Generation (kW) > 10 kW	Number of Connected REG <= 10 kW	Connected Generation (kW) <= 10 kW	Total Number of Connected REG	Total Connected Generation (kW)
19	5291	352	2877	371	8168

Figure 1-7 illustrates the growth in Renewable Generation since 2010.

Figure 1-7: Growth in Renewable Generation

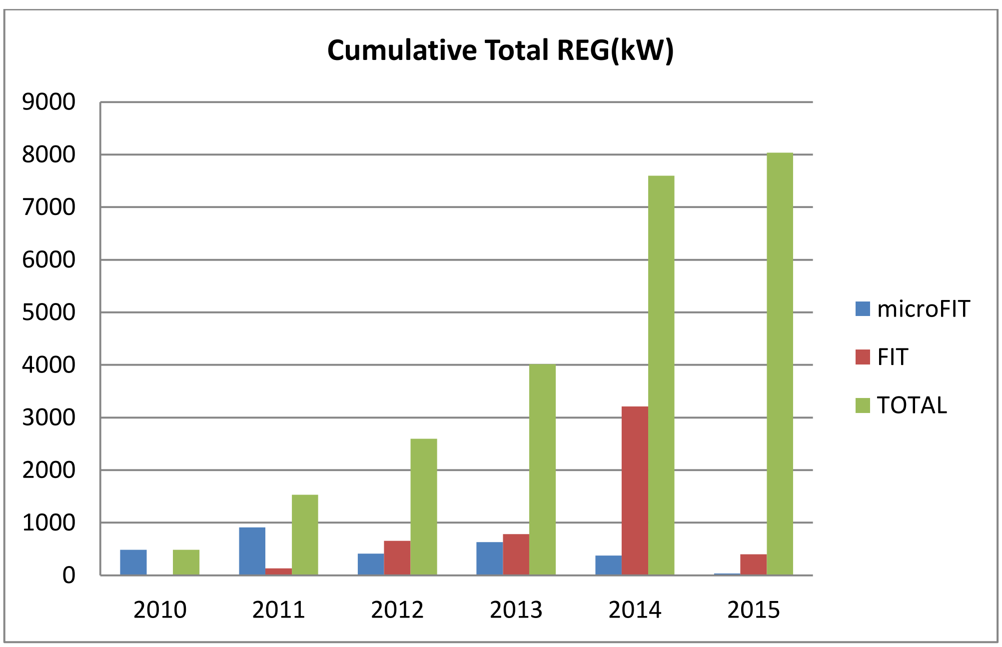


Table 1-11: Ten Largest Renewable Energy Generators

Rank	Project ID#	Fuel Type	Generator Size (kW)	Feeder #	Capacity Status
1	FIT-F0MH1Z7	biogas	2850	33M1	Connected
2	FIT-FDT42CX	solar PV	250	HS-10	Connected
3	FIT-F5F23J6	solar PV	250	HS-28	Connected
4	FIT-F4XKW01	solar PV	250	HS-13	Connected
5	FIT-FE6YSUK	solar PV	250	HS-23	Connected
6	FIT-FMK5ZSR	solar PV	225	3F-61	Connected
7	FIT-F8D899K	solar PV	200	HS-10	Connected
8	FIT-GMK75B8	solar PV	200	HS-28	Connected
9	FIT-GTISXAP	solar PV	200	HS-21	Connected
10	FIT-FNF9BFF	solar PV	135	33M1	Connected

Table 1-12: Renewable Energy Generators by Fuel Type

Fuel Type	# FIT Generators	Connected kW	%
Biogas	1	2850	54%
Solar	16	2336	44%
Wind	2	105	2%
Total	19	5291	100%

Please refer to WNH’s Renewable Energy Generation (REG) Investments Plan (**Appendix A**) regarding the readiness of WNH’s distribution system to connect Renewable Energy Generation. There are no constraints preventing the connection of additional distributed generation from renewable sources to WNH’s distribution system. There are no investment requirements for any expansion or reinforcement necessary to remove grid constraints to accommodate the connections of renewable energy generation under the province’s Feed-in-Tariff (FIT) and microFIT programs for the period 2016 to 2020.

1.3 Background & Drivers

A summary of WNH's proposed capital investments by OEB investment category for the forecast period 2016 - 2020 is provided in **Table 1-13**. The proposed levels of capital investment, for each category and in total, are relatively consistent and constant over the forecast year. This is reflective of the WNH's belief that over the forecast period, investment drivers will remain characteristically similar to 2016 and that there are no foreseen extraordinary expenditures.

Table 1-13: Summary of Capital Spending for Forecast Period

OEB Investment Category	Forecast Period					% of Annual Investment	Average Annual Investment
	2016	2017	2018	2019	2020	2016 - 2020	2016 - 2020
System Access	$ 6,622,858	$ 5,892,104	$ 6,020,046	$ 5,946,859	$ 6,085,796	33.1%	$ 6,113,533
System Renewal	$ 8,181,031	$ 8,545,000	$ 9,438,200	$ 8,800,764	$ 8,975,779	47.6%	$ 8,788,155
System Service	$ 2,405,950	$ 1,680,000	$ 1,725,200	$ 1,175,404	$ 1,175,612	8.8%	$ 1,632,433
General Plant	$ 1,869,078	$ 2,813,765	$ 1,661,176	$ 1,670,309	$ 1,649,525	10.5%	$ 1,932,771
Totals	$ 19,078,917	$ 18,930,869	$ 18,844,622	$ 17,593,336	$ 17,886,713	100.0%	$ 18,466,891

This DS Plan was informed by consultations with municipal planning and economic development staff, developers, builders and real estate brokers along with WNH's historical knowledge of private and public development within the service area. The plan was also informed by WNH's condition assessments and asset management plan, and by WNH's distribution system performance metrics.

The background and drivers for the proposed capital investments over the forecast period 2016 -2020 are discussed in the following sections under the following investment categories;

- System Access;
- System Renewal;
- System Service;
- General Plant.

Summary detail on WNH's proposed 2016 investments is also provided.

1.3.1 System Access

Excerpt from Ontario Energy Board's "Chapter 5 Consolidated Distribution System Plan Filing Requirements, March 28, 2013", 5.5.1 Table 1. - Investment Categories.

EXAMPLE DRIVERS	***EXAMPLE ACTIVITIES***
• **customer service requests** • **other 3rd party infrastructure development requirements** • **mandated service obligations (DSC; Cond. of Serv.; etc.)**	• **new customer connections** • **modifications to existing customer connections** • **expansions for customer connections or property development** • **system modifications for property or infrastructure** • **development (e.g. relocating pole lines for road widening)** • **metering** • **long term load transfer**

Table 1-14 provides an overview of WNH's System Access investments for 2016 and the primary drivers for each investment subgroup. There are 15 projects in the 2016 budget in this category above the materiality threshold of $175,000. More detailed information on these specific projects can be found in **Appendix G.**

Table 1-14: 2016 System Access Investment Summary

System Access	# Projects	Total $	% of 2016 Investment Category
Total	40	$ 6,622,858	100%
Materiality > $175,000	15	$ 5,738,833	87%
Material Project Drivers	**# Projects**	**Total $**	**% of 2016 Total Investments**
Customer Requests	3	$ 2,750,171	14.4%
Relocations (LRT)	7	$ 1,768,099	9.3%
Relocations (Other)	3	$ 703,694	3.7%
Meters	2	$ 516,869	2.7%
Total	15	$ 5,738,833	30.1%

Customer Requests

- New customer connections: WNH has seen steady growth in the number of customers served and peak demand during the past several years. WNH is forecasting the connection of 200 new subdivision lots for 2016 and each of the next 4 years. Also growth in new commercial, institutional and commercial customer connections is expected to remain steady.

- Modifications to existing customer connections are based on historical activity. WNH sees no pressures over the forecast period to substantially alter this level of activity.

Relocations

- The Region is constructing a Light Rail Transit (LRT) System. This is a multiyear project and represents the largest portion of relocation costs.
- Other relocations represent municipal requests for various road widening projects throughout the service area.

Metering

- WNH has deployed a Sensus Smart Meter Infrastructure that serves all residential customers and general service customers < 50 kW. All new residential and commercial customers receive a smart meter as part of their connection.
- WNH has also deployed interval metering for all general service and large user customers > 200 kW. WNH is currently working to convert the population of general service customers not covered by Smart or Interval metering over the next five years. The change-over of revenue meters to smart meters for general service customers will improve operating efficiency, permit control of peak demand and enable hourly pricing for customers as the transition is completed. The conversion period is aligned with the Ontario Energy Board’s amendments as set out in EB-2013-0311.

1.3.2 System Renewal

Excerpt from Ontario Energy Board's "Chapter 5 Consolidated Distribution System Plan Filing Requirements, March 28, 2013", 5.5.1 Table 1. - Investment Categories.

EXAMPLE DRIVERS	***EXAMPLE ACTIVITIES***
• **assets/asset systems at end of service life due to:** • **failure** • **failure risk** • **substandard performance** • **high performance risk** • **functional obsolescence**	• **programs to refurbish/replace assets or asset systems;** • **e.g.: batteries; cable (by type); cable splices; civil works; conductor; elbows & inserts; insulators; poles (by type); physical plant; relays; switchgear; transformers (by type); other equipment (by type)**

Table 1-15 provides an overview of WNH's System Renewal investments for 2016 and the primary drivers for each investment subgroup. There are 18 projects in the 2016 budget in this category above the materiality threshold of $175,000. More detailed information on these specific projects can be found in **Appendix G.**

Table 1-15: 2016 System Renewal Investment Summary

System Renewal	# Projects	Total $	% of 2016 Investment Category
Total	44	$ 8,181,031	100%
Materiality > $175,000	18	$ 5,812,055	71%
Material Project Drivers	**# Projects**	**Total $**	**% of 2016 Total Investments**
Overhead Lines	15	$ 4,809,327	25.2%
Underground Lines	2	$ 809,117	4.2%
Transformer Stations	1	$ 193,611	1.0%
Total	18	$ 5,812,055	30.5%

WNH's Renewal projects represent investments required due to assets reaching the end of their Typical Useful Life (TUL) or found to be in poor condition. WNH has established comprehensive data collection, asset inspection, testing and maintenance programs to provide for continuous condition assessment and remediation of distribution system assets. Specific outputs of the asset management process relating to TUL will be discussed further in **Section 4.**

WNH's projects have been identified by their age and condition as requiring replacement. As part of WNH's asset renewal plans, assets when replaced are also uprated to higher and more efficient voltages or capacities such as 13.8 kV and 27.6 kV. Generally the lines that are the oldest and in poorest condition also operate at the 4.16 kV and 8.32 kV voltage levels.

Uprating also helps facilitate the connection of larger load customers and Renewable Energy Generation. A significant percentage of WNH's 4.16 kV overhead distribution system and portions of the 8.32 kV system have been uprated as assets are renewed. With the renewal projects proposed, WNH anticipates that the 4.16 kV distribution system within the City of Waterloo will be completely retired by the end of 2016.

Overhead Lines

- The majority of this work involves the replacement of wood poles and conductors as identified by WNH's Asset Management Plan. Approximately 64% of 2016 renewal investments are in the rural area and 36% are in the urban area of WNH.

Underground Lines

- The majority of the proposed work involves the replacement of submersible transformers, cables and switching devices that are 36-37 years old and in poor condition. (TUL of 35 yrs.).
- The oldest sections of WNH's 15 kV direct buried underground distribution have been experiencing an increase in condition and reliability problems. Approximately 88% of these cables are direct buried and connected to submersible transformers. These assets are costly and time consuming to repair on a reactive basis.
- The submersible transformer vaults (TUL of 50 yrs.) have also been found to be physically deteriorating at an accelerated rate due to salt and corrosion. Many are located in sidewalks and boulevards where physical deterioration can present a public safety hazard.

Transformer Stations

- Grid connected Transformer Station circuit breakers and Transfer Trip equipment in service for 30 years are at their end of TUL and experiencing reliability issues that impact system safety and operation. WNH is proposing a combination of new and life extension refurbishment activities.

1.3.3 System Service

Excerpt from Ontario Energy Board's "Chapter 5 Consolidated Distribution System Plan Filing Requirements, March 28, 2013", 5.5.1 Table 1. - Investment Categories.

EXAMPLE DRIVERS	***EXAMPLE ACTIVITIES***
system operational objectives: • **safety** • **reliability** • **power quality** • **system efficiency** • **other performance/functionality**	• **protection & control upgrade; e.g. reclosers; tap changer** • **controls/relays; transfer trip** • **automation (new/upgrades) by device type/function** • **SCADA** • **distribution loss reduction**

Table 1-16 provides an overview of WNH's System Service investments for 2016 and the primary drivers for each investment subgroup. There are 3 projects in the 2016 budget under this category above the materiality threshold of $175,000. More detailed information on these specific projects can be found in **Appendix G**.

Table 1-16: 2016 System Service Investment Summary

System Service	# Projects	Total $	% of 2016 Investment Category
Total	11	$ 2,405,950	100%
Materiality > $175,000	3	$ 1,844,467	77%
Material Project Drivers	**# Projects**	**Total $**	**% of 2016 Total Investments**
Reliability – Load Transfer	2	$ 808,832	4.2%
Reliability - Distribution Automation	1	$ 1,035,635	5.4%
Total	3	$ 1,844,467	9.6%

WNH's System Service projects represent investments aimed at improving system operations, reliability and efficiencies through distribution automation, intelligent devices or equipment, all aimed at operational effectiveness and consistent service delivery.

Through the 2016 - 2020 forecast period, WNH is proposing to make Distribution Automation / Smart Grid investments, in part, to reduce customer restoration times during certain transmission, station and distribution loss-of-supply contingencies.

There are also abnormal system operating contingencies under which WNH customers will benefit from these investments. These include temporary constraints due to planned or forced equipment outage on the distribution system.

Reliability

- These investments provide additional overhead circuits and SCADA controlled electronic reclosers at strategic locations in WNH's distribution system to improve load transfer capabilities between transformer stations. These improvements will also reduce customer restoration times during certain transmission, station and distribution loss of supply contingencies, ease congestion points on the distribution system during abnormal configurations and increase the opportunities to remove equipment from service for maintenance.
- Also included is an investment in stations to improve WNH's ability to control moisture levels in large power transformer oil at HMSTS.

The remaining investments are in the area of SCADA & Communications work which involves integrating devices such as electronic reclosers and fault indicators into WNH's SCADA and Outage Management System. These improvements will reduce the time needed to restore power to customers during an unplanned outage.

1.3.4 General Plant

Excerpt from Ontario Energy Board's "Chapter 5 Consolidated Distribution System Plan Filing Requirements, March 28, 2013", 5.5.1 Table 1. - Investment Categories.

EXAMPLE DRIVERS	EXAMPLE ACTIVITIES
• system capital investment • support • system maintenance support • business operations efficiency • non-system physical plant	• land acquisition • structures & depreciable improvements • equipment and tools • supplies • finance/admin/billing software & systems • rolling stock • intangibles (e.g. land rights; capital contributions to other utilities)

Table 1-17 provides an overview of WNH's General Plant investments for 2016 and the primary drivers for each investment subgroup. There are 4 projects in the 2016 budget in this category above the materiality threshold of $175.000. More detailed information on these specific projects can be found in **Appendix G**.

The capital investments under this category include investments into motor vehicle fleet, equipment and tools, buildings and facilities, computer hardware and software systems. These investments are driven by the objectives to improve employee safety, worker productivity and operating efficiency.

Table 1-17: 2016 General Plant Investment Summary

General Plant	# Projects	Total	% of Investment Category
Total	34	$ 1,869,078	100%
Materiality > $175,000	4	$ 1,260,810	67%
Primary Driver	**# Projects**	**Total**	**% of 2016 Investments**
Computer Software	2	$ 617,907	3.2%
Fleet / Rolling Stock	1	$ 454,513	2.4%
Tools & Equipment	1	$ 188,390	1.0%
Total	4	$ 1,260,810	6.5%

Computer Software

- Replacement of Customer Information System (CIS) Software. Current CIS software was purchased in 2000 and uses outdated technology that has significant restrictions and is costly to maintain.
- Purchase of Asset Management Software and integration into WNH's information systems. This investment supports WNH efforts in operational efficiencies and improved asset investment planning.
- More detail is provided in **Section 4**.

Fleet / Rolling Stock

- WNH's Fleet renewal plan is based on the age and condition of these assets. WNH also takes a levelized approach to targeted replacements. The material 2016 fleet investment is for a Radial Boom Derick; a large vehicle designed to install utility poles by using augers to drill holes and a hydraulic boom to set the poles. The unit (R65) is 20 years old and in poor condition.

Tools & Equipment

- Tools, equipment and furniture purchases are numerous and across all departments of the company. No single purchase rises to the level of materiality.

The remainder of the investments in General Plant involve various purchases in laptops, workstations, servers; and land rights. None of these purchases rises to the level of materiality.

1.4 Objectives & Scope of Work

The key objectives of WNH's proposed 2016 - 2020 capital investment program are as follows:

- The largest portion of the proposed investment plan centres on the Renewal of assets. Referring to WNH's strategic imperatives in **Section 1.2**, supply & reliability, cost reduction and aesthetics are all supported by these investments. A renewed distribution system also is better able to support the connection of Renewable Energy Generation.

- WNH's second largest investment is in the area of System Access. As previously stated WNH serves a robust and growing community. Expansions for customer connections and municipal relocations are investments that form part of WNH's statutory obligation to serve and are aligned with WNH's strategic imperatives for supply and customer service.

- WNH's System Service investments are targeted to enhance the operation of the distribution system and support WNH's strategic imperative of reliability.

- WNH's general plant investments are focused on improving worker productivity and enhancing operating efficiency. Newer information technologies and equipment support WNH's strategic imperatives of productivity and cost reduction, organizational effectiveness and customer service.

In summary, WNH believes the objective and scope of this 2016 – 2020 investment plan speaks directly to WNH's strategic imperatives and also to the OEB's DS Plan evaluation criteria of efficiency, customer value and reliability.

2.0 Distribution System Plan (5.2)

2.1 Distribution System Plan Overview (5.2.1)

2.1.1 (5.2.1a) key elements of the DS Plan that affect its rates proposal

- **especially prospective business conditions driving the size and mix of capital investments needed to achieve planning objectives:**

A summary of WNH's capital investments proposed for the forecast period 2016 - 2020 is provided in **Table 2-1.** These amounts are indicative of gross spending, and do not account for capital contributions. Details of this will be further discussed in **Section 4. Table 2-AE** in **Appendix E** provides actual year-over-year spending by investment category from 2011 – 2014 and forecast spending for 2015 – 2020. Because of the timing of this filing, there will be no material 2015 actual spending information available. This is WNH's first DS Plan and as such no DS Plan spending is being provided for the historical period 2011 - 2015.

Each year WNH maintains, refurbishes and replaces assets as they age, deteriorate or become obsolete and cannot perform their intended functions in a safe and reliable manner. WNH's proposed investments are aligned with its strategic imperatives and also to the OEB's DS Plan evaluation criteria of efficiency, customer value and reliability. The scope and timing of the investments in each category has been determined by taking into account information available at the time of preparation of the DS Plan.

Table 2-1: Summary of Capital Spending for Forecast Period

OEB Investment Category	Forecast Period					Average Annual Investment	% of Annual Investment
	2016	2017	2018	2019	2020	2016 - 2020	2016 - 2020
System Access	$ 6,622,858	$ 5,892,104	$ 6,020,046	$ 5,946,859	$ 6,085,796	$ 6,113,533	33.1%
System Renewal	$ 8,181,031	$ 8,545,000	$ 9,438,200	$ 8,800,764	$ 8,975,779	$ 8,788,155	47.6%
System Service	$ 2,405,950	$ 1,680,000	$ 1,725,200	$ 1,175,404	$ 1,175,612	$ 1,632,433	8.8%
General Plant	$ 1,869,078	$ 2,813,765	$ 1,661,176	$ 1,670,309	$ 1,649,525	$ 1,932,771	10.5%
Totals	$ 19,078,917	$ 18,930,869	$ 18,844,622	$ 17,593,336	$ 17,886,713	$ 18,466,891	100.0%

Table 2-2: 2016 Capital Spending by Investment Category

OEB Investment Category	Investment		% of Annual Investment	Average Annual Investment		% of Annual Investment
	2016		2016	2016 - 2020		2016 - 2020
System Access	$	6,622,858	34.7%	$	6,113,533	33.1%
System Renewal	$	8,181,031	42.9%	$	8,788,155	47.6%
System Service	$	2,405,950	12.6%	$	1,632,433	8.8%
General Plant	$	1,869,078	9.8%	$	1,932,771	10.5%
Totals	$	19,078,917	100.0%	$	18,466,891	100.0%

From **Table 2-1** it can be seen that the key elements of WNH investment plans are in the area of System Renewal and System Access. Over the entire forecast period these two categories account for almost 81% of total planned investments.

The following section provides key elements of the DS Plan. More detailed information is provided in **Section 4.**

System Renewal

System Renewal investments involve replacing and/or refurbishing system assets to extend the original service life of the assets and thereby maintain the ability of the distributor's distribution system to provide customers with electricity services. WNH incorporates historic performance, experience from other utilities, Kinectrics Inc. Report No: K-418033-RA-001-R000, July 8, 2010, "Asset Depreciation Study for the Ontario Energy Board", and WNH's own analytics to determine Typical Useful Life (TUL) of its assets. These investments are instrumental in reducing the risk of critical asset failures, maintaining reliability and safety performance measures and keeping expensive reactive maintenance activities to a minimum.

As can be seen in **Table 2-1**, System Renewal investments represent the largest component (47.6%) of WNH's proposed investment plan from 2016 – 2020. In 2016 WNH proposes approximately $8.18 million in System Renewal investments. This is typical of the level of investment proposed in the 2017 – 2020 forecast period.

WNH’s proposed System Renewal investments are centered on 3 major areas;

1. Overhead Lines
2. Underground Lines
3. Transformer Stations

Overhead Lines represent WNH’s largest asset class. **Table 1-15** illustrates WNH’s proposal for material investments of $4.8 million over 15 various projects in 2016. This represents approximately 59% of all 2016 System Renewal investments and 25% of WNH’s total 2016 proposed investment plan. This is typical of the level of investment proposed in the 2017 – 2020 forecast period.

WNH has one of the larger service areas in the province at 672 sq. km. of which 90% is rural with a very low customer density. This translates to a significantly higher number of overhead line assets per customer served than other LDC’s in WNH’s cohort.

Table 2-3: WNH Customer Density

MUNICIPALITY	CUSTOMERS	%	CUSTOMER DENSITY (per sq. km)
City of Waterloo	42,560	77%	655
Township of Woolwich	9,579	17%	29
Township of Wellesley	3,043	6%	11
Total	55,182	100%	82

WNH continually monitors the age and condition of its assets. Of WNH’s approximately 22,200 poles, 97% are wood and their age and condition are the main drivers in overhead line renewal projects. WNH’s own analytics supported by extensive inspection and testing programs along with Health Indices developed with the assistance of Kinectrics support an effective renewal program and this DS Plan.

Underground Lines represent WNH’s second largest asset class. **Table 1-15** illustrates WNH’s proposal to make material investments $809,000 in 2 projects in 2016. This represents approximately 10% of all 2016 System Renewal investments and 4% of WNH’s proposed 2016 total investment plan. This is typical of the level of investment proposed in the 2017 – 2020 forecast period.

WNH has approximately 517 km of underground lines categorized into 3 distinct groups. The vast majority of WNH's underground cable in in residential subdivisions.

Group 1 - 5 kV direct buried cables. This cable type was installed from approximately 1965 to 1978.

Group 2 - 15 kV direct buried cables. This cable type was installed from approximately 1978 to 1988.

Group 3 - 15 kV ducted cables. This cable type was installed from approximately 1988 to present.

WNH's historic renewal investments in underground lines have been focused for the most part on its oldest and poorest performing assets (Group 1); 4.16 kV cable, transformers and vaults. Direct buried cables are uprated to 13.8 kV or 27.6 kV and placed in conduit. Submersible transformers and vaults are replaced with padmount equipment. WNH's 4.16 kV distribution is expected to be fully retired by 2018.

WNH also has been experiencing an increase in condition and reliability problems with the oldest sections of WNH's 15 kV direct buried underground distribution (Group 2). Currently at 37 years of age, the oldest assets are past their TUL. Proposed investments in this group of assets is also included in WNH's DS Plan.

Stations – In 2016 WNH proposes to make a material investment of $194,000 in 1 project. This represents approximately 2.4% of all 2016 Renewal investments and 1% of WNH's total 2016 investment plan **(Table 1-15).**

Since 1963 WNH has owned and operated its own grid connected transformer stations (TSs) operating at 115 kV and 230 kV. Currently WNH has 4 DESN stations as part of its distribution assets **(Table 1-6).** Selected assets, namely circuit breakers, switchgear, and bus duct at HMSTS B which became operational in the mid 1980's are undergoing renewal to maintain reliability and improve worker safety. These investments are forecast throughout 2016 – 2020. There are no Renewal investments proposed for WNH's other 3 TS's in the DS Plan.

WNH's Municipal and Distribution Stations (MS/DS's) are listed in **Table 1-7** and currently there are five 4.16 kV MS's remaining in service; All 5 are scheduled to be retired by 2018 in coordination with the rebuilding of the last of WNH's 4.16 kV distribution. Major components of these stations will range in age from 41 to 69 years at retirement. There are no Renewal investments planned for the 4.16 kV stations.

Of the remaining eight 8.32 kV DS's, WNH is planning to retire 1 DS in 2016 and 1 DS in 2018. Major components of these stations will be 63 and 51 years of age at retirement and past their TUL. WNH's proposed renewal investments in overhead lines and the resulting uprating from 8.32 kV to 27.6 kV will complete the work necessary to retire these stations. There are no Renewal investments planned for these stations themselves.

The remaining six 8.32 kV DSs will need to remain in service over the forecast period and well beyond due to the very large 8.32 kV distribution system remaining in the rural area. These stations are mature; however, WNH has made investments to extend the life of these stations past their TUL. Investments include protections, communications and SCADA control at these stations to maintain safety, reliability and to facilitate the connection of load and Renewable Energy Generation customers. Various proactive capital replacements are proposed for 2016 – 2020 to maintain the safety and reliability of these stations. In 2018 WNH proposes a material investment to replace its oldest, in service, DS transformer (1947).

WNH also owns a mobile unit substation (MUS) that can be moved into place quickly and capable of providing load at a DS in case of a power transformer failure. This would only be considered a temporary measure as the MUS is also needed to act as a back-up supply during planned maintenance work.

System Access

System Access investments are modifications (including asset relocation) to a distributor's distribution system. A distributor is obligated to provide a customer (including a generator customer) or group of customers with access to electricity services via the distribution system.

As can be seen in **Table 2-1**, System Access investments represent the second largest component (33%) of WNH's proposed investment plan from 2016 – 2020. In 2016 WNH proposes approximately $6.62 million in System Access investments. This is also typical of the level of investment proposed in the 2017 – 2020 forecast period.

WNH's proposed System Access investments are centered on 3 major areas;

1. Customer Requests
2. Roadway Relocations
3. Third Party Infrastructure requirements

Customer Requests represent WNH's largest proposed investment in this asset category. In 2016 WNH proposes to make material investments of $2.8 million over 3 various projects. This represents approximately 42% of all 2016 System Access investments and 14% of WNH's total 2016 investment plan **(Table 1-14).** This is also typical of the level of investment proposed in the 2017 – 2020 forecast period.

WNH operates in a robust localized economy supported by over 500 technology companies and 3 major educational institutions. WNH's summer peak demand as shown in **Figure 1-4** has grown steadily over the last 20 years at over 2 times the provincial average. Waterloo Region continues to be one of the fastest growing communities in the province. With the LRT and Metrolinx Rail transit projects in progress or planned, this rate of growth is expected to continue. WNH is aided in the development of its investment plans in response these mandated services through continuous consultations with the municipal planning staff, developers, builders, real estate agencies, and major customers to determine the level and timing of activities.

Regulatory obligations in the areas of metering are also included in this DS Plan. The change-over of revenue meters to smart meters for general service customers will improve WNH's operating efficiency, better inform customers to support peak demand reduction or off peak shifting, and enable hourly pricing for customers. The conversion period is aligned with the Ontario Energy Board's amendments as set out in EB-2013-0311.

Roadway relocations represent WNH's second largest proposed investment in this asset category. In 2016 WNH proposes to make material investments of $2.5 million over 10 various projects. This represents approximately 37% of all 2016 System Access investments and 13% of WNH's total 2016 investment plan **(Table 1-14).** This is NOT typical of the level of investment proposed in the 2017 – 2020 forecast period due mostly to the LRT project. In this multi-year project (2014 – 2016)

WNH is expecting to invest approximately $6.3 million in relocation work and expecting to recover approximately 60% from the Region of Waterloo.

Roadway relocations are one of the most difficult activities to forecast. Despite best efforts at consulting with roadway authorities, the scope, timing, and more importantly the financial impact of relocation projects on WNH's DS Plan remains uncertain until shortly before construction. **Table 1-14** illustrates WNH's proposal in 2016 for material investments of $1.8 million over 7 various projects for the LRT project and $703,000 over 3 projects for other municipal relocations. Investments in the LRT, which is a one-off project, is expected to be complete by the end of 2016. The investments in other municipal relocations are more typical of that proposed during the forecast period.

Meters represent investments to connect new customers and to replace failed meters. Included in the proposed work plan are investments to comply with amendments to the Distribution System Code EB-2013-0311 (Interval Meters). In 2016 WNH proposes to make material investments of $517,000. This represents approximately 8% of all 2016 System Access investments and 3% of WNH's total 2016 investment plan **(Table 1-14).** This is typical of the level of investment proposed in the 2017 – 2020 forecast period.

General Plant

General plant investments are modifications, replacements or additions to a distributor's assets that are not part of its distribution system; including land and buildings; tools and equipment; rolling stock and electronic devices and software used to support day-to-day business and operations activities. Investments into General Plant are aimed at improving employee safety and worker productivity by providing safe work environment and modern tools and equipment, as well improvement in customers services through increased productivity and efficiency.

As can be seen in **Table 2-1**, General Plant investments represent the third largest component (11%) of WNH's proposed investment plan from 2016 – 2020. In 2016 WNH proposes approximately $1.87 million in General Plant investments. The magnitude of individual General Plant investments varies from year to year, however WNH attempts to pace many asset replacements such as vehicles and computer hardware. This level of investment is typical for the 2018 – 2020 forecast period. The forecast for 2017 is atypical; there are additional material investments in 2017 in the area of Service Centre and Administration building improvements, system software and operations furniture & equipment.

WNH's capital investments in this category are many and various. Drivers are divided into a number of areas including fleet / rolling stock; buildings and facilities, information technology hardware and software; and intangibles.

Computer Software represents WNH's largest proposed investment in this asset category. **Table 1-17** illustrates WNH's proposal to make material investments of $617,000 in 2 various projects. This represents approximately 33% of all 2016 General Plant investments and 3% of WNH's 2016 proposed investment plan. These investments in Asset Management software and Customer Information System (CIS) software are one-off projects not expected to reoccur during the forecast period.

Fleet / Rolling Stock represents WNH's second largest proposed investment in this asset category in 2016. **Table 1-17** illustrates WNH's proposal to make a material investment of $455,000 in one large vehicle in 2016. This represents approximately 24% of all 2016 General Plant investments and 2% of WNH's 2016 proposed investment plan. This is typical of the level of investment proposed in Fleet / Rolling Stock from 2017 – 2020.

Tools & Equipment represents WNH's third largest proposed investment in this asset category in 2016. **Table 1-17** illustrates WNH's proposal to invest $188,000 over 9 various projects in 2016. This represents approximately 10% of all 2016 General Plant investments and 1.0% of WNH's 2016 proposed investment plan. This is typical of the level of investment proposed in Tools & Equipment from 2017 – 2020.

The remaining investments, all well below the level of materiality, involve minor investments in computer hardware and intangibles.

System Service

System Service investments are modifications made to ensure the distribution system continues to meet distributor operational objectives while addressing anticipated future customer electricity requirements. These investments are instrumental in maintaining reliability and safety performance measures and improving the overall efficiency of the distribution system.

As can be seen in **Table 2-1**, System Service investments represent the fourth largest (8.8%) and last component of WNH's proposed investment plan from 2016 – 2020. In 2016 WNH proposes approximately $2.4 million in System Access investments. System Access Investments proposed in 2016 are higher by approximately $800,000 over those proposed in 2017 – 2020. This is mainly due to 2 large reliability centred projects coming into service in 2016.

WNH's proposed System Service investments are centered on Reliability in 2 major areas;

1. Capacity Transfer
2. Distribution Automation

<u>Capacity Transfer</u> investments include line construction to improve distribution system interconnectivity and load transfer. When combined with distribution automation investments, improved utilization of existing station capacity, reliability and power restoration result. **Table 1-16** illustrates WNH's proposal to make material investments of $809,000 in 2 projects in 2016. This represents approximately 34% of all 2016 System Service investments and 4% of WNH's 2016 proposed investment plan.

<u>Distribution Automation</u> investments include electronic reclosers, fault indicators, protection systems, and communications. **Table 1-16** illustrates WNH's proposal to make a material investment of $1.0 million in 2016. This represents approximately 43% of all 2016 System Service investments and 5% of WNH's 2016 proposed investment plan.

The remaining investments, all well below the level of materiality, involve minor betterments in transformer station equipment and supply point wholesale metering.

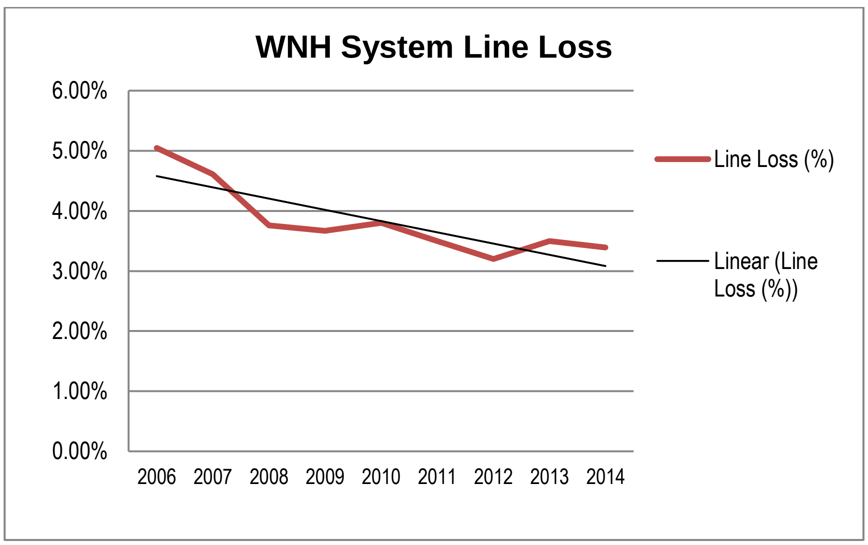
2.1.2 (5.2.1b) sources of cost savings

- **expected to be achieved over the forecast period through good planning and DS Plan execution:**

The sources of cost savings expected to be achieved include the following:

- Continued asset renewal of the 4.16 kV lines in the City of Waterloo and Town of Elmira; and 8.32 kV lines in the rural area, along with the retirement of their associated transformer stations will maintain the reliability of supply to WNH customers and contribute to continued lowering of line losses. WNH has reduced line losses from 5.0% in 2006 to 3.4% in 2014 through these and other initiatives. This represents annual savings that flow directly to the benefit of the ratepayers in the lower cost of power. Currently savings are estimated to be $2.4 million annually.

Figure 2-1: WNH System Line Losses



- The retirement of WNH's last 5 operating 4.16 kV stations (MS1, 5, 22, 23, 24) and one 8.32 kV station between 2016 and 2020 will eliminate their associated O&M cost. This will also avoid the need for further capital renewal investments for buildings & equipment as these stations are past their TUL. Total annual savings in Stations O&M are estimated to average $100,000 annually.

- The installation of distribution automation devices such as electronic line reclosers and fault sensors is anticipated to reduce man hours and truck rolls required to identify and locate the causes of power outages and will reduce customer restoration times due to the capability to operate more devices from the control room. Total annual savings in O&M by the end of 2016 are expected to average $12,000 annually. This will increase over the forecast period with investments proposed in this DS Plan, to approximately $40,000 annually.

- In addition to WNH's direct savings in O&M, shorter restoration times reduce the customer's lost revenue associated with a loss of power event. WNH has yet to quantify these savings and intends to study how its customers quantitatively value loss of power events.

- The change-over of revenue meters to smart meters for general service customers will inform customers to allow peak demand reduction or shifting, both of which can improve the overall efficiency of the distribution system and reduce stress on key components of the distribution and transmission system during times of peak load. Savings are dependent upon the customers' future response to the enhanced usage information. WNH is not yet been able to quantify these savings.

- Implementation of asset management software along with the investments already made in GIS, ODS, and Cognos will allow WNH to have stronger and more efficient practices in asset health determination, asset prioritization and investment planning. Currently this is still a labour intensive process for WNH. Total annual savings in O&M by the end of 2016 are expected to average $90,000 annually.

- The uprating to higher operating voltages that comes with SR investments in overhead and underground lines reduces the requirement for 4.16 kV and 8.32 kV inventory materials. Total estimated savings in inventory costs of $112,000 are expected as the 4.16 kV distribution system is retired by 2018.

- The renewal of assets that are past their useful life will result in less reactive based maintenance and lower the risk of failure and safety issues. WNH has not quantified these expected savings.

2.1.3 (5.2.1c) period covered by the DS Plan (historical and forecast):

This DS Plan covers the historical period of 2011 to 2015. The 2015 year includes 12 months of forecast spending. Due to the timing of the filing, no actual spending is being reported. The DS Plan forecast period includes 2016 to 2020.

2.1.4 (5.2.1d) vintage of information on investment drivers used to justify investments identified in the application:

All data is current to December 31, 2014.

2.1.5 (5.2.1e) where applicable, indication of important changes to the distributor's asset management processes

- **(e.g. enhanced asset data quality or scope; improved analytic tools, process refinements; etc.) since the last DS Plan filing:**

This is WNH's first DS Plan under the Ontario Energy Board's "Chapter 5 Consolidated Distribution System Plan Filing Requirements, March 28, 2013".

WNH has long established and comprehensive inspection and maintenance programs to provide for continuous condition assessment and remediation, respectively, of assets within its distribution system. In addition to satisfying the reporting requirements of the Ontario Energy Board's (OEB) Distribution System Code (DSC) and the Independent Electricity System Operator (IESO), these programs provide for continuous system improvement and performance reliability, ensuring long term capacity, supply availability/reliability to meet customer demands. These programs further contribute to the effective and successful management of the distribution system and its assets.

Senior Engineering and Operations management have the responsibility for Asset Management at WNH. All have formal training and extensive experience in distribution systems and LDCs. It is this knowledge and experience that has led staff and management to effectively manage the WNH distribution system, facilitated by the following:

- An organized program for the inspection and condition-assessment of the overhead distribution system, underground distribution system, transformer stations and substations;
- An adaptive maintenance program based on inspection findings and keeping with industry best practices;
- Generally accurate and current asset and inspection records maintained within the Geographic Information System (GIS) and other electronic databases;
- Development of operations budgets, maintenance budgets and capital investment plans reflecting the capacity, condition and growth of the distribution system, allowing for enhanced reliability and cost effectiveness.

Since its last rebasing application, WNH has embarked upon a program to formalize and improve its Asset Management process. Improvements include:

- Improvement in data collection and data warehousing tools needed to enhance the quality of its asset data and analytical tools. WNH is proposing to introduce an Asset Management software system in 2016;
- Engaging Kinectrics to improve WNH's asset condition assessment of overhead wood poles;
- WNH will be seeking to improve its current qualitative risk assessment process for a more quantitative valuation of the risk of assets' failure; and
- Seeking to enhance its current heuristic approach to cost minimization with an algorithmic based tool set.

2.1.6 (5.2.1f) aspects of the DS Plan

- **that relate to or are contingent upon the outcome of ongoing activities or future events, the nature of the activity (e.g. Regional planning process) or event (Board decision, LTLT) and the expected dates by which such outcomes are expected or will be known:**

In order of potential impact the following activities have been identified:

KWCG IRRP

Since 2010, WNH has been working with Kitchener Wilmot Hydro Inc (KWHI), Cambridge and North Dumfries Hydro Inc (CNDHI), Guelph Hydro Electric System Inc (GHESI), HONI Distribution (HONI Dx), HONI Transmission, (HONI Tx) the Ontario Power Authority (OPA) and the Independent Electricity System Operator (IESO) on the Kitchener-Waterloo-Cambridge-Guelph Integrated (KWCG) Integrated Regional Resources Plan (IRRP).

The planning activity for the KWCG Region was already underway prior to the new regional planning process and was deemed to be in the Integrated Regional Resource Planning ("IRRP") phase of the process. This IRRP phase, led by the IESO (formerly OPA), is expected to be completed by Q2 2015.

Two transmission projects have been identified to address the near-term and medium-term needs in this Region: the first being the Guelph Area Transmission Reinforcement ("GATR") project, and the second being the installation of switches on circuits M20D and M21D. Execution of the first project is already underway while the second is in the project development phase.

The following stations that serve WNH customers are affected by the GATR project: WNH MTS #3, Scheifele MTS, and HONI Fergus TS. Each of these stations is supplied by 230 kV 2-circuit D6V/D7V line from HONI Detweiler TS and HONI Orangeville TS. In the event of the loss of both circuits customer loads supplied from these stations will be interrupted.

One component of the GATR project that directly impacts WNH involves the installation of two load interrupter switches on 230 kV circuits D6V/D7V at Guelph North Junction. The switches will minimize the impact of interruptions to Waterloo North Hydro customers in the event of the loss of both circuits D6V and D7V.

The investments associated with the GATR project are proposed as a network pool cost, and there is no cost implication for WNH.

WNH anticipates that there will be no material impact arising from any recommendations that may flow out of the IRRP. See IESO/OPA and HONI letters of comment **(Appendix A & B)**.

Region of Waterloo - Light Rail Transit System

WNH has statutory obligations to relocate portions of its electrical distribution system as part of the LRT multiyear project. The work is in progress and scheduled to be completed in 2016. The value of WNH's work has been estimated at approximately $6.3 million; approximately 60% of which WNH will recover from the Region, leaving approximately $2.5 million in direct costs to WNH. It is important to note that WNH has been required to produce cost estimates and start engineering with the LRT plans only 10 - 30% complete. This presents the risk of having to perform rework in a climate of uncertainty.

These costs have been built into this DS Plan. WNH works closely with all parties however this is a complex multi-party project requiring a high degree of planning and coordination. WNH's risk exposure is to the extent that project design changes, delays in schedule and locational conflicts can increase WNH's relocation costs. WNH estimates this exposure at approximately 10% - 15% of its total exposure or approximately $375 – $435,000. The extent of this risk may not be fully quantifiable until sometime in late 2016.

To help mitigate the risk of cost increases, WNH has an agreement with the Region that all rework stemming from lack of detail and design changes will be at 100% their cost. WNH has also secured additional contracted services in order to meet reasonable changes in project scope and schedule.

System Access Requests

Aspects of the DS Plan are also contingent upon the actual number of connection and expansion requests. WNH takes extensive measures to consult with stakeholders **(Section 2.2.1)** and utilize historical data to estimate future System Access requests. These estimates however, are subject to strong and varying influences not the least of which are unforeseen government, regulatory and economic changes. WNH's historical System Access activity is illustrative of these influences.

To mitigate the risk of variable System Access requests, WNH attempts to pace Condition and Performance investments with Mandated and Customer-Driven investments in a strategy to develop executable and sustainable investment plans.

2.2 Coordinated Planning with Third Parties (5.2.2)

2.2.1 (5.2.2a) to demonstrate that a distributor has met the Board's expectations

- **in relation to coordinating infrastructure planning with customers, the transmitter, other distributors and/or OPA or other third parties, a distributor must provide:**
- **the purpose of the consultation;**
- **whether the distributor initiated the consultation or was invited to participate;**
- **the other participants in the consultation process;**
- **the nature and prospective timing of the final deliverables, that are expected to result from or otherwise be informed by the consultation; and**
- **an indication of whether the consultation has or is expected to affect this DS Plan as filed and if so, a brief explanation as to how.**

Stakeholders Involved

WNH operates in a robust localized economy that has seen growth above the provincial average steadily over the last 20 years. Providing distribution services in a growing community requires constant consultation with a number of stakeholders as part of our normal planning and business processes. Input from the following stakeholders has been taken into consideration by WNH in the development of this DS Plan;

- Customers;
- Municipal Governments;
- Development Community;
- Independent Electricity System Operator(formerly the OPA);
- Transmitter (HONI);
- Independent Electricity System Operator (IESO); and
- Embedded Distributors.

The following section addresses the specific questions under the Filing Requirements for each of the specific stakeholders identified above.

2.2.1.1 Customer Engagement

a) UtilityPULSE Electric Utility Customer Satisfaction Survey

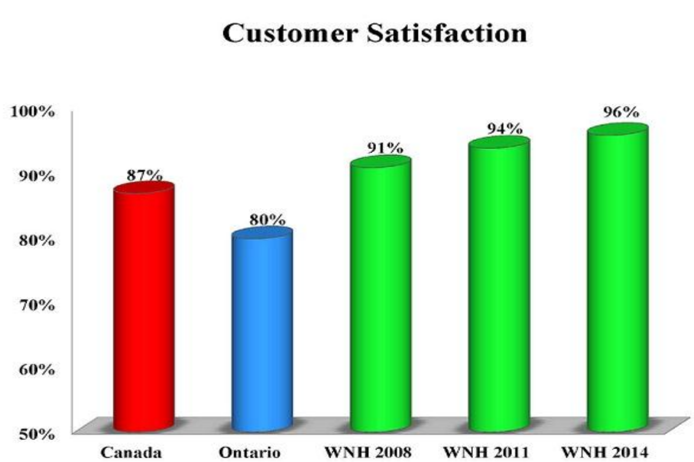
Dating back to 2008, WNH has engaged UtilityPULSE, Simul Corporation to perform Electric Utility Customer Satisfaction Surveys (EUCSS) to obtain actionable and measurable feedback from WNH customers. The surveys which in the past were performed every 3 years, and now every 2 years going forward are part of WNH's overall commitment to continuous improvement. The feedback is considered in WNH's ongoing planning process and the development of this DS Plan. The primary objective of the EUCSS is to provide information that will support decisions about improving customer care at every level of the utility. These reports also contain data comparisons to: an Ontario-wide LDC benchmark, National LDC benchmark and a Previous year's ratings (where available) in order to benchmark WNH's progress.

The report finds that WNH consistently meets or exceeds industry comparators from Ontario and across Canada. A copy of the full survey results (2014) is provided in Exhibit 1 of this Application. Highlights from the report are as follows;

<u>*Overall Performance*</u>

In 2014, WNH customers communicated a 96% satisfaction rating with WNH's overall performance. WNH equalled or exceeded Ontario and National Utility average scores. WNH had received a 94% satisfaction rating in its previous report **(Figure 2-2).**

Figure 2-2: UtilityPULSE Customer Satisfaction Ratings



The purpose of the UtilityPULSE Report Card is to provide the utility with a snapshot of performance. It represents the sum total of respondents' ratings on 6 categories of attributes that research has shown are important to customers in influencing satisfaction and affinity levels with their utility.

Figure 2-3: UtilityPULSE Report Card

Waterloo North Hydro's UtilityPULSE Report Card®

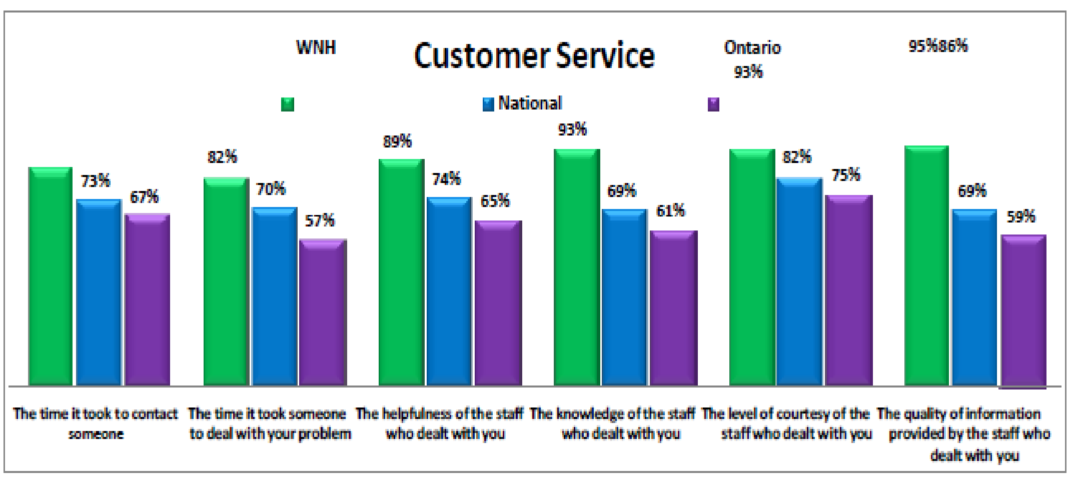
Performance

	CATEGORY	Waterloo North Hydro	National	Ontario
1	**Customer Care**	**B+**	**B+**	**B**
	Price and Value	B	B	C+
	Customer Service	A	B+	B
2	**Company Image**	**A**	**B+**	**B+**
	Company Leadership	A	B+	B+
	Corporate Stewardship	A	A	B+
3	**Management Operations**	**A**	**A**	**A**
	Operational Effectiveness	A	A	B+
	Power Quality and Reliability	A	A	A
	OVERALL	**A**	**B+**	**B+**

Customer Service and Satisfaction

Customer expectations continue to rise and WNH continues to exceed Ontario and national averages on 6 important measures of customer service.

Figure 2-4: Customer Service



Base: total respondents who contacted the utility

Table 2-4: Recent Experience

Overall satisfaction with most recent experience			
	WNH	National	Ontario
Top 2 Boxes: 'very + fairly satisfied'	92%	75%	62%

High numbers in WNH's Customer Experience Performance rating (CEPr) indicate that a large majority of customers would agree that their next contact with WNH will be a good or positive one.

Table 2-5: Customer Experience

	Customer Experience Performance rating (CEPr)		
	WNH	National	Ontario
CEPr: all respondents	86%	82%	79%

Base: total respondents

Operational Effectiveness

WNH is highly rated by its customers on its service delivery.

Table 2-6: Management Operations

Management Operations			
Top 2 boxes, 'strongly + somewhat agree'	WNH	National	Ontario
Provides consistent, reliable electricity	91%	89%	86%
Quickly handles outages and restores power	87%	86%	83%
Makes electricity safety a top priority for employees and contractors	89%	89%	87%
Operates a cost effective electricity system	77%	69%	62%
Overall the utility provides excellent quality services	87%	83%	80%

Utility Effectiveness

Customers rated WNH generally at or slightly above Ontario averages in communication effectiveness during power outages. WNH recognized before this DS Plan that improvements in this area were warranted. In 2014 WNH made investments in a number of areas including the roll-out of social media strategy, the acquisition and implementation of an integrated Outage Management System (OMS) with a Customer Public Outage Map and enhanced Interactive Voice Response (IVR). This technology investment is customer centric and will provide our Customers with 24x7 improvements in both telephone response to outage inquiries as well as timely status updates on unplanned (and planned) outages with estimated restoration times on their smart phones. The benefits of these investments will be realized once they are fully operational in 2015.

Table 2-7: Utility Effectiveness

	Utility's effectiveness during an unplanned outage	
Top 2 Boxes: 'very + somewhat effective'	**Ontario LDCs**	**WNH**
Responding to questions	61%	62%
Providing a reason for the outage	61%	63%
Providing an estimate when power will be restored	60%	66%
Responding to the power outage	81%	83%
Restoring power quickly	85%	86%
Communicating updates periodically	64%	68%
Posting information to the website	35%	34%
Using media channels for providing updates	53%	60%

Top Priority Investments

Customers were asked for their views about prioritizing investments. The top 4 areas customers identified as important are;

1. Reducing the time needed to restore power (79%)
2. Maintaining and upgrading equipment (78%)
3. Investing more in the electricity grid to reduce the number of outages (74%)
4. Educating customers about Energy Conservation (71%)

The outcomes from the UtilityPULSE and other customer consultations are being addressed by investments that began in 2013 and will carry on through to the 2020 time frame. Deliverables include:

1. Reduced time needed to restore power through investments in OMS, electronic reclosers, fault indicators, SCADA improvements, Fault Detection, Isolation and Restoration (FDIR), and communications.
2. Increased distribution interconnectivity to improve capacity utilization, reliability and load transfer capabilities through investments in additional lines and reclosers.
3. Replacement of assets in poor condition to maintain safety and reliability is supported through investments in renewal projects; 47% of total 2016 – 2020 investments.
4. Reduced magnitude and duration of power outages. Supported by investments stated above in priorities 1 - 3.
5. Better education programs for WNH customers about Energy Conservation and how to reduce their energy consumption. These programs will be delivered through WNH's Conservation and Demand Management (CDM) programs, and although not funded directly by WNH these initiatives, will positively impact WNH customers.

b) Innovative Research Customer Consultation

Innovative Research Group (INNOVATIVE) was commissioned by WNH to design and facilitate a customer consultation research program. Customers were provided with an overview of WNH's DS Plan and investment plans for the next five years spanning 2016 - 2020. Research engagements with these customer groups provided an opportunity to identify customer preferences and priorities, seek customer feedback on rate increases, and to inform the subsequent online feedback and telephone survey phases of the consultation.

Full copies are provided in **Exhibit 1** of this Application. Highlights from the reports are as follows;

General Service < 50kW and Residential Consultations

General Satisfaction

Both general service and residential rate classes are generally satisfied with the service they receive from WNH. WNH's customer service and response time during outages is seen to be a strength. Residential customers are generally dissatisfied with rising rates, not only for electricity, but all other utilities and overall cost of living.

System Reliability

The majority of customers in both rate classes feel that WNH is highly reliable. While most customers have experienced an outage in the past year outside of extreme weather, recovery time was generally seen to be adequate. Few customers in either rate class have experienced prolonged outages in the past year. For residential customers, outages were often quite short (only a few seconds in most instances), and often occurred at night where the impacts resulted only in minor inconveniences.

Areas for Improvement

While both rate classes are generally satisfied with the service they receive from WNH, they are able to identify areas for improvement. The prevailing theme amongst both rate classes was rates. Customers feel that WNH can do more to help customers reduce their overall bill, whether through CDM initiatives or improved usage tracking. Additionally, customers in both groups mentioned improved communication, especially during outages. For general service customers, receiving information regarding expected outage duration is crucial in deciding whether or not to keep their establishment open. Overall, customers in both rate classes would benefit from further education of the services that WNH is responsible for. Customers in both rate classes frequently requested programs and services that are already being offered by WNH.

Top Priority Investments

Similar to the UtilityPULSE Report, General Service < 50kW and Residential customers were generally satisfied with the service they receive from WNH. They identify areas for improvement; the main 3 of which are listed below;

1. Educating customers about Energy Conservation.
2. Providing more ways for customers to save on bills.
3. Improved communications, especially during power outages.

Large Business Consultations (GS>50 kW)

The vast majority of Large Business customers at the consultation were satisfied with the service they receive from WNH, and when asked what WNH might do to improve their service, most cited concerns regarding outages (frequency and duration), with only two participants mentioning cost as an area for improvement. Almost all feel WNH should invest what is required to maintain system reliability even if the result is a slight increase to their electricity bill. The stated reasons for supporting the rate increase suggest that this customer group understands the balance between keeping the system reliable while keeping costs down.

These customers don't like rate increases but also acknowledge that it costs money to keep the system functioning reliably and that the cost to do so must be borne by customers.

One participant is "not very satisfied" with their service from WNH. All others are either "very" or "somewhat" satisfied. The survey was anonymous. Both the participant and the reason for dissatisfaction are unknown to WNH. WNH did encourage all participants to contact the utility with any problems or concerns that they might have.

When asked what WNH can do to improve their service, participants provided feedback which WNH has consolidated in these 3 areas;

1. Reduce power outages including momentary outages.
2. Improve communications during power outages.
3. Assist customers in using less electricity / lowering bills.

Top Priority Investments

Similar to the UtilityPULSE Report; the General Service < 50kW and Residential customers, the Large Business Customers were generally satisfied with the service they receive from WNH. They identify areas for improvement; the top 3 of which are listed below;

1. Reliability of supply.
2. Improved communications during power outages.
3. Educating customers about Energy Conservation.

The outcomes from the Innovative Research Customer Consultations are similar to the UtilityPULSE and other WNH customer consultations and are being addressed through investments that began in 2013 and will carry on through to the 2020 time frame. Deliverables include:

1. Reduced time needed to restore power through investments in OMS, electronic reclosers, fault indicators, SCADA improvements, Fault Detection, Isolation and Restoration (FDIR), and communications.
2. Increased distribution interconnectivity to improve capacity utilization, reliability and load transfer capabilities through investments in additional lines and reclosers.
3. Replacement of assets in poor condition to maintain safety and reliability is being supported through investments in renewal projects; 47% of total 2016 – 2020 investments.
4. Improved communications during power outages is being addressed by investments (2014 – 2015) in WNH’s new Outage Management System and Outage Web Presentment tool (Power Outage Map), as well as the development of a social media strategy.
5. Better education programs for WNH customers about Energy Conservation and how to reduce their energy consumption. These programs will be delivered through WNH’s Conservation and Demand Management (CDM) programs, and although not funded directly by WNH these initiatives will positively impact WNH customers.

2.2.1.2 *Municipal Government Consultations*

WNH regularly consults with local municipal planning and economic development staff from the City of Waterloo, Township of Woolwich, Township of Wellesley and the Region. The purposes of the consultations are to share planning and development information that will aid in the timely, coordinated and cost effective delivery of services for both WNH and the municipalities. The value of the information may be immediate and considered in current design or construction decisions or longer term to be used in system planning. These consultations can be initiated by either party and vary in format and timing.

Some examples are;

a) With 4 municipal planning departments with which to interact, WNH receives on almost a weekly basis development information to be reviewed and taken into consideration. A portion of these transmittals require WNH to respond with comment or action. Some develop into further discussions and meetings. These consultations have their greatest impact on current and following year investments.

b) On a monthly basis WNH participates in the City of Waterloo Utilities Coordinating Committee. This is a standing committee that meets to discuss local development and includes other stakeholders such as the Region, Bell, Rogers, and Union Gas. These consultations have their greatest impact on current and following year investments.

c) Both the municipalities and WNH initiate ad hoc consultations normally regarding larger and longer term commercial and residential developments. These consultations can be as brief as one meeting or can last months to several years depending on the timing and scale of development. There also may be other participants such as customers, developers, and other agencies. These consultations can have an impact on WNH’s DS plan.

   One such example impacting this DS Plan is the Region of Waterloo LRT project. This is a large, multiyear project and since 2011 WNH has had regular meetings with the Region, consultants, contractors and other stakeholders to plan, design and coordinate the reconstruction and relocation of the distribution system impacted by the LRT construction. Meetings are typically multi-stakeholder exchanges of information and feedback on developing plans. Frequency of design meetings is increasing from monthly at the outset to weekly as construction proceeds and can be at the call of any stakeholder. Construction coordination meetings are held on a weekly basis one-on-one between WNH and the general contractor for the LRT project.

d) On an annual basis, WNH initiates consultations with economic development and planning departments of the various municipalities it services regarding larger and longer term development or road relocation projects. This information is taken into consideration in the development of WNH's annual budgets, long-term load forecast and 5 year capital forecast. These consultations have their greatest impact on WNH's DS plan.

The deliverables from these consultations is in the form of information WNH uses to prepare short term and long term System Access investment plans; and to ensure adequate resources are scheduled. Without them WNH would always be in a reactionary state which leads to inefficiencies and poor customer satisfaction.

2.2.1.3 Development Community

a) On a monthly basis, WNH participates in the City of Waterloo Home Builders Association meetings. Information on the direction of long-term development and growth trends is shared.

b) On an ad hoc basis and during the normal course of business WNH engineering staff consult with builders, developers and real estate companies. WNH uses these opportunities to gather information on the trends and timing of development. These consultations are initiated by both parties as the need arises.

c) On an annual basis WNH solicits information from the development community to feed into WNH's annual budget, long term load forecast and 5 year capital forecast. These consultations have an impact on the current year and WNH's DS plan.

Similar to the consultations with Municipalities, the deliverables from these consultations is in the form of information WNH uses to prepare short term and long term System Access investment plans; and ensure adequate resources are scheduled. Without them WNH would always be in a reactionary state which leads to inefficiencies and poor customer satisfaction.

2.2.1.4 Independent Electricity System Operator (formerly the OPA)

WNH has been undergoing long term consultations with the IESO/OPA in two areas.

1) KWCG Integrated Regional Resources Plan (IRRP), Please refer to **Section 2.2.2.**
2) Conservation and Demand Management

<u>Conservation and Demand Management (CDM)</u>

WNH has been offering IESO Province-Wide Conservation and Demand Management (CDM) programs from 2011 through 2014. Engagement and consultation with stakeholders including the OPA, customers, trade allies, associations, government and non-government organizations have occurred frequently and on an ongoing basis as part of engagement, promotion, and delivery of the CDM programs. The 2011-2014 Province-Wide CDM programs were funded directly from the OPA and had no direct impact on rates. Indirectly these programs have not had material impacts on WNH's growth in electrical demand and energy. Other factors such as weather, development constraints, the price of the commodity and the provincial economy have had far greater impacts. WNH's capital investment plan has not directly or indirectly been impacted by CDM.

WNH is now preparing to transition to the new 2015 – 2020 Conservation First framework. As per the Minister of Energy's directive on Conservation and Demand Management dated March 31, 2014, WNH will to continue to engage and consult with its stakeholders. WNH will work together with its regional LDCs to develop a refined delivery model that best suits regional needs. Under the new framework, local distribution companies are to have increased autonomy to develop and implement customized and unique individual and regional CDM programs through a simplified and streamlined process.

A targeted and aggressive approach of implementing CDM to areas of the distribution system where load reductions could have the greatest potential to delay and potentially mitigate distribution system investments would be most beneficial; having the potential to influence WNH's DS Plan. An approach of this nature, however, may not be aligned with the Conservation First directive, which outlines that CDM is to be focused on all customer segments. Funding for CDM for the 2015-2020 Conservation First period will come directly from the IESO, and therefore, will not have a direct impact on distribution rates. WNH does not believe the new framework will have material impacts on WNH's DS Plan.

2.2.1.5 *Transmitter (HONI)*

WNH owns and operates grid connected transformer stations connected to Hydro One Networks (HONI) 115 kV and 230 kV transmission lines. HONI is WNH's only transmitter. WNH regularly consults with HONI to share planning and operational information that will aid in the timely, coordinated and cost effective delivery of services for both parties. The value of the information may be immediate and considered in current design, construction or operational decisions or longer term to be used in system planning. These consultations can be initiated by either party and vary in format and timing.

Currently and through the forecast period, there are no transmission capacity constraints to deter new load or connections of Renewable Energy Generation (micro-FIT and FIT). Most of WNH's engagement with HONI will be over operational issues; especially supply point reliability.
Some examples are;

a) On a regular basis WNH operations and stations staff and their HONI counterparts communicate and coordinate over daily operations, planned and emergency maintenance. These communications can be initiated by either party, have their greatest impact on O&M and resulting actions are coordinated as much as possible to minimize equipment outage requirements.

b) On an as needed basis, WNH senior engineering and operations staff initiate consultations with more senior HONI staff, mainly over supply point reliability concerns. Transmission reliability has been and will continue to be a concern over the forecast period. These consultations have their greatest impact on O&M, however this DS Plan does include investments that will provide some mitigation of the impact of transmission contingencies on the WNH distribution system. Deliverables from these consultations also come in the form of raising HONI's awareness over transmission supply and reliability concerns and encouraging HONI to prioritize on reliability centric investments.

c) On an annual basis WNH meet with HONI senior staff at a Large Customer Conference hosted by HONI. Both parties use this opportunity for all HONI large customers to share information, concerns and challenges on transmission supply and reliability issues. WNH takes from these meetings information to improve the development of WNH's mid and long term supply plans.

d) Regional Infrastructure Planning (RIP) - WNH belongs to the "KWCG Region" which is in Group 1 of HONI's Regional Infrastructure Groups. Since 2010, HONI along with WNH have been active participants in the OPA's IRRP process currently under way. This is in lieu of HONI leading an independent RIP process. A regional planning status letter from HONI can be found in **Appendix B.**

2.2.1.6 Independent Electricity System Operator (IESO)

WNH owns its own grid connected Transformer Stations, has all its metered points of supply registered in the wholesale market and is also a registered Wholesale Meter Service Provider. This results in various and frequent consultations with the IESO on matters of operations, planning and settlement. **Also see 2.2.2.3 OPA, and 2.2.2 IRRP**.

2.2.1.7 Embedded Distributors

HONI is registered as an embedded distributor to WNH on the Elmira TS M2 feeder; however HONI has no distribution assets within WNH's Service area.

WNH consulted with HONI regarding any forecast impacts by load or Renewable Energy Generation connections on the M2 feeder from Elmira TS. HONI has stated that each connection request will be assessed individually as per the established process. The current load growth forecast for Elmira TS is less than 1% annually.

WNH does not foresee any impacts from Embedded Distributors on this DS Plan. No investments over the forecast period to support this Embedded Distributors have been included in this Application. HONI's letter of comment can be found in **Appendix B.**

2.2.2 (5.2.2 b) where a final deliverable of the Regional Planning Process is available,

- **the final deliverable; where a final deliverable is expected but not available at the time of filing, information indicating: the role of the distributor in the consultation; the status of the consultation process; and where applicable the expected date(s) on which final deliverables are expected to be issued.**

As previously described in Section 2.1.6, since 2010, WNH has been working with Kitchener Wilmot Hydro (KWHI), Cambridge and North Dumfries Hydro (CNDHI), Guelph Hydro Electric System (GHESI), Hydro One Distribution (HONI Dx), Hydro One Transmission, (HONI Tx) the Ontario Power Authority (OPA) and the Independent Electricity System Operator (IESO) on the Kitchener-Waterloo-Cambridge-Guelph Integrated (KWCG) Integrated Regional Resources Plan (IRRP).

The planning activity for the KWCG Region was already underway prior to the new regional planning process and was deemed to be in the Integrated Regional Resource Planning ("IRRP") phase of the process. This IRRP phase, led by the IESO (formerly OPA), is expected to be completed by Q2 2015.

WNH has been a full participant in this IRRP including but not limited to all meetings, discussions and alternatives development. WNH has shared with stakeholders' information regarding WNH's distribution system capabilities and constraints, load forecasts, expansion and enhancement plans. WNH has also taken into consideration all information shared by other stakeholders at the distribution and transmission level in the development of this DS Plan.

For further information please refer to;

i) The IESO/OPA's Letter of Comment regarding the KWCG IRRP , **Appendix A**
ii) Hydro One Networks Regional Planning Status Letter, **Appendix B**

2.2.3 (5.2.2 c) the comment letter provided by the OPA in relation to REG investments

- **included in the distributor's DS Plan, along with any written response to the letter from the distributor, if applicable.**

WNH's Renewable Energy Generation Plan and the IESO's Letter of Comment can be found in **Appendix A**. Based on the IESO's evaluation and response to WNH's Renewable Energy Generation Plan, no response from WNH was required.

2.3 Performance Measurement for Continuous Improvement (5.2.3)

2.3.1 (5.2.3a) identify and define the methods and measures (metrics) used to monitor distribution system planning process performance

- **providing for each a brief description of its purpose, form (e.g. formula if quantitative metric) and motivation (e.g. consumer, legislative, regulatory, corporate). These measures and metrics are expected to address, but need not be limited to:**
- **customer oriented performance (e.g. consumer bill impacts; reliability; power quality);**
- **cost efficiency and effectiveness with respect to planning quality and DS Plan implementation (e.g. physical and financial progress vs. plan; actual vs. planned cost of work completed); and**
- **asset and/or system operations performance.**

WNH measures and monitors its performance through the following performance indicators. Review of these indicators provides WNH feedback as to the effectiveness of its operating performance:

Customer Oriented Performance

- Consumer Bill Impacts;
- Reliability;
- Power Quality;
- Stray Voltage.

Cost Efficiency and Effectiveness with respect to Planning Quality and DS PLAN Implementation

- Planning Quality Indicators;
- Operating Efficiency Indicators;

Asset and/or System Operations Performance

- Supply System Reliability Indicators;
- Typical Useful Life (TUL); and
- Asset Health Indices.

The metrics and methods for measurement of each of the above indicated performance indicators are described below.

2.3.1.1 Customer Oriented Performance

Consumer Bill Impacts

WNH takes the impact of its operations and investments on customer bills very seriously. Annually O&M and Capital investment plans are constructed from the ground up. The senior management team is integral in the development, review and approval of all investment plans. WNH considers customer feedback, rates at neighbouring LDC's and cohort LDC's from across the province as measurement of relative impact of proposed rate increases. An analysis of bill impacts for all customer classes at the distribution, delivery and total bill impact level, including the percentage and the absolute dollar impact in comparison to an average bill, forms part of the decision making process before the final investment plan is approved by WNH senior management and the WNH Board of Directors.

Reliability

Please refer to the following sections on reliability

1. *2.3.1.3 Asset and/or System Operations Performance,* sections on reliability
2. Appendix F - Annual Service Continuity Report – Distribution System Performance

Power Quality

Power quality determines the fitness of electric power to consumer devices and their ability to function in their intended manner without significant loss of performance or life. WNH investigates 100% of all customer inquiries regarding Power Quality.

The quality of electrical power may be described as a set of parameters such as:

- Continuity of Service (reliability)
- Variation in Voltage Magnitude
- Transient Voltages and Currents
- Harmonic Content in the Waveforms for AC power

Continuity of Service (Reliability)

Please refer to the following sections on reliability

1. *2.3.1.3 Asset and/or System Operations Performance, sections on reliability*
2. *Appendix F - Annual Service Continuity Report – Distribution System Performance*

Variation in Voltage Magnitude

WNH endeavours to maintain steady state voltage limits, under normal operating conditions, at the Customer's delivery points, as specified in the latest edition of the Canadian Standards Association (CSA), C235.

Table 2-8: CSA Standard CAN3-C235-83

Nominal Voltage	**Voltage Variation Limits**			
	Extreme Conditions			**Extreme Conditions**
		Normal Conditions	**Normal Conditions**	
SINGLE PHASE				
120/240	106/212	110/220	125/250	127/254
240	212	220	250	254
480	424	440	500	508
600	530	550	625	635
THREE PHASE 4W				
120/208	110/190	112/194	125/216	127/220
240/416	220/380	224/388	250/432	254/440
277/480	245/424	254/440	288/500	293/508
347/600	306/530	318/550	360/625	367/635
THREE PHASE 3W				
240	212	220	250	254
480	424	440	500	508
600	530	550	625	635

In addition to the above standard, WNH requires three-phase Customers to limit their load unbalance to within 10% between phases. At no time shall the customer's voltage unbalance exceed 5% between phases.

WNH takes appropriate actions to mitigate power disturbances found to be detrimental to the customer and will use WNH's Conditions of Service and appropriate industry standards such as IEEE 1547 (Standard for Interconnecting Distributed Resources with Electric Power Systems) and good utility practice. Where supply voltages consistently lie outside the indicated limits for normal operating conditions but within the indicated limits for extreme operating conditions, improvement or corrective action is taken on a planned and programmed basis. Where supply voltages consistently lie outside the indicated limits for extreme operating conditions, improvement or corrective action should be taken as soon as practical. The urgency for such action will depend on many factors such as the location and nature of load or circuit involved and the extent to which limits are exceeded with respect to supply voltage levels and duration.

Transient Voltages and Currents

These power quality issues are almost entirely customer driven and very difficult for any LDC to mitigate. That being said, such events that have the magnitude to impact customer equipment are rare. WNH possesses the equipment and trained staff to investigate these issues and works with the offending party to mitigate the problems as they arise.

Harmonic Content

Similar to Transient Voltages and Currents, these power quality issues are entirely customer driven and very difficult for any LDC to mitigate. To ensure that the distribution system is not adversely affected by harmonics WNH uses as a guideline IEEE Standard 519 (IEEE Recommended Practice and Requirements for Harmonic Control in Electric Power Systems - latest edition). The voltage harmonic distortion limits are 3% on any individual frequency and 5% on total harmonic distortion. WNH possesses the equipment and trained staff to investigate these issues and works with the offending party to mitigate the problems as they arise.

Stray Voltage

As previously stated, WNH has a large rural service area of 607 sq.km. Prior to 2010, WNH investigated all stray voltage concerns on a complaint basis. Since 2010, WNH annually contacts the approximately 900 customers with livestock operations to inform them of the service WNH provides to investigate and remediate stray voltage concerns. WNH possesses the equipment and trained staff to investigate these issues and works to mitigate the problems as they arise.

All customer concerns are investigated. WNH follows the “Farm Stray Voltage Distributor Investigation Procedure” as outlined in **DSC Appendix H**. If testing identifies values above the OEB guidelines, WNH will install a solid-state decoupling device (Neutral Isolator) to remedy the problem at its cost.

2.3.1.2 *Cost Efficiency and Effectiveness with Respect to Planning Quality and DS Plan* Implementation

Planning Quality Indicators

WNH is committed to continuous improvement processes for efficiency and productivity performance. Since WNH's last Cost of Service Application, considerable work has been done to improve the quality of asset data; quality and quantity of available analytics to support further development of asset management and investment planning; improved project management and variance analysis.

Improvements include:

1. Introduction of ESRI GIS Arc FM with more intelligent and efficient capabilities also for better tracking of distribution system events and contingency planning;
2. Delivery of Project Management Training to all engineering technical staff;
3. Extended deployment of Microsoft Project to all Engineering Supervisors to track capital projects. Also extended to Stations department to track O&M projects;
4. Development of WNH's Operational Data Store and in combination with Cognos analytics to report on Smart Meter infrastructure performance and deliver data to WNH's Outage Management System.

In 2014 WNH began developing Cognos Analytical tools to improve reporting and trending on capital investments, O&M expenditures and asset information. These tools will allow staff at various levels to track capital investments and O&M expenditures with greater ease and efficiency.

WNH has set variance targets for annual capital expenditures over $50,000 and O&M expenditures over $5,000:

1. On a project level, variances between actual and budgeted capital <10% ;
2. On department level, total actual vs budgeted expenditures < 5% ;
3. Total annual capital program < +/- 3%;
4. 100% completion of projects required to be compliant with regulations

As part of WNH's continuous improvement processes, variances that exceed these targets are investigated and lessons learned provides feedback for improvement;

Operating Efficiency Indicators

Efficiency Assessment

A total cost benchmarking analysis is used by the OEB to produce a single efficiency ranking of Ontario's distributors; the ranking is based on the size of the difference between a distributor's actual costs and those predicted in the benchmarking analysis conducted by Pacific Economics Group Research, LLC (PEG) on behalf of the OEB.

WNH monitors the annual efficiency assessment to maintain or improve its performance. WNH is currently in Group 3.

Operational Staffing Levels

Roughly 3-4% of staff retires in any given year; however, WNH's workforce demographics have shown an elevated number of retirements in recent and upcoming years.

WNH has been frustrated for some time in its ability to hire the necessary experienced trades and technical staff. For this reason WNH generally hires into training positions and develops its own staff. WNH hires approximately 3 years in advance of impending retirements of trades and technical staff in order to train and provide experience to new staff before existing staff leave. The continuity and transfer of knowledge does not entirely make up for the skills deficit WNH experiences when staff retires; however, it does leave WNH in a position to still carry on effective operations.

As a means of supporting this recruitment program, WNH hires 3-4 co-op apprentices and 3 co-op technical/engineering students for each 4 month term. These opportunities provide apprentices and engineering students with valuable work experience, return value to WNH for the work they perform and provide WNH an opportunity to evaluate them as future employees. Those that are not recruited for permanent positions at WNH, leave having been introduced to the industry and with valuable work experience. Many have gone on to fill roles at other companies in the industry.

WNH has found its recruitment program to be a highly successful and directly aligned with WNH's Strategic Imperatives (Employee Relations and Development).

WNH utilizes a mixture of permanent staff, part-time staff and contract services to execute its investment plans in a cost effective manner. WNH maintains relatively consistent staffing levels which allows it to perform most of the O&M work; approximately 65% of annual capital overhead construction and approximately 90% of all capital engineering work. In underground capital construction 100% of the civil work and 80% of the electrical installation is completed by contracted services. In stations, nearly 100% of all O&M is performed by WNH staff. Capital projects vary considerably project by project. Overall, contracted services are utilized where they can be most effective in both cost and execution.

2.3.1.3 Asset and/or System Operations Performance

Supply System Reliability Indicators

WNH monitors distribution system reliability on a close and continuous basis. WNH considers quantitative metrics such as System Average Interruption Duration Index ("SAIDI"), System Average Interruption Frequency Index ("SAIFI"), and Customer Average Interruption Duration Index ("CAIDI") as well as more qualitative feedback from customer consultations in its O&M and capital plans. Although not specifically a performance metric in the OEB score card, WNH also monitors and considers momentary interruptions as part of its overall focus on reliability improvement.

Events impacting reliability are recorded, analyzed by cause and geospatially referenced to identify patterns in frequency and location of events. Reliability events are symbol coded by cause and colour coded by year for better recognition of clusters and patterns over time. Annual performance is analyzed and recommendations for action are developed and considered for either more immediate O&M action or longer term planned capital investments.

Annually WNH produces a Service Continuity Report on Distribution Performance. This report captures distribution system outage details including sustained and momentary interruptions by feeder, cause code and location. Metrics are in place to identify worst performing feeders which aids in the prioritizations of maintenance and capital improvement investments. Supplementary maps are included to illustrate root cause clustering and trending. The full report is provided in **Appendix F;** at a summary level the Report provides information on the following;

- Customer Sustained Interruption minutes by year and by cause code
- Historical Comparisons
- Major events
- Normalized Comparisons
- Top Contributing Events
- Cause Code Observations with spatial trending maps
- Momentary Interruptions
- Historical Comparisons
- Top Contributing (worst performing) Feeders
- Annual Reliability Indices
- Summary of Recommendations and status

WNH analyzes its reliability indices with and without the inclusion of Major Event (ME) data. WNH uses the Canadian Electrical Association (CEA) definition of Major Events, also known as Prominent Events, which is *" Major Events are events where 10% of a Distributor's customer base is out of power for more than 24 hours and caused by a storm or event impacting more than one Distributor ".* This allows WNH to separately identify chronic and acute reliability concerns as often they have different drivers and solutions.

Table 2-9: WNH Reliability Targets

WNH RELIABILITY INDICES		3 YEAR AVERAGE INDICES	
	WNH TARGETS	Excluding ME	Including ME
Exclusive of Supply			
SAIDI	0.75-1.66	0.83	2.56
SAIFI	0.85-1.39	1.41	1.92
Inclusive of Supply			
SAIDI	0.75-1.66	1.05	4.49
SAIFI	0.85-1.39	1.71	2.59
EME = Excluding Major Events			
	<= Target	> Target	>>>Target

More detail on distribution system performance is provided in WNH’s 2014 Annual Service Continuity Report **(Appendix F).**

Typical Useful Life (TUL)

One metric WNH uses in monitoring asset performance is TUL. WNH has applied TULs to its major assets using WNH’s own historical experience with asset and information published in Kinectrics Inc. Report No: K-418033-RA-001-R000, July 8, 2010, “Asset Depreciation Study for the Ontario Energy Board” (the “Kinectrics Report”)

The Kinectrics Report identified 48 different asset components or sub components. WNH reviewed this listing and added an additional 13 components to its Depreciation Componentization List for greater clarity in its asset management process.

WNH believes its Depreciation Componentization List to be in general compliance to the Kinectrics Report. All but 2 of WNH’s adopted TUL’s fell within the study’s minimum – maximum ranges. In the first instance, WNH has assigned a TUL of 45 years for its overhead conductor assets instead of 50 years. This is due to the fact that in most renewal projects, the conductors need to be replaced at the same time as the pole. The TUL of WNH’s poles is 45 years. In the second instance, WNH’s TUL for towers/cable, antenna was set at 50 years. The report minimum TUL was 60 for this category. This has not been the experience of WNH nor its communication service provider. For the remaining assets, 23 agree with the min TUL, 13 are in mid-range and 10 agree with the Kinectrics Report’s maximum TUL.

Asset Health Indices

For WNH’s major distribution assets, a condition assessment rating is employed. A rating of Very Good, Good, Fair, Poor and Very Poor is assigned to an asset based on its age, remaining TUL, inspection and maintenance observations, operational performance and testing data. Not all assets are subject to the same metrics. This rating system was developed in house and relies on the evaluation capacities of experienced staff.

Recognizing the importance health indices can play in an effective asset management program WNH has initiated a program to develop an improved set of Health Indices for its distribution and station assets. Kinectrics was engaged by WNH to develop a health index for wood poles which is being utilized for this DS Plan. Health indices for substations, underground cable and other assets will be developed in 2015 and 2016. This work is a precursor to WNH's purchase of Asset Management Software in 2016 and the development of a more efficient and effective Asset Management Program.

2.3.2 (5.2.3b) Provide a summary of performance and performance trends over the historical period

- **using the methods and measures (metrics/targets) identified and described above. This summary must include historical period data on: 1) all interruptions; and 2) all interruptions excluding loss of supply' for a) the distribution system average interruption frequency index; b) system average interruption duration index; and c) customer average interruption duration index.**
- **Where performance assessments indicate marked adverse deviations from trend or targets (including any established in a previously filed DS Plan), provide a brief explanation and refer to these instances individually when responding to provision 'c)' below.**

Consumer Bill Impacts

The bill impact feedback WNH received through its customer consultations has been considered in the development of this DS Plan. WNH constantly monitors its distribution rates with respect to its comparators and cohorts however a metric has not yet been formally established and monitored. Accordingly, no historical performance data is available for this metric.

Going forward, WNH will continue to include bill impact considerations in the rate application process and will undertake to minimize and mitigate to the greatest extent possible when balancing against the needs of the business.

Reliability

Please refer to the following sections on reliability

1. *2.3.1.3 Asset and/or System Operations Performance, sections on reliability*
2. *Appendix F - Annual Service Continuity Report – Distribution System Performance*

Power Quality

Continuity of Service (Reliability)

Please refer to the following sections on reliability

1. *2.3.1.3 Asset and/or System Operations Performance, sections on reliability*
2. *Appendix F - Annual Service Continuity Report – Distribution System Performance*

Variation in Voltage Magnitude

Table 2-10 provides historical data in WNH Customer Voltage investigations. All voltage concerns reported by customers were investigated and 100% were resolved by either determining that the customer's service entrance voltage was in fact within CSA C235 limits or taking corrective action such as transformer tap adjustments to bring service entrance voltages back within C235 limits. Prior to 2014 WNH's historical records do not capture corrective actions taken. In 2014, 13 of the 21 investigations resulted in WNH taking corrective action. The other 8 investigations did not result in excursions outside of the C235 guidelines.

Table 2-10: Customer Voltage Investigations

Year	Voltage Investigations Completed	Resolved by WNH	% Resolved
2010	No Data Available		
2011	34	34	100%
2012	47	47	100%
2013	45	45	100%
2014	21	21	100%
Total	147	147	100%
Average	37		

Transient Voltages and Currents

Investigations into Transient Voltages and Currents are infrequent. WNH does not keep historical records of these events.

Harmonic Content

Investigations into Transient Voltages and Currents are infrequent. WNH does not keep historical records of these events.

Stray Voltage

As can be seen in **Table 2-11,** investigation activity peaked in 2010; however, once the initial publicity subsided, investigation requests have leveled to an average of 5 per year or 0.6% of the farming community.

Table 2-11: Stray Voltage Investigations

Year	Stray Voltage Investigations Completed	Compliant with OEB/DSC Guidelines	Noncompliant with OEB/DSC Guidelines	Neutral Isolator Installed by WNH
2010	20	18	2	2
2011	6	6	0	0
2012	3	2	1	1
2013	2	2	0	0
2014	8	6	2	2

Over the last 5 years, only 5 installations have been found to be non-compliant with the OEB Guidelines. In each of these circumstances WNH has installed solid-state decoupling devices (Neutral Isolator) to isolate the customer's service neutral while simultaneously providing safety grounding for AC fault current and lightning. Each case has been successfully resolved by these measures.

The low frequency of stray voltage incidents in WNH service territory is representative of the good condition of WNH's neutral and grounding systems and its load balancing efforts on the distribution system.

Planning Quality Indicators

As previously stated in Section 2.3.1.2, the development of tools to track and trend the performance of Planning Quality Indicators are just being introduced. Historical performance is not available. WNH will begin to monitor in 2015 and be able to report at the next Application.

Operating Efficiency Indicators

Efficiency Assessment

WNH has been ranked in Group 3 for efficiency in 2012 and 2013.

Operational Staffing Levels

As can be seen in **Table 2-12**, WNH's staffing levels have increased over the last 5 years but have started to level off in the 2013 – 2015 time frame. This is due almost exclusively to the hiring of replacement staff due to upcoming retirements. Roughly 3-4% of staff retire in any given year, however WNH's workforce demographics have shown an elevated number of retirements in recent and upcoming years.

Table 2-12: WNH Historical Staffing Levels

Inspection Year	2011 COS	2011	2012	2013	2014	2015	2016	2016 vs 2011 COS
Full Time	120.1	114.3	114.3	119.2	118.0	122.8	123.9	3.8
Students/Contract	5.0	9.5	13.6	13.3	13.2	10.3	8.3	3.3
Total	125.0	123.9	127.9	132.5	131.1	133.1	132.1	7.1

<u>Supply System Reliability Indicators</u>

Table 2-13 provides a 5 year side by side comparison of historical Customer Outage Minutes (COM).

Table 2-13: WNH Historical Customer Outage Minutes

Year	Total Annual Customer Outage Minutes (Gross)	Total Annual Customer Outage Minutes (EME)
2010	2,248,352	2,248,352
2011	3,311,682	3,311,682
2012	10,714,478	2,778,791
2013	29,335,283	4,374,569
2014	3,149,650	3,149,650
Total	48,759,445	15,863,044
Average	9,751,889	3,172,609

EME – Excludes Major Events

- 2014 had no Major Events.
- 2013 remains noteworthy as the worst year on record for WNH. The high COM's were

attributable to 3 Major Events; an April ice storm, a July wind storm and a December ice storm. These 3 events contributed 24,960,714 customer outage minutes or 85% of the annual total. The storm events were so severe that many local municipalities exercised their Emergency Preparedness Plans during these events. All of the 2013 Major Events were weather related.

Table 2-14: WNH Reliability Performance

	2011	2012	2012 EME	2013	2013 EME	2014	WNH TARGETS
Exclusive of Supply							
SAIDI	0.75	1.66	0.79	5.19	0.88	0.81	0.75-1.66
SAIFI	0.85	1.39	1.16	3.16	1.86	1.21	0.85-1.39
	2011	2012	2012 EME	2013	2013 EME	2014	WNH TARGETS
Inclusive of Supply							
SAIDI	1.06	3.37	0.82	9.13	1.36	0.97	0.75-1.66
SAIFI	0.96	2.10	1.18	3.97	2.23	1.71	0.85-1.39
EME = Excludes Major Events					3 ME	0 ME	No ME

- In 2012 the increase is attributable to 2 events; a February 29, 2012 Loss of Supply event and an October 29, 2012, defective equipment event, contributing in total 8,119,210 customer outage minutes.
- 2011 and 2010 were more typical years for COM's

It can be seen from **Table 2-14** the major impacts that Supply Reliability and Major Events have had on WNH's SAIDI and SAIFI performance from 2011-2014. From **Table 2-9**, Exclusive of Major Events and Supply Reliability, WNH's 3 year average for SAIDI is within the OEB reliability target range, however SAIFI falls just outside the target range. Including the impacts of Supply Reliability, WNH again meets its SAIDI target but fails to meets its SAIFI target. Including Major Events, it can be seen from **Table 2-14** that WNH has missed all of its SAIDI and SAIFI targets.

WNH's most frequent causes of reliability events for the last 5 years can be seen in **Table 2-15**. It is noteworthy that the major cause of power outages to WNH customers over the last 5 years has been loss of supply (39%). Loss of HONI transmission has accounted for 78% of supply related outages **(Table 2-16**) and 30% of all WNH customer outage minutes. This is a serious concern and as noted in **Section 2.2.2.4**, WNH senior staff have had numerous consultations with HONI over the last 3 years in order to obtain substantial improvement in this area.

WNH is concerned about its entire reliability performance as is its customers. WNH is proposing investments included in this DS Plan specifically targeting reliability and improvement in this area is expected.

Table 2-15: WNH Reliability Event Causes (2010 - 2014)

	Reliability Event Causes (2010- 2014)	%
1	Loss of Supply (all sources)	39%
2	Loss of Supply (HONI transmission lines)	30%
3	Defective Equipment	20%
4	Adverse Weather	19%
5	Scheduled Outages (maintenance, replacements)	13%
6	Foreign Interference (motor vehicle accidents, digins)	9%
7	Loss of Supply (< 50 kV from Host LDC's)	9%
8	Tree Contacts	5%

Table 2-16: WNH Loss of Supply

Year	HONI 230kV - D6V	HONI 115kV - D10H	HONI Dx 44kV - 73M7	HONI Dx 27.6kV - 33M2	KWHI 27.6kV - 9M4	CNDHI 27.6kV - 21M25	Total Loss of Supply (COM)
2010	0	0	52,240	0	62,436	4	114,680
2011	0	0	786,015		130,433	54,976	971,424
2012	5,368,709	0	88,219			0	5,456,928
2013	6,450,270	2,794,557	2,665,103			0	11,909,930
2014	0	24,645	13,622	138,777	177,841	13,058	367,943
Total	11,818,979	2,819,202	3,605,199	138,777	370,710	68,038	18,820,905
	62.8%	15.0%	19.2%	0.7%	2.0%	0.4%	100.0%

Typical Useful Life (TUL)

The Kinectrics report identified 48 different asset components or sub components. WNH reviewed this listing and has added an additional 13 components to its Depreciation Componentization List for greater clarity in its asset management process.

All but 2 of WNH's TUL's fell within the study's minimum – maximum ranges. In the first instance, WNH has assigned a TUL of 45 years for its overhead conductor assets instead of 50 years. This is due to the fact that in most renewal projects, the conductors need to be replaced at the same time as the pole. The TUL of WNH's poles is 45 years. In the second instance, WNH's TUL for towers/cable, antenna was set at 50 years. The report minimum TUL was 60 for this category. This has not been the experience of WNH nor its communication service provider. For the remaining assets, 23 agreed with the min TUL, 13 were somewhere mid-range and 10 agreed with the reports maximum TUL.

WNH reviews these comparisons on an annual basis. As more historical asset performance data is collected and analyzed, WNH will make the necessary adjustments and feed it back into its Asset Management and DS plans.

Asset Health Indices

WNH's Asset Health Indices and Condition Ratings for major distribution equipment are reported in Section 3.1. WNH does not have historical data available for the performance of the indices. WNH will work with Kinectrics to establish appropriate trending of these metrics.

2.3.3 (5.2.3c) explain how this information has affected the DS Plan

- **(e.g. objectives; investment priorities; expected outcomes) and has been used to continuously improve the asset management and capital expenditure planning process.**

Consumer Bill Impacts

As previously stated in **Section 2.2.1.1** Customer Engagement, WNH has received very high ratings from all its customers; however the feedback indicated that customers feel that WNH can do more to help them reduce their overall bill. Almost all feel WNH should invest what is required to maintain system reliability even if the result is a slight increase to their electricity bill. These customers don't like rate increases but also acknowledge that it costs money to keep the system functioning reliably and that the cost to do so must be borne by customers.

WNH acknowledges the importance of bill impacts on its customers and seeks opportunities to mitigate increases where possible. WNH will continue to look into meaningful ways to incorporate bill impact considerations into its capital and O&M investment processes.

Reliability

As previously stated in **Section 2.2.1.1** Customer Engagement, reliability of supply was foremost in the customer's minds. In addition as can been seen in **Table 2-14**, WNH has had difficulty achieving some of its reliability performance targets.

With that in mind, WNH is proposing System Service and System Renewal investments in this DS Plan directly focused on reliability of the system whether it is by renewal of deteriorating assets before they impact customer reliability or by smart technologies to more quickly identify, isolate and restore power. WNH continuously monitors and analyzes reliability metrics for underperforming assets and for worst performing feeders. Geospatial analysis of fault location and cause identification allow investments, whether they are O&M or capital, to be focused directly on the problem areas. A reading **of Section 1.3.2** and **Section 1.3.3** will provide greater detail on 2016 proposed investments in System Renewal and System Service.

Power Quality

Continuity of Service (Reliability)

Please refer to previous section on reliability.

Variation in Voltage Magnitude

As previously mentioned incidents of Voltage issues are not common. They have not affected this DS Plan and have not been used to improve the asset management and capital expenditure planning process.

Transient Voltages and Currents

As previously mentioned incidents of Transient Voltage and Current issues are not common. They have not affected this DS Plan and have not been used to improve the asset management and capital expenditure planning process.

Harmonic Content

As previously mentioned incidents Harmonic Content issues are not common. They have not affected this DS Plan and have not been used to improve the asset management and capital expenditure planning process.

Stray Voltage

As previously mentioned incidents Stray Voltage issues are not common. They have not affected this DS Plan and have not been used to improve the asset management and capital expenditure planning process.

Operational Staffing Levels

All annual WNH staff labour hours are allocated into either O&M or Capital or Recoverable work plans. Each work plan is performed by either WNH staff or contracted services based on the following criteria;

1. Availability of the required resources
2. Skill set / equipment required to complete the work
3. Cost effectiveness of alternative resources

Key engineering and operations personnel meet weekly to continuously develop and revise the capital investment plan. This plan is maintained in MS Project on a 12 month go forward basis and is published regularly to communicate plan status to engineering and operations staff. WNH forecasts labour resource needs from this plan and adjusts accordingly.

Supply System Reliability Indicators

Please refer to previous section on reliability.

Typical Useful Life (TUL)

The TULs in the Kinectrics Report provided WNH with the opportunity to re-examine its own assumptions on major asset TUL. As a first order approximation of the remaining life of an asset, WNH calculates the in-service age of the asset and compares it to the asset's TUL. This is helpful as a screening tool to help identify potential concerns. Although TULs are only one of many inputs to WNH's Asset Management Process they have had an impact on this DS Plan.

As the technologies employed in assets change and more data becomes available WNH expects that asset TULs will change over time impacting the asset management and capital expenditure planning process.

Asset Health Indices

The asset condition assessment is one of the main inputs into the asset management process and therefore drives the investment in System Renewal over the forecast period. WNH has performed extensive asset condition assessments in the past and has employed its own Condition Rating system to major assets. The recent move to Asset Health Indices developed by Kinectrics is part of WNH’s continuous improvements process in Asset Management. The results are expected to either validate or improve upon WNH’s Condition Rating system. Kinectrics Health Indices on wood poles is the first such collaborative effort and as more Health indices are developed in 2015 and 2016 the WNH expects this will have a positive impact on the asset management and capital expenditure planning process.

3.0 Asset Management Process (5.3)

3.1 Asset Management Process Overview (5.3.1)

- **This section provides the Board and stakeholders with a high level overview of the information filed on a distributor's asset management process, including key elements of the process that have informed the preparation of the distributor's capital expenditure plan.**

3.1.1 (5.3.1a) description of asset management objectives

- **relationship to corporate goals and how distributor ranks asset management objectives for the purpose of prioritizing investments:**

WNH's Mission, Vision, Corporate Values and Strategic Imperatives (**Section 1.2)** are part of WNH's strategic planning process. WNH's Asset Management Objectives are driven by its Mission and Vision, and directly aligned with WNH's Strategic Imperatives. These Strategic Imperatives were developed and ranked by the WNH Board of Directors and senior management through a series of collaborative strategic planning sessions. Formalized in 2003, these objectives have been revisited and reaffirmed over time and have guided WNH's asset management and Investment planning processes.

To provide alignment with its Corporate Values and Strategic Imperatives WNH manages its assets while recognizing realistic service and performance goals. Customer expectations for the delivery of safe, reliable electricity at a reasonable price have to be respected. The following considerations are critical to WNH's strategy:

- The activities should demonstrate good stewardship in the long term up-keep and growth of the distribution system
- Service delivery should be safe, fair and consistent within all customer groups
- The performance measures should demonstrate progress towards and/or achievement of the goals within reasonable budget considerations
- Maintenance plans should be consistent with good utility practice but capture specific items from the annual assessments and any specific customer needs

- Capital budgets should justify proposed expenditures and be flexible to respond to new priorities
- The asset management strategy should create opportunities for improved efficiencies
- The asset management strategy should find the right balance between capital investments and O&M costs so that the total cost over the life of the asset is minimized
- Annual reviews of the strategies and procedures should be a priority

Asset Management Objectives

For asset management purposes 7 of WNH's Strategic Imperatives have been adopted as Asset Management Objectives.

1. Electrical Supply – Electrical Supply is the foremost consideration in WNH's management of assets. Waterloo Region has been and continues to be a growing community. Adequate electrical supply allows this economy to sustain itself and allows local government and business leaders to attract business to the Region in what is a very competitive global economy. Opportunities lost due to inadequate supply do not only impact future WNH revenue growth but also community jobs, tax base and secondary development.

2. Reliability – Reliability is a prominent consideration as it is the key measure of how well WNH is fulfilling its mandate to supply electricity to its customers. The importance of electrical supply reliability has been a consistent message WHN has received from all of its stakeholders through its many consultations. Reliability is an important contributor, both for business and for residential customers, to the prosperity of the community.

3. Health, Safety and Environment – WNH owes a legal and moral duty to carry out its business in a manner safe to its workers, customers and the general public. Safety has been and continues to be high on WNH's list of strategic objectives.

4. Cost Reduction – WNH understands that its own success and that of its customers depends upon the affordability of the services it delivers. WNH actively investigates opportunities to improve value and lower the costs of its operations without sacrificing service levels. Although cost pressures such as labour and material inputs, regulatory requirements and service levels continue to increase, WNH continues to focus on improvement in this area.

5. Organizational Effectiveness – WNH considers organizational effectiveness as a key factor in supporting: cost reduction; health, safety and environmental improvements; timeliness of service delivery; O&M execution; and capital investment planning.

6. Customer Service – WNH has customer service level expectations and targets that are both adopted and imposed. There are many inputs that contribute to the ultimate service provided to customers. Each of WNH's strategic objectives can, in isolation, have positive or negative influences. WNH believes it is important to consider the effect of its combined objectives on customer service in order to provide better insights and balance to WNH's investment decision making process.

7. Esthetics of its Distribution System – WNH's consultations have provided various stakeholder groups in the community an opportunity to express their support for more aesthetically pleasing forms of distribution construction. WNH adheres to service levels as prescribed in its Conditions of Service, overarching regulations, adopted standards and good utility practice. Although not ranked as high as other strategic objectives, esthetics is taken into consideration on all projects and when balanced with other strategic objectives positive outcomes can be realized.

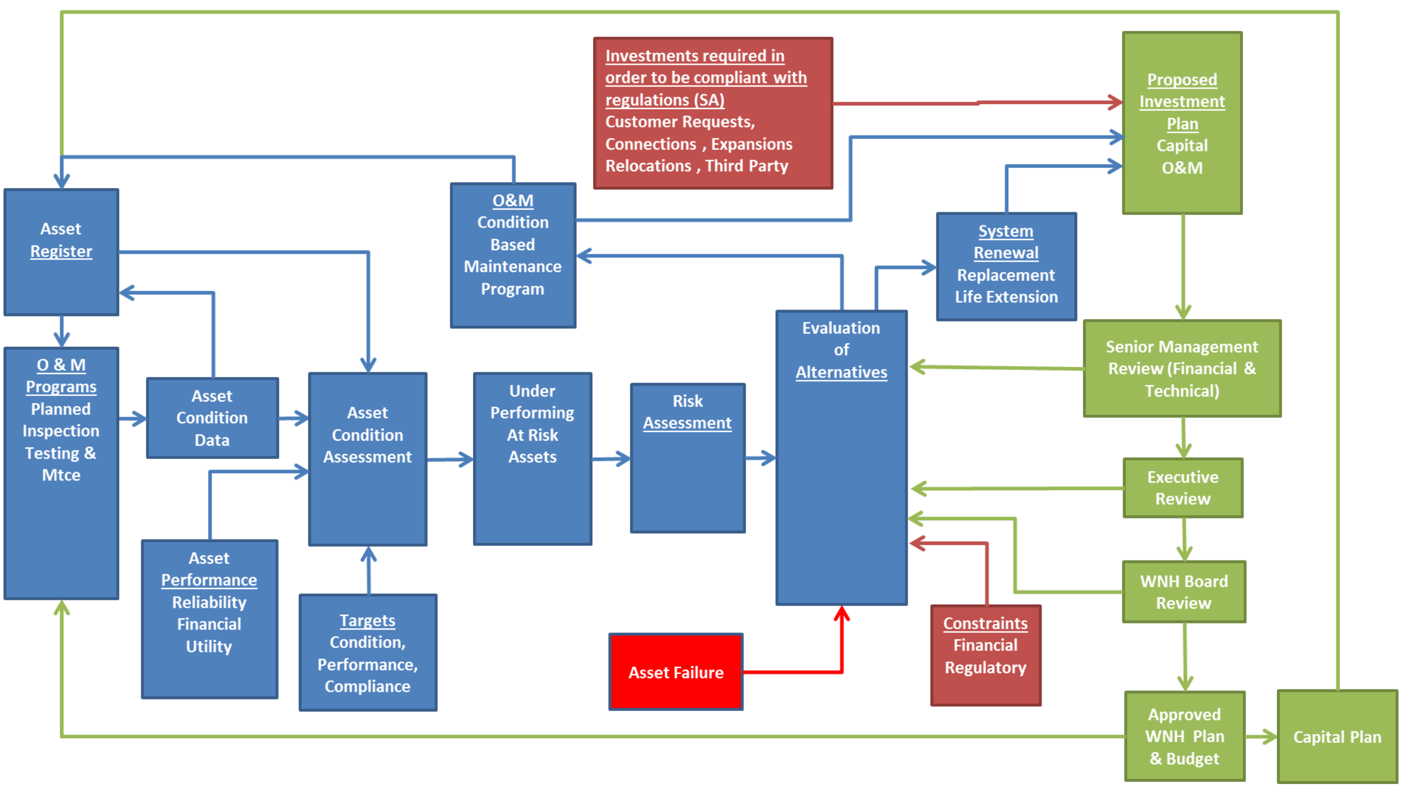
The ranking of these objectives has proven to remain consistent over time and has guided WNH's Asset Management processes.

WNH's Asset Management strategy identifies and prioritizes investments that achieve multiple objectives to aid in maximizing the value of its investments. It also considers maintenance and refurbishment alternatives to lower the life cycle costs of its assets.

3.1.2 (5.3.1b) information regarding the components (input/output) of the asset management

- **process used to prepare a capital expenditure plan, data sets, primary process steps, and information flows used to identify, select, prioritize and/or pace investments:**

Figure 3-1: WNH Asset Management Framework



WNH maintains a register of its largest and most significant assets. Depending on the asset class, available data can include quantities, age, condition, inspection data, testing data, operational performance and location. More information on WNH's Asset Register is provided later in this section.

WNH has well established comprehensive inspection, testing and maintenance programs to provide for on-going asset condition assessment. These O&M programs have been developed and refined over time from manufacturers' recommendations; industry best practices; historical findings; WNH's past experience and prescribed requirements. More information on WNH's O&M programs is provided further in this section.

These programs are executed at various times and by various means. They yield asset condition information upon which the Asset Register is updated. WNH also takes into consideration other areas of asset performance such as reliability and financial performance. Together with asset performance targets, underperforming or at risk assets are identified through an analytical process.

For identified assets, alternatives are developed and evaluated. Considerations during this process are constraints such as financial, regulatory, schedule, remaining TUL, Strategic Plan, availability of temporary measures and consequence of failure. Outputs from this analysis form either a condition based maintenance (O&M) solution or a capital investment solution involving replacement or life extension. Asset failures undergo the same analysis.

Depending on the severity and/or time criticality of the outcome, O&M proposed investments are either performed as soon as practical or go on to be considered for WNH’s planned O&M programs. Similarly proposed capital investments may be either immediate (Proactive Renewal) or go on to be considered for WNH’s capital investment plan.

Investments required in order to be compliant with regulations such as new connections, customer requests, road widenings, mandated inspection and maintenance form part of WNH’s O&M and Capital investment plan. Cost reduction is always a consideration WNH employs, however the timing of these investments normally leaves little discretion.

Senior Engineering and Operations management have the responsibility for Asset Management at WNH and are an integral part of the evaluation and development of all proposed capital and O&M investment proposals.

Recommended investment plans are further reviewed by executive management before being recommended to the WNH Board of Directors for approval.

Asset Prioritization

At a high level, WNH utilizes the following system of prioritization for capital investments:

1. Mandated (SA)
2. Customer-Driven (SA)
3. Condition Based (SR)
4. Performance Based (SS)

Mandated investments fall under System Access and are those required by various government agencies such as local municipalities, OEB, IESO, Electrical Safety Authority (ESA), government ministries, and similar authorities. The necessity of these investments becomes known to WNH through various communications, legislation / regulations, orders or the like. Examples include overhead relocations to accommodate municipal road work, amendments to the Distribution System Code EB-2013-0311 (Interval Meters), and ESA Order to remove iConA Generation 3.2 remote disconnect meters. WNH's prioritization strategy prioritizes investments necessary to meet all regulatory obligations and these investments are always included in WNH's capital expenditure plan. Generally, there is little to no flexibility in the timeframe within which these types of investment must be made; however, when there is, the execution of the work is paced to balance these types of investments with other high priorities. Not completing this work within the prescribed timeframe leaves WNH open to regulatory sanctions.

Customer-Driven investments fall under System Access and are those projects undertaken to accommodate load and generation customer requests for connections to WNH's distribution system. They may also be accompanied by requests for expansions to the distribution system. WNH's prioritization strategy is directly aligned with its Mission statement – "to be a key partner in contributing to community prosperity and success". To achieve this, WNH must be able to make timely investments to meet customer requests for service. These investments are always included in WNH's Capital expenditure plan. Generally there is some flexibility in the timeframe within which these types of investment must be made and the execution of the work is paced to balance these types of investments with other high priorities. Not completing this work within the requested timeframe can damage or eliminate growth opportunities for WNH and the community it serves.

Condition based investments fall under System Renewal and are as a result of WNH's asset condition assessment programs. Deficiencies are identified when asset condition assessments from inspections, testing and maintenance fail to meet established targets. These targets may be condition or performance based and may also be mandated (OEB, IESO, ESA) or adopted (IEC, IEEE, USF, industry best practices). A hazard level is assigned to the identified deficiency and may be indicative of the extent of the deficiency and response time. Deficiencies are categorized by the degree of noncompliance to a target, the estimated time to failure and consequence of failure. These investments have varying degrees of flexibility in the staging of their execution. Some may need to be addressed through more immediate proactive maintenance or capital investments. Where time permits, these investments will be allocated along with less flexible Mandated and Customer-Driven investments to smooth out the overall plan. Not completing this work within the determined timeframe will lead to performance and safety degradation; increased customer complaints; more expensive reactive maintenance and capital replacement; and leaves WNH open to regulatory sanctions and legal action.

Performance based investments fall under System Service and are the result of failure to meet prescribed (OEB, IESO) or adopted (IEC, IEEE, CEA industry best practices) performance targets or to address supply constraints. These investments are generally targeted to enhance reliability; improve operational efficiency or improve the amount and flexibility of system capacity. Higher priority is placed on those projects focused on alleviating supply constraints. Not completing this work within the determined timeframe will lead to supply constraints preventing the connection of load or generation customers; degradation in system performance and customer satisfaction; and more expensive reactive maintenance and capital replacement.

Within each of the 4 previously mentioned priority groups, individual projects are also subject to a prioritization process. For Mandated and Customer-Driven investments, timing normally becomes the prioritizing factor. Where conflicts occur, extra resources often need to be procured. For Condition and Performance based investments, timing may have greater flexibility. Projects with multiple objectives are deemed to have greater value and are assigned a higher priority, in which case execution may be more immediate. These objectives are directly aligned with WNH Strategic Imperatives **(Section 1.2)** and Asset Management Objectives **(Section 3.1.1)**

Annually, WNH's plan will have a mixture of these various types of investments and all plans receive scrutiny in terms of affordability and impact on customer rates. WNH develops its investment plans by attempting to pace Condition and Performance investments with Mandated and Customer-Driven investments in a strategy to develop executable and sustainable investment plans.

Asset Register

WNH maintains a register of its largest and most significant assets. Depending on the asset class, data available can include one of more of the following quantities: age, condition, inspection data, test data, operational performance, health indices and location. This data is maintained in various software data bases and analytical tools such as GIS, Operational Data Store (ODS), Customer Information Systems (CIS), Enterprise Resource Planning (ERP), Power Interruption Logging and Reporting (PILAR) and other miscellaneous software.

Individual asset information is kept current as part of ongoing after inspection, testing and maintenance and capital replacement programs. WNH's distribution assets are categorized in the following major groups

1) Overhead Distribution Lines
   a. Poles & Structures
   b. Conductors & Devices
   c. Reclosers & Switches
   d. Capacitors & Voltage Regulators
2) Underground Lines
   a. Cables
   b. Switching Cubicles
   c. Vault and Duct Structures
3) Transformers
   a. Polemount
   b. Padmount
   c. Submersible
   d. Vault

4) Meters

    a. Residential
    b. Commercial & Industrial
        i. <50kW
        ii. >=50kW
        i. Large user >5000kW
    c. Wholesale

5) Substations

    a. Transformers
    b. Switchgear
    c. Circuit Breakers
    d. Protection Systems
    e. Auxiliary Systems & Equipment
        i. Security
        ii. Station Grounding
    f. Building & Property
        i. Building
        ii. Fence

6) Monitoring & Control Systems

    a. Hardware
    b. Software
    c. Communications

7) Fleet

    a. Vehicles
    b. Trailers
    c. Tension Stringing Machines

8) Information Technology Software & Hardware (Major Asset Categories)

    a. Desktop/Portable Computers (PC's / Laptops / Tablets)
    b. Servers & Peripherals (i.e. SAN Hardware, Tape Drives etc)
    c. Printers
    d. Software License Entitlements (PC Software, Server Operating Systems, Server Data Bases, Application S/W, Backup Utilities)

9) Facilities

    a. HVAC equipment
    b. Emergency Backup Generator
    c. Cranes

Asset Condition Assessment

WNH asset condition assessments are based on well-established comprehensive inspection, testing and maintenance programs. These O&M programs have been developed and refined over time from manufacturers' recommendations, industry best practices, historical findings, WNH's past experience and prescribed requirements. These programs are executed at various times and by various means. They yield asset condition information upon which the Asset Register is updated. WNH also takes into consideration other areas of asset performance such as reliability and financial performance. Together with asset performance targets, underperforming or at risk assets are identified through an analytical process. A sample of WNH's inspection and maintenance schedules are provided below.

Inspections

The Minimum Inspection Requirements of the OEB's Distribution System Code (DSC) outline the minimum inspection standards and intervals required. Specifically, Table C-1 of the DSC identifies the maximum intervals, in years, for visual patrols, which for most urban facilities is 3 years, rural facilities is 6 years and stations is 1 month, 6 months, 1 year or 3 years. In addition, WNH has grid connected Transformer Stations which have inspection standards identified in the OEB Transmission System Code.

WNH's distribution system is divided into one urban region, serving the City of Waterloo, and two rural regions, serving the Township of Wellesley and the Township of Woolwich, as illustrated in **Figure 1.2.** These regions form the basis for implementation of systematic and routine visual patrols for compliance with the OEB inspection requirements, as a minimum. The visual patrols of the major distribution facilities, noted below, are comprehensive and the level of detail exceeds the Patrol Inspection requirements as defined in the Appendix C of the DSC. In addition to fulfilling the requirements, the inspections allow for identification and documentation of condition-related deficiencies, with subsequent analysis to support maintenance and capital expenditures concerning various assets such as transformers, stations, switching cubicles, and poles/supports/attachments among others.

Table 3-1a: Inspections – Lines

OVERHEAD AND UNDERGROUND LINES	FREQUENCY
OEB Inspections (Urban)	3 year
OEB Inspections (Rural)	6 year
Inspection of major overhead crossings of Highway 85 Expressway	Annual
Inspections of overhead crossings of rivers and railways	Annual
Inspections of overhead and underground plant located adjacent to schools and playgrounds	Annual
Inspections of pole mounted capacitor banks	Annual
Infrared Thermography	Annual

Table 3-1b: Inspections – Stations (TS)

TRANSFORMER STATION INSPECTIONS	FREQUENCY
Transformer Equipment	Weekly
Tap Changers	Weekly
Battery Chargers	Weekly
Miscellaneous (building, yard, lighting, alarms)	Weekly
Station Equipment (e.g. transformer, switchgear, reclosers, fans, fencing)	Monthly
Transformer Oil Testing	Annual
Transformer cooling fan and pump vibration analysis	Annual
Infrared Thermography	Annual

Table 3-1c: Inspections – Stations (MS/DS)

DISTRIBUTION / MUNICIPAL STATIONS	FREQUENCY
Reclosers	Monthly
Transformer Equipment	Monthly
Station Equipment (e.g. switchgear, capacitor bank, fencing, lighting, radio/RTU)	Monthly
Transformer Oil Testing	Annual
Infrared Thermography	Annual

Table 3-1d: Inspections – Fleet / Rolling Stock

FLEET / ROLLING STOCK	FREQUENCY
All commercial vehicles (vehicles > 4,500 kg) and all trailers receive an annual MTO safety inspection.	Annual
All commercial vehicles (vehicles > 4,500 kg) receive an inspection.	12 weeks
All small vehicles (< 4,500 kg) receive a full inspection every 36 weeks.	36 weeks

Table 3-1e: Inspections – Information Technology

INFORMATION & TECHNOLOGY SYSTEMS	FREQUENCY
Audio Visual Equipment	Quarterly Preventive Maintenance
PC/Laptop Antivirus Updates	Daily
PC/Laptop Operating System (O/S) Patches	Bi-Monthly or As Needed
PC/Laptop Hardware Upgrades	Generally a 5 Year Cycle
Server Antivirus Updates	Daily
Server O/S Patches	Bi-Monthly or as Needed
Server O/S Version Upgrades	As Needed
Virtual Machine Software Version Upgrades	As Needed

Testing & Maintenance

Generally, 'high' hazard level deficiencies discovered during regularly scheduled inspections are corrected to remediate the deficiency either at the time of inspection, or as soon as possible following the inspection. Additionally, corrective action to remediate 'low' hazard level deficiencies may also be performed during the visual patrol. This may include replacement of broken guy guards or missing phase markers, for example.

Remaining deficiencies receive a thorough review and are prioritized for corrective action based on cause and hazard level. Recurring deficiencies are identified and channeled into either an enhanced maintenance program or for capital replacement.

Table 3-2a: Testing & Mtce – Lines

OVERHEAD AND UNDERGROUND LINES	FREQUENCY
Load break switches (1/6 population)	Annual
Infrared Thermography	Annual
Pole Testing (fibre strength) Poles > 40 years	Annual

Table 3-2b: Testing & Mtce – Stations (TS)

TRANSFORMER STATION MAINTENANCE	1 YEAR INTERVAL	2 YEAR INTERVAL	4 YEAR INTERVAL	5 YEAR INTERVAL	10 YEAR INTERVAL
TS Maintenance					
Transformer & Line Switches			X		
Bus					X
Protections Transformer/Line/CBF		X			
Bus Protections		X			
Bank and Tie Breakers		X			
Feeders (breakers/cables/protections)			X		
Battery Banks	X				
Sustained Alarms		X			
Full SCADA Check		X			
IR Thermography	X				
Transformer Oil Testing	X				
Painting					X
Vibration Analysis (Tx oil cooling fans and pumps)	X				

Table 3-2c: Testing & Mtce – Stations (MS/DS)

TRANSFORMER STATION MAINTENANCE	1 YEAR INTERVAL	2 YEAR INTERVAL	4 YEAR INTERVAL	5 YEAR INTERVAL	10 YEAR INTERVAL
MS-DS Maintenance					
Transformers & Line Switches				X	
Bus Inspection					X
Station 24/48 Battery Banks	X				
Breakers / Reclosers/ Protections				X	
Capacitor Banks & Switches				X	
SCADA/Local Alarms		X			
Feeders				X	
Transformer Oil Testing	X				
IR Thermography	X				
Painting					X

Table 3-2d: Testing & Mtce – Information Technologies

INFORMATION & TECHNOLOGY SYSTEMS	FREQUENCY
Backup Software Version Upgrades	As Needed
3rd Party Application Software Upgrades & Patches	As Needed

Table 3-2e: Testing & Mtce – Fleet / Rolling Stock

FLEET / ROLLING STOCK	FREQUENCY
All commercial vehicles (vehicles > 4,500 kg) receive a lube, oil, filter.	24 weeks
All aerial devices and cranes have a visual boom inspection and preventative maintenance.	6 weeks
All aerial devices and cranes have a full boom inspection including rotation bearing checks and preventative maintenance completed.	Annual
All small vehicles (< 4,500 kg) receive preventative maintenance of lube, oil, filter .	18 weeks

Asset Capacity Utilization / Constraint Assessment

WNH has continuous monitoring on all of its supply points; transformer station and municipal/distribution station transformers, busses and distribution feeders. Capacities for all of these assets have been determined and alarms have been programmed in SCADA providing automatic warning to Control Room operators of approaching loading limits.

WNH has developed and maintains an electrical connectivity model of its distribution system. Engineers employing load flow analysis software, check outputs of the model against the operation of the distribution system to identify existing or impending system constraints.

Actual system loading data is recorded and archived for supply planning and asset management. Engineering staff monitor loading levels and trends to assist in developing the timing for future capacity upgrades.

Based on WNH's evaluation of its distribution system, it is expected to have sufficient capacity to accommodate new Renewable Energy Generators and new load connections forecast for the years 2016 - 2020. Further details on distribution system capacity can be found in **Section 3.2.4 and Appendix A.**

Load and Renewable Energy Generation is expected to increase throughout the forecast period however not at a pace that would impose any capacity constraints or any changes in loading requirements of the system.

There are no investment requirements for any expansion or reinforcement necessary to remove grid constraints to accommodate the connections of renewable energy generation under the province's Feed-in-Tariff (FIT) and microFIT programs for the period 2016-2020. There are investments outlined in this DS Plan that will provide WNH with a greater flexibility with existing capacity to keep generators and load customers connected to the distribution system under a wider range of abnormal system conditions. These investments will also allow a greater and timelier ability to restore power.

Historical Period Data – Customer Interruptions due to Equipment Failure

As previously illustrated in **Table 2-15**, defective equipment accounted for 20% of all reliability events from 2010 – 2014. WNH keeps detailed records on customer interruptions by cause code.

Detailed historical data on customer interruptions due to equipment failure (cause code #5) can be found in WNH's Annual Service Continuity Report on Distribution System Performance, **Appendix F, pages 4, 13, and 14.**

Worst Performing Feeder

Annually WNH analyses and ranks feeder performance and focuses on worst performing areas. WNH analyses the geospatial relationship of faults with cause codes and other pertinent information to identify line sections that are under performing. Outcomes from this process can range from minor maintenance such as additional insulator washing or tree trimming to moderate enhancements such as increasing line reinsulation or animal guarding to more significant capital renewal investments. WNH's Annual Service Continuity report on Distribution System performance can be found in **Appendix F.**

Reliability Risk / Consequence of Failure Analysis

When dealing with risk, WNH's Asset Management process attempts to answer three basic questions:

1. What can go wrong?
2. How likely (probability) is something to go wrong?
3. What and how severe are the potential detriments, or the adverse consequences?

As previously stated in this section, WNH maintains an extensive Asset Register and a body of condition data for its assets. In addition, through continuous monitoring (SCADA), inspection and maintenance programs WNH has a very good understanding of the condition of its assets. WNH also utilizes the skills, training and experience of its engineering and operations staff to be able to recognize and assess potential asset problems.

As previously stated WNH's asset condition, age and performance targets are either prescribed (i.e. OEB, IESO) or adopted (i.e. IEC, IEEE, CEA, industry best practices). Utilizing the judgment, skills and experience of in-house and contracted subject matter experts, WNH analyses and compares actual asset condition and performance to target parameters. The degree to which these targets are approached or exceeded helps define the relative probability that the asset may physically fail or may fail to meet performance targets.

WNH uses qualitative and semi-quantitative risk assessment methods to determine the severity of the asset condition or performance and the probability of occurrence. WNH's qualitative methods are based on the judgment, skills and experience of specialists and experts. WNH's semi-quantitative methods use classifications such as low, medium, high or immediate to provide relative levels of risk.

In determining the consequences of failure, WNH considers the known failure modes of the asset along with the asset type, distribution system impacts (supply & reliability), its physical proximity to the workers and the public (safety), proximity to sensitive areas (environmental), cost of asset failure (cost of replacement), and consequential damages (customer service). These factors may vary due to seasonal influences (summer versus winter), system conditions, and system operating conditions (other forced or planned constraints).

WNH’s evaluation of risk informs the DS Plan’s investment prioritization process.

3.2 Overview of Assets Managed (5.3.2)

3.2.1 (5.3.2a) description/explanation of features of the distribution service area pertinent for asset management purposes:

This section makes a number of references to information contained in **Section 1.2.** A thorough reading of **Section 1.2** will aid in the understanding of assets managed by WNH.

Embedded Distributors

WNH's service area is bounded by Kitchener-Wilmot Hydro, Cambridge and North Dumfries Hydro, and HONI.

- HONI is embedded to WNH on the 27.6 kV Feeder (33M2) out of Elmira TS.
- WNH is embedded to
    - HONI on the 44 kV Feeder (73M2) out of Fergus TS.
    - Cambridge and North Dumfries Hydro on the 27.6 kV Feeder (21M25) out of Preston TS.
    - Kitchener-Wilmot Hydro on the 27.6 kV Feeder (9M4) out of Kitchener-Wilmot MTS #9.

These points of supply, although not significant in terms of gross capacity have strategic value as they enter the WNH service territory at locations remote to WNH main Transformer Stations and provide alternate points of supply in the rural area to assist with load recovery during storm events.

Weather

WNH experiences weather typical of South Western Ontario; however the last several years have been marked with an increase in the frequency of severe weather events. WNH's large rural area provides a greater exposure to damage by severe wind and ice events**. Section 2.3.1.3** *Asset and/or System Operations Performance* provides additional information of weather related impacts on WNH's reliability.

Service Area Size & Customer Density

WNH is an amalgamated utility that has one of the largest service areas in the province at 672 sq. km. of which 90% is rural. The urban and rural component of WNH's service area is illustrated in **Table 1-1 and Fig 1-2.** This is pertinent because it translates to a significantly high number of overhead line assets per customer served that need to be maintained and replaced. WNH's Service Area current Population and Customer densities served are illustrated in **Tables 1-2 and Table 1-3**.

Load Growth

As discussed in **Section 1.2,** WNH operates in a growing regional economy. WNH's recent growth in electrical peak demand (kW) is illustrated in **Figure 1-4.**

Due to the characteristic of WNH's customer base, the system peak is affected to a higher degree by weather and local development conditions and to a lesser degree by provincial or global factors. WNH's system peak has a tendency to rebound from recessions faster than other Ontario jurisdictions. Conservation and green power generation have recently slowed the growth in electrical demand to 2%, still double the provincial average. Since 1996 WNH's electrical demand has been summer peaking with a relatively high variability with respect to temperature due to electrical air conditioning loads. WNH's winter peak demand has experienced less growth since 2004 and has considerably less variability to temperature due in part to the shift away from electric heating loads over the past two decades. More detailed information is provided in **Section 1.2**

3.2.2 (5.3.2b) description of system configuration:

This section makes a number of references to information contained in **Section 1.2.** A thorough reading of **Section 1.2** will aid in the understanding of system configuration.

WNH is connected to the HONI Transmission System (HONI Tx) through 5 grid connected DESN Transformer Stations (TS's) as illustrated in **Table 1-6**. Four (4) of these are owned and operated by WNH. One (1), Elmira Transformer Station (ELTS), is owned and operated by HONI and is embedded inside of WNH's service territory. WNH owns 2 and portions of the third feeder

emanating from the ELTS. Approximately 90% of the ELTS load is supplied from WNH customers with the remaining load supplied from HONI customers in nearby Wellington County. WNH also receives electrical supply at < 50 kV (Dx) from 3 neighbouring LDCs; Hydro One Distribution (HONI Dx), Kitchener-Wilmot Hydro (KWH) and Cambridge and North Dumfries Hydro (CNDH).
In addition to the TSs noted in **Table 1-6**, WNH's distribution network consists of 13 Municipal and Distribution Stations (MS/DS) operating at < 50 kV; an overview of which is provided in **Table 1-8.**

WNH currently operates thirty-two 13.8 kV and ten 27.6 kV, 600 amp feeders each being comprised of overhead and underground sections. The feeders are operated in a radial network and all have interconnectivity to adjacent feeders for reliability and load transfer capabilities. In addition, WNH operates twenty-two 8.32 kV and nineteen 4.16 kV, 400 amp feeders in a similar manner.

Table 3-3 and **Table 3-4** provide an overview of WNH's circuit lengths by voltage and other major distribution equipment.

Table 3-3: Distribution Line Length by Voltage Level

Voltage (kV)	OH Line Length (m)	%	UG Line Length (m)	%	Total Length (m)	%
2.4	6,970	0.6%	6,595	1.3%	13,565	0.8%
4.16	32,616	3.0%	1,783	0.3%	34,399	2.1%
4.8	302,661	27.8%	15,687	3.0%	318,348	19.8%
8.0	23,290	2.1%	303,983	58.8%	327,273	20.4%
8.32	189,260	17.4%	1,385	0.3%	190,645	11.9%
13.8	206,557	19.0%	20,129	3.9%	226,686	14.1%
16.0	52,397	4.8%	150,612	29.1%	203,009	12.6%
27.6	256,667	23.6%	16,536	3.2%	273,203	17.0%
44.0	18,654	1.7%		0.0%	18,654	1.2%
Total	1,089,072	100%	516,710	100%	1,605,782	100%

Table 3-4: Other Distribution Equipment

	Asset Group	Single Phase	Three Phase	Total
1	Poles			21,229
2	Distribution Transformers	7,649	651	8,300
3	Revenue Meters	51,177	3,951	55,128
4	SCADA Integrated Reclosers (Lines)		36	36
5	SCADA Integrated Fault Indicators		12	12
6	Capacitor Banks		52	52
7	Load Break Switches		496	496
8	Reclosers (non SCADA)	7	35	42

More detailed information regarding WNH's Distribution Assets are provided **Section 3.2.3.**

WNH has a total of 371 Renewable Energy Generators (REG's) totaling 8.2 MW connected to its distribution system. **Figure 1-7** illustrates the growth in Renewable Generation since 2010. WNH's total REG is relatively small when compared to WNH's system capacity and therefore have little impact on system operation. Please refer to WNH's Renewable Energy Generation (REG) Investments Plan regarding the readiness of Waterloo North Hydro's (WNH) distribution system to connect Renewable Energy Generation. There are no constraints preventing the connection of additional distributed generation from renewable sources to WNH's distribution system. There are no investment requirements for any expansion or reinforcement necessary to remove grid constraints to accommodate the connections of renewable energy generation under the province's Feed-in-Tariff (FIT) and microFIT programs for the period 2016 - 2020.

3.2.3 (5.3.2c) information by asset type on quantity/years in service profile and condition, including the date the data was compiled:

WNH maintains an extensive asset register and has established comprehensive data collection, asset inspection, testing and maintenance programs to provide condition assessments for its major distribution system assets.

Factors such as assessment data, remaining TUL, and asset performance are evaluated with respect to condition and performance targets to develop a condition rating.

This data was compiled during the first quarter of 2015 and represents the most up to data information WNH has on its distribution assets.

Power Transformers (115 kV and 230 kV TS's)

WNH has adopted a TUL of 50 years for large power transformers. This is consistent with the Kinectrics Report and WNH's own experience.

Table 3-5: Power Transformer (TUL)

	KINECTRICS STUDY		**WNH**
Min UL	TUL	Max UL	**TUL**
30	45	60	**50**

WNH owns a fleet of 8 large power transformers (**Table 3-6**) connected to the HONI transmission system. With an average age of 22.6 years, approximately 92% of WNH's total electrical supply flows through these assets. Due to their importance, asset condition is frequently monitored and assessed. These are high valued capital assets and WNH invests in comprehensive inspection and maintenance programs to ensure TUL's are maximized.

MTS #3 is a relatively new station constructed in 2000-2001. ERTS originally went into service in 1963 and was rebuilt in two phases, 1995 and 2012. HMSTS"B" went into service in 1988 and its two transformers are at approximately mid-life.

Table 3-6: Large Power Transformer Age & Condition

	Transformer Stations	HV (kV)	LV (kV)	Tx ID	Tx ONAF Rating (MVA)	In Service	Age	WNH TUL (yrs)	Remaining TUL	Condition
1	HMSTS “A”	230	13.8	T1	50.0	1969	46	50	8%	Fair
2				T2	50.0	1969	46	50	8%	Fair
3	HMSTS “B”	230	13.8	T3	83.0	1986	29	50	42%	Good
4				T4	83.0	1988	27	50	46%	Good
5	MTS #3	230	27.6	T1	67.0	2001	14	50	72%	Very Good
6				T2	67.0	2001	14	50	72%	Very Good
7	ERTS	115	13.8	T1	50.0	2013	2	50	96%	Very Good
8				T2	50.0	2012	3	50	94%	Very Good

HMSTS”A” T1 and T2 will reach their TUL in 2019 however ongoing condition assessments indicate that these assets may outperform this date. Extending the life of these transformers will be assisted with the overhaul/replacement of high voltage bushings and tap changers. Due to their age and condition there are no material capital investments needed for either ERTS or MTS#3 transformers assets prior to 2020.

Transformer Station (TS) Switchgear

WNH has adopted a TUL of 30 years for medium voltage station switchgear. This is consistent with the Kinectrics Report and WNH’s own experience.

Table 3-7: Transformer Station Switchgear (TUL)

	KINECTRICS STUDY		**WNH**
Min UL	TUL	Max UL	**TUL**
30	45	60	**30**

HMSTS “A” switchgear originally went into service in 1969. In 2005-2006 as part of a life extension project, the switchgear was rebuilt and provided with Arc Resistant ‘B” enhancements for safety and reliability. This work is expected to increase the expected life of these assets by an additional 20 years.

Table 3-8: TS Switchgear Age and Condition

# SWGR	Transformer Stations	LV (kV)	BUS ID	Bus Rating (A)	In Service	Age	WNH TUL (yrs)	Remaining TUL	Condition
1	HMSTS “A”	13.8	B	3000	2006	9	20	55%	Good
2			Y	3000	2006	9	20	55%	Good
3	HMSTS “B”	13.8	H	2500	1986	29	30	3%	Poor
4			J	2500	1986	29	30	3%	Poor
5			Q	2500	1986	29	30	3%	Poor
6			T	2500	1986	29	30	3%	Poor
7	MTS #3	27.6	B1	2400	2000	15	30	50%	Good
8			B2	2400	2000	15	30	50%	Good
9	ERTS	13.8	B1	3000	1996	19	30	37%	Good
10			B2	3000	1996	19	30	37%	Good

HMSTS “B” switchgear originally went into service in two stages, in 1986 and 1988. These assets are reaching their expected TUL and condition inspections and assessments have found deterioration of insulation systems within the switchgear. The assets are currently undergoing life extension work similar to that performed at HMSTS”A”. Capital investments will extend into the 2016 – 2020 forecast period and are part of this DS Plan.

Due to their age and condition, there are no material capital investments needed for either ERTS or MTS#3 switchgear assets prior to 2020.

Transformer Station (TS) Circuit Breakers

WNH has adopted a TUL of 30 years for medium voltage station circuit breakers. This is consistent with the Kinectrics Report and WNH’s own experience.

Table 3-9: Medium Voltage TS Circuit Breaker (TUL)

	KINECTRICS STUDY		**WNH**
Min UL	TUL	Max UL	**TUL**
30	50	60	**30**

There are approximately 65 assets in this group including spare units and they are divided into two categories; main/tie breakers and feeder breakers.

Table 3-10: TS Main and Tie Breaker Age and Condition

# BKR	Transformer Stations	LV (kV)	BREAKER ID	Bus Rating (A)	In Service	Age	WNH TUL (yrs)	Remaining TUL	Condition
1	HMSTS “A”	13.8	B	3000	2006	9	30	70%	Good
2			Y	3000	2006	9	30	70%	Good
3			BY	3000	2006	9	30	70%	Good
4	HMSTS “B”	13.8	H	2500	1986	29	30	3%	Poor
5			J	2500	1986	29	30	3%	Poor
6			HJ	2500	1986	29	30	3%	Poor
7			Q	2500	1986	29	30	3%	Poor
8			T	2500	1986	29	30	3%	Poor
9			QT	2500	1986	29	30	3%	Poor
10	MTS #3	27.6	B1	2400	2000	15	30	50%	Good
11			B2	2400	2000	15	30	50%	Good
12			B1B2	2400	2000	15	30	50%	Good
13	ERTS	13.8	B1	3000	1996	19	30	37%	Good
14			B2	3000	1996	19	30	37%	Good
15			B1B2	3000	1996	19	30	37%	Good

HMTS”A” went into service in 1969. In 2005-2006 as part of a life extension project, WNH replaced the old 1969 air magnetic circuit breakers with vacuum retrofit breakers. These assets were past their TUL, required high maintenance, contained asbestos arc chutes and were prone to catastrophic failure.

A number of HMSTS”B” circuit breakers are nearing their TUL. WNH has been experiencing breaker component failures, and high contact resistance. WNH’s life extension strategy is to use both replacement and refurbishment of these units to minimize capital costs.

Due to their age and condition there are no material capital investments needed for either ERTS or MTS#3 circuit assets prior to 2020.

Table 3-11a: TS Feeder Breaker Age and Condition

# BKR	Transformer Stations	LV (kV)	Feeder ID	Bus Rating (A)	In Service	Age	WNH TUL (yrs)	Remaining TUL	Condition
1	HMSTS “A”	13.8	HS 7	1200	2012	3	30	90%	Very Good
2		13.8	HS 8	1200	2012	3	30	90%	Very Good
3		13.8	HS 9	1200	2012	3	30	90%	Very Good
4		13.8	HS 10	1200	2012	3	30	90%	Very Good
5		13.8	HS 11	1200	2012	3	30	90%	Very Good
6		13.8	HS 12	1200	2012	3	30	90%	Very Good
7		13.8	HS 13	1200	2012	3	30	90%	Very Good
8		13.8	HS 14	1200	2012	3	30	90%	Very Good
9	HMSTS “B”	13.8	HS 15	1200	1995	20	30	33%	Fair
10		13.8	HS 16	1200	1996	19	30	37%	Fair
11		13.8	HS 17	1200	2014	1	30	97%	Very Good
12		13.8	HS 18	1200	1994	21	30	30%	Fair
13		13.8	HS 19	1200	1993	22	30	27%	Fair
14		13.8	HS 20	1200	1986	29	30	3%	Poor
15		13.8	HS 21	1200	1986	29	30	3%	Poor
16		13.8	HS 22	1200	2009	6	30	80%	Very Good
17		13.8	HS 23	1200	1989	26	30	13%	Poor
18		13.8	HS 24	1200	1986	29	30	3%	Poor
19		13.8	HS 25	1200	2012	3	30	90%	Very Good
20		13.8	HS 26	1200	1993	22	30	27%	Fair
21		13.8	HS 27	1200	2009	6	30	80%	Very Good
22		13.8	HS 28	1200	1994	21	30	30%	Fair
23		13.8	HS 29	1200	1992	23	30	23%	Fair
24		13.8	HS 30	1200	1992	23	30	23%	Fair

Table 3-11b: TS Feeder Breaker Age and Condition

# BKR	Transformer Stations	LV (kV)	Feeder ID	Bus Rating (A)	In Service	Age	WNH TUL (yrs)	Remaining TUL	Condition
25	MTS #3	27.6	3F-60	1200	2001	14	30	53%	Good
26		27.6	3F-61	1200	2001	14	30	53%	Good
27		27.6	3F-62	1200	2001	14	30	53%	Good
28		27.6	3F-63	1200	2001	14	30	53%	Good
29		27.6	3F-64	1200	2001	14	30	53%	Good
30		27.6	3F-65	1200	2001	14	30	53%	Good
31		27.6	3F-66	1200	2001	14	30	53%	Good
32		27.6	3F-67	1200	2001	14	30	53%	Good
33		27.6	3F-68	1200	2001	14	30	53%	Good
34		27.6	3F-69	1200	2001	14	30	53%	Good
35		27.6	3F-50	1200	2001	14	30	53%	Good
36		27.6	3F-51	1200	2001	14	30	53%	Good
37	ERTS	13.8	ER-41	1200	1996	19	30	37%	Good
38		13.8	ER-42	1200	1996	19	30	37%	Good
39		13.8	ER-43	1200	1996	19	30	37%	Good
40		13.8	ER-44	1200	1996	19	30	37%	Good
41		13.8	ER-45	1200	1996	19	30	37%	Good
42		13.8	ER-46	1200	1996	19	30	37%	Good
43		13.8	ER-47	1200	1996	19	30	37%	Good
44		13.8	ER-48	1200	1996	19	30	37%	Good

Transformer Station (TS) Feeder Cables

WNH has adopted a TUL of 35 years for medium voltage station feeder cables. This is consistent with the Kinectrics Report and WNH's own experience.

Table 3-12: Medium Voltage TS Feeder Cables (TUL)

	KINECTRICS STUDY		**WNH**
Min UL	TUL	Max UL	**TUL**
35	40	55	**35**

There are 45 sets of station feeder cables of various age and circuit lengths.

At HMTS"A", WNH replaced the original 1969 feeder cables between 2011 and 2013.

At HMSTS "B" WNH has a number of feeders in fair condition. Asset condition assessments are performed regularly and these assets will be monitored closely as they approach their TUL.

Due to their age and condition there are no material capital investments needed for either ERTS or MTS#3 cable replacement assets prior to 2020. There are 2 spare feeders that will be placed into service in 2015.

Table 3-13a: TS Feeder Cable Age and Condition

# FDR	Transformer Stations	LV (kV)	Feeder ID	Bus Rating (A)	In Service	Age	WNH TUL (yrs)	Remaining TUL	Condition
1	HMSTS "A"	13.8	HS 7	600	2011	4	35	89%	Very Good
2		13.8	HS 8	600	2011	4	35	89%	Very Good
3		13.8	HS 9	600	2011	4	35	89%	Very Good
4		13.8	HS 10	600	2011	4	35	89%	Very Good
5		13.8	HS 11	600	2013	2	35	94%	Very Good
6		13.8	HS 12	600	2013	2	35	94%	Very Good
7		13.8	HS 13	600	2013	2	35	94%	Very Good
8		13.8	HS 14	600	2013	2	35	94%	Very Good
9	HMSTS "B"	13.8	HS 15	600	1992	23	35	34%	Fair
10		13.8	HS 16	600	1991	24	35	31%	Fair
11		13.8	HS 17	600	2014	1	35	97%	Very Good
12		13.8	HS 18	600	2009	6	35	83%	Very Good
13		13.8	HS 19	600	1992	23	35	34%	Fair
14		13.8	HS 20	600	1986	29	35	17%	Fair
15		13.8	HS 21	600	1986	29	35	17%	Fair
16		13.8	HS 22	600	1987	28	35	20%	Fair
17		13.8	HS 23	600	1989	26	35	26%	Fair
18		13.8	HS 24	600	1986	29	35	17%	Fair
19		13.8	HS 25	600	2009	6	35	83%	Very Good
20		13.8	HS 26	600	1992	23	35	34%	Fair
21		13.8	HS 27	600	1996	19	35	46%	Good
22		13.8	HS 28	600	1993	22	35	37%	Fair
23		13.8	HS 29	600	1992	23	35	34%	Fair
24		13.8	HS 30	600	1991	24	35	31%	Fair

Table 3-13b: TS Feeder Cable Age and Condition

# FDR	Transformer Stations	LV (kV)	Feeder ID	Bus Rating (A)	In Service	Age	WNH TUL (yrs)	Remaining TUL	Condition
25	MTS #3	27.6	3F-60	600	2003	12	35	66%	Good
26		27.6	3F-61	600	2002	13	35	63%	Good
27		27.6	3F-62	600	2002	13	35	63%	Good
28		27.6	3F-63	600	2002	13	35	63%	Good
29		27.6	3F-64						SPARE
30		27.6	3F-65	600	2003	12	35	66%	Good
31		27.6	3F-66	600	2002	13	35	63%	Good
32		27.6	3F-67	600	2002	13	35	63%	Good
33		27.6	3F-68	600	2002	13	35	63%	Good
34		27.6	3F-69						SPARE
35		27.6	3F-50	600	2002	13	35	63%	Good
36		27.6	3F-51	600	2002	13	35	63%	Good
37	ERTS	13.8	ER-41	600	1996	19	35	46%	Good
38		13.8	ER-42	600	1996	19	35	46%	Good
39		13.8	ER-43	600	1996	19	35	46%	Good
40		13.8	ER-44	600	1996	19	35	46%	Good
41		13.8	ER-45	600	1996	19	35	46%	Good
42		13.8	ER-46	600	1996	19	35	46%	Good
43		13.8	ER-47	600	1996	19	35	46%	Good
44		13.8	ER-48	600	1996	19	35	46%	Good

High Voltage Transformer Circuit Switches (230 kV and 115 kV)

WNH has adopted a TUL of 30 years for high voltage station switches. This is consistent with the Kinectrics Report and WNH's own experience.

Table 3-14: Transformer Station Switchgear (TUL)

	KINECTRICS STUDY		**WNH**
Min UL	TUL	Max UL	**TUL**
30	45	60	**30**

HMSTS "A" 230 kV air break switches originally went into service in 1969. In 2005 - 2006 as part of a life extension project, these switches were replaced due to high maintenance, numerous misoperations as a result of failing components and concerns over the risk of failure. Although the replacement units are only 14 years old, currently their condition has been downgraded from "Good" to "Fair" due to operational performance.

WNH has been in discussions with the vendor and if recent component replacements are found not to be effective, these units may not reach their expected TUL and will need to be retired early.

At HMSTS "B" although the switches are reaching their TUL, their operational performance and maintenance requirements have been good. Asset condition assessments are performed regularly and these assets will be monitored closely as they reach their TUL.

Table 3-15: TS HV Circuit Switches

# Tx	Transformer Stations	HV (kV)	Tx ID	In Service	Age	WNH TUL (yrs)	Remaining TUL	Condition
1	HMSTS "A"	230	T1	2006	9	30	70%	Fair
2			T2	2006	9	30	70%	Fair
3	HMSTS "B"	230	T3	1986	29	30	3%	Fair
4			T4	1988	27	30	10%	Fair
5	MTS #3	230	T1	2001	14	30	53%	Very Good
6			T2	2001	14	30	53%	Very Good
7	ERTS	115	T1	2012	3	30	90%	Very Good
8			T2	2012	3	30	90%	Very Good

Due to their age and condition there are no material capital investments needed for either ERTS or MTS#3 high voltage switch assets prior to 2020.

Transformer Station (TS) Protection Systems

The expected TUL of 15 years is based on WNH's experience with electronic and first generation programmable microprocessor protection relays.

Table 3-16: TS Protection Systems (TUL)

	KINECTRICS STUDY		**WNH**
Min UL	TUL	Max UL	**TUL**
15	20	20	**15**

WNH has updated all of its TS Protection Systems with modern programmable microprocessor based relays. These relays have the ability to be interrogated and reconfigured remotely and have multiple sets of protection settings to support reconfiguration during abnormal system conditions. These relays will support WNH's Distribution Automation initiative to implement Feeder Fault Detection, Isolation and Restoration (FDIR).

Although MTS#3 relays are aging and nearing their TUL, their performance can be categorized as very good. In addition to on-board health diagnostics, the accuracy and functionality of these assets are reverifed every 2 – 4 years depending on the protection group.

Unlike previous generations of protection relays, the majority at MTS#3 are modular in form, making component failure easier to correct. Availability of spare parts and vendor firmware support remains strong. Overall, WNH has assessed these assets to be in "Fair" condition. WNH does not expect to make any material investments in these systems over the forecast period.

Table 3-17: TS Protection Systems Age and Condition

# Tx	Transformer Stations	Line	Tx	Bus	Feeder	Ave Age	WNH TUL (yrs)	Remaining TUL	Condition
1	HMSTS "A"	2009	2009	2009	2009	6	15.0	60%	Good
2	HMSTS "B"	2015	2014	2014	2011	2	15.0	90%	Very Good
3	MTS #3	2001	2001	2001	2001	14	15.0	7%	Fair
4	ERTS	2012	2012	2012	2012	3	15.0	80%	Very Good

Municipal and Distribution Power Transformers

Historically WNH used a TUL of 30 years for MS / DS Station transformer assets. This is consistent with the Kinectrics Report.

Table 3-18: MS/DS Transformer (TUL)

	KINECTRICS STUDY		WNH
Min UL	TUL	Max UL	TUL
30	45	60	**30**

Over the years WNH's SR programs for 4.16 kV and 8.32 kV distribution line assets has allowed for the concurrent uprating of these assets to higher and more efficient voltages. A significant portion of WNH's 4.16 kV distribution system has been replaced over time and the remainder is expected to be out of service by 2018. Similarly for the 8.32 kV distribution system, WNH's Renewal program will ultimately retire all of these assets by 2030.

There are 13 stations with 15 medium sized station power transformers remaining in service at the end of 2014. The average age of this asset group is 50 years. **Table 3-19** provides individual station information.

Table 3-19: MS/DS Transformer Age & Condition

	MS/DS	Location	HV (kV)	LV (kV)	Tx ID	Transformer Rating (MVA)	In Service	Age	Condition	NOTES
1	MS#1	Waterloo	13.8	4.16	T1	3.0	1952	63	Poor	OOS 2016
			13.8	4.16	T2	3.0	1952	63	Poor	OOS 2016
2	MS#5	Waterloo	13.8	4.16	T1	6.0	1967	48	Fair	OOS 2016
3	MS#22	Elmira	27.6	4.16	T1	3.6	1949	66	Poor	OOS 2018
4	MS#23	Elmira	27.6	4.16	T1	6.7	1971	44	Fair	OOS 2018
5	MS#24	Elmira	27.6	4.16	T1	5.0	1975	40	Fair	OOS 2017
6	DS#26	Wellesley	27.6	8.32	T1	5.0	1990	25	Good	MUS backup
7	DS#27	Wallenstein	27.6	8.32	T1	3.6	1947	68	Poor	MUS Backup
8	DS#28	Floradale	27.6	8.32	T1	5.0	1996	19	Good	MUS Backup
9	DS#29	St Jacobs	27.6	8.32	T1	3.6	1948	67	Poor	MUS Backup
			27.6	8.32	T2	3.6	1954	61	Poor	MUS Backup
10	DS#30	Zubers Corners	44.0	8.32	T1	5.0	1976	39	Fair	Spare available
11	DS#31	Bloomingdale	27.6	8.32	T1	5.0	1980	35	Good	MUS Backup
12	DS#32	Breslau	27.6	8.32	T1	5.0	1967	48	Fair	OOS 2018
13	DS#34	South Woolwich	27.6	8.32	T1	2.0	1952	63	Poor	OOS 2016

(OOS – Out of Service) (MUS – Mobile Unit Substation)

To manage the remaining population of station transformers and to mitigate the increasing risk associated with their age, WNH is taking the following approach;

1. WNH owns and maintains a mobile unit substation (MUS) to provide temporary supply to any 4.16kV or 8.32 kV station within 4 hours.

2. WNH maintains 1-44 kV and 1-27.6 kV transformer (used) that can be pressed into service in case of failure; and

3. WNH is planning to make an investment in 2018 to replace or extend the life of one of its oldest transformers (DS 27 or DS 29).

Overhead Lines

WNH tracks the following overhead line assets in its asset registry;

1. Poles;
2. Conductor and devices;
3. Transformers.

The age and condition of poles are the main drivers of overhead line SR investments. Although other assets associated with overhead lines such as distribution transformers, wires, insulators and switches generally have slightly longer TUL's, when it comes time to replace the poles, the remaining life of these associated assets is normally not sufficient to justify off-cycle replacement. WNH performs full inspections of all assets during renewal projects and will salvage any assets that condition and standards will allow.

Poles

It can be seen in **Table 3-20** that of WNH's approximately 21,200 poles, of which 97.2% are wood. Their age and condition are the main drivers in overhead line renewal projects. Concrete, steel and composite poles comprise only a small portion of the population and are typically only used in specialized applications.

Table 3-20: WNH Pole Demographics

WNH Pole Population		Units	% POP
Wood	Cedar	5,907	27.8%
	Pine	14,727	69.4%
Wood	**Total**	**20,634**	**97.2%**
Concrete		311	1.5%
Steel		280	1.3%
Composite		4	0.0%
Total		**21,229**	**100.0%**

WNH utilizes 3 factors in determining the condition of its wood pole assets;

1. Age
2. Wood fibre strength (pole testing)
3. Visual Inspections

Age is one of the determining factors in the overall condition assessment of wood poles. **Table 3-21** illustrates that WNH's pole population has an average and median age of 22 and 24.5 respectively. In recent years WNH has moved away from cedar poles to pine poles which are lower in cost and believed to be able to provide a longer TUL.

Table 3-21: WNH Pole Age

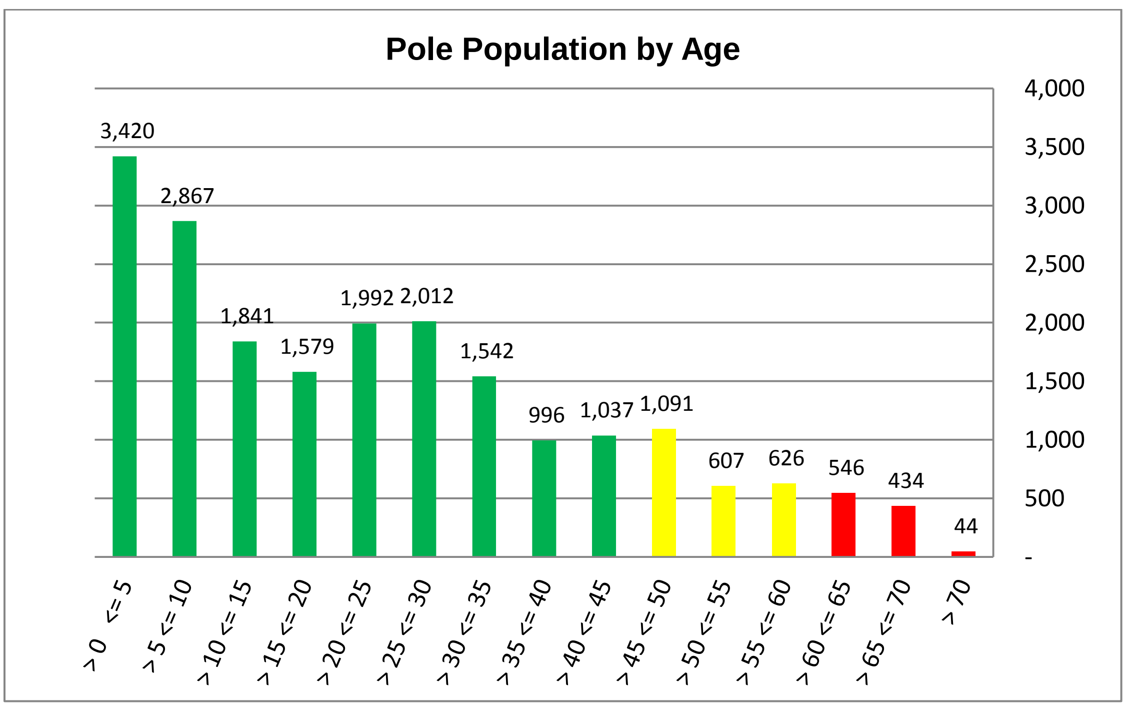
	Total POP	PINE	CEDAR
Poles	20,634	14,727	5,907
Ave Age	24.5	22.7	29.2
Median Age	22.0	14.0	28.0

Table 3-22 further breaks down WNH's pole population by decade.

Table 3-22: WNH Wood Pole Age

AGE of Wood Poles (yrs)	ALL Units	% POP
> 70	44	0.2%
> 65 <= 70	434	2.1%
> 60 <= 65	546	2.6%
> 55 <= 60	626	3.0%
> 50 <= 55	607	2.9%
> 45 <= 50	1,091	5.3%
> 40 <= 45	1,037	5.0%
> 35 <= 40	996	4.8%
> 30 <= 35	1,542	7.5%
> 25 <= 30	2,012	9.8%
> 20 <= 25	1,992	9.7%
> 15 <= 20	1,579	7.7%
> 10 <= 15	1,841	8.9%
> 5 <= 10	2,867	13.9%
> 0 <= 5	3,420	17%
	20,634	100%

Figure 3-2: WNH Pole Age



Wood fibre strength is another determining factor in the overall condition assessment of wood poles. The normal failure mode for wood poles is loss of mechanical strength due to wood fibre deterioration causing the wood fibres to become overstressed which leads to structural collapse of the pole. Poles with remaining fibre strength less than 50% are scheduled for immediate replacement. Poles with remaining fibre strength between 50% and 67% are scheduled to be replaced in 1 - 2 years. Poles with remaining fibre strength between 67% and 70% are scheduled to be retested in 5 years.

Wood is a natural fibre. Neither the initial fibre strength, the application of treatment used to retard fibre degradation nor the degradation process itself is homogeneous across the asset group. While wood fibre strength decreases with age, it does not do so in either a linear or homogeneous manner across the asset group.

For these reasons, WNH maintains an extensive inspection and testing program for the management of its wood pole population. Data collected from these programs is routinely analysed and used in determining the condition assessment of wood poles.

Approximately 6,000 poles or 30% of the total population have been tested at the ground line where normally the most significant deterioration occurs. This includes approximately 4,395 poles that are 40 years of age or older as well as other poles that have shown signs of advanced deterioration.

From the results **in Table 3-23** it can be seen that, in general, ground line test results indicate relatively high wood fibre strengths across the pole population, however this is only one type of deteriorating factor that can negatively affect the pole. Other deteriorating conditions such as pole top rotting are best identified through inspection **(Appendix H, Figure AH-1).**

Table 3-23: WNH Pole Fibre Strength

AGE (yrs)	ALL Units	% POP	Ave Fibre Strength	PINE Units	% POP	Ave Fibre Strength	CEDAR Units	% POP	Ave Fibre Strength
Age > 70	44	0.2%	94.8%	41	0.2%	94.6%	3	0.0%	98.0%
Age > 60 <= 70	980	4.7%	94.7%	945	4.6%	94.8%	35	0.2%	92.9%
Age > 50 <= 60	1,233	6.0%	92.1%	1,109	5.4%	92.5%	124	0.6%	87.8%
Age > 40 <= 50	2,128	10.3%	91.4%	1,269	6.2%	91.8%	859	4.2%	90.8%
Age > 30 <= 40	2,538	12.3%	89.0%	1,301	6.3%	91.0%	1,237	6.0%	87.0%
Age > 20 <= 30	4,004	19.4%	92.8%	1,414	6.9%	94.6%	2,590	12.6%	91.8%
Age > 10 <= 20	3,420	16.6%	97.3%	2,628	12.7%	97.8%	792	3.8%	95.5%
Age > 0 <= 10	6,287	30.5%	98.2%	6,020	29.2%	99.2%	267	1.3%	86.0%
	20,634	100%	92.3%	14,727	71.4%	93.3%	5,907	28.6%	89.7%

WNH has engaged Kinectrics to develop health Indices for its wood pole population. This will better support WNH's own condition assessments and analytics. The TUL of an asset is on average, the time an asset remains in service. In addition to physical deterioration previously discussed, wood poles are removed from service for other various reasons including motor vehicle accidents where a pole is struck; municipal relocation work and storm damage.

WNH has adopted a TUL of 45 years **(Table 3-24).** This is consistent with the Kinectrics Report and WNH's own experience.

Table 3-24: Wood Pole TUL

	KINECTRICS STUDY		**WNH**
Min UL	Tul	Max UL	**TUL**
35	45	75	**45**

Health indices developed with the assistance of Kinectrics support an effective renewal program in this DS Plan. As illustrated in **Table 3-25**, approximately 96% of WNH's wood pole population ranges from "Very Good" to "Fair" condition. WNH's own test data and analytics indicate that this population of poles has an average wood fibre strength of approximately 94%. Kinectrics total population differs by 47 poles from WNH's 2014 year-end total due to the timing of the Kinectrics work.

Table 3-25: WNH Wood Pole Health Indices

Kinectrics Health Indices	Subtotal	%	Total	%
Very Good	15,670	76.1%		
Good	3,660	17.8%	19,330	93.9%
Fair	532	2.6%	532	2.6%
Poor	706	3.4%		
Very Poor	19	0.1%	725	3.5%
Total	20,587	100%	20,587	100%

Figure 3-3: Wood Poles Health Index

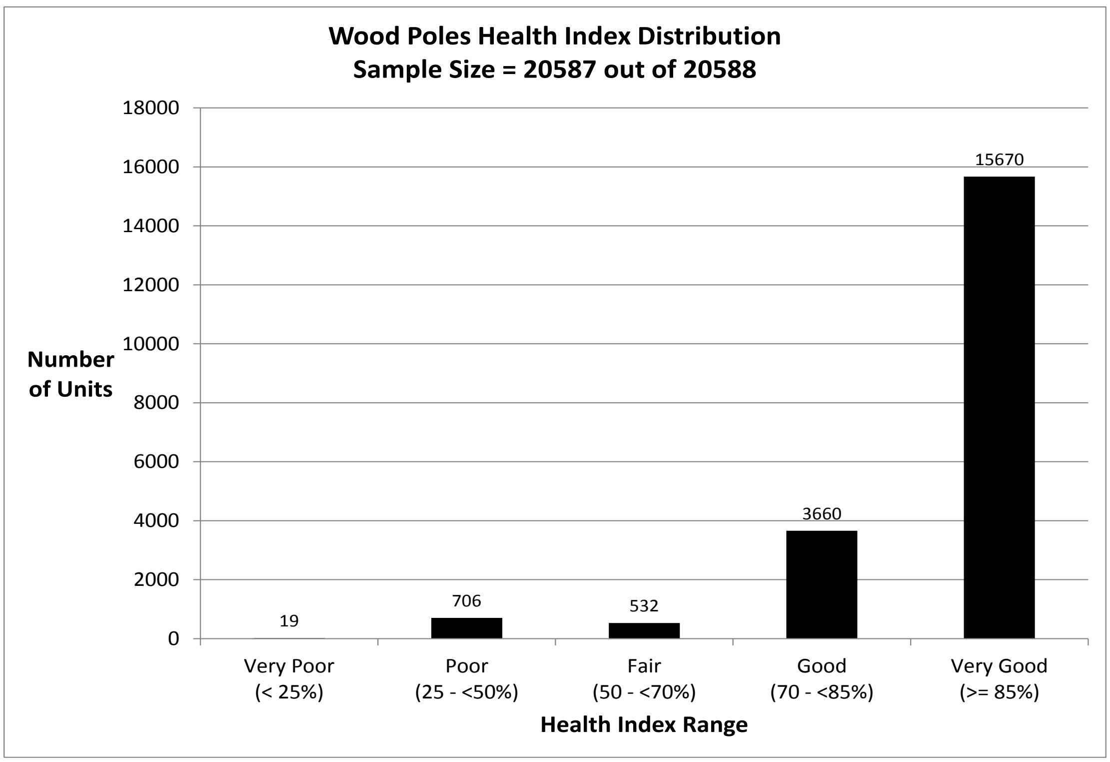
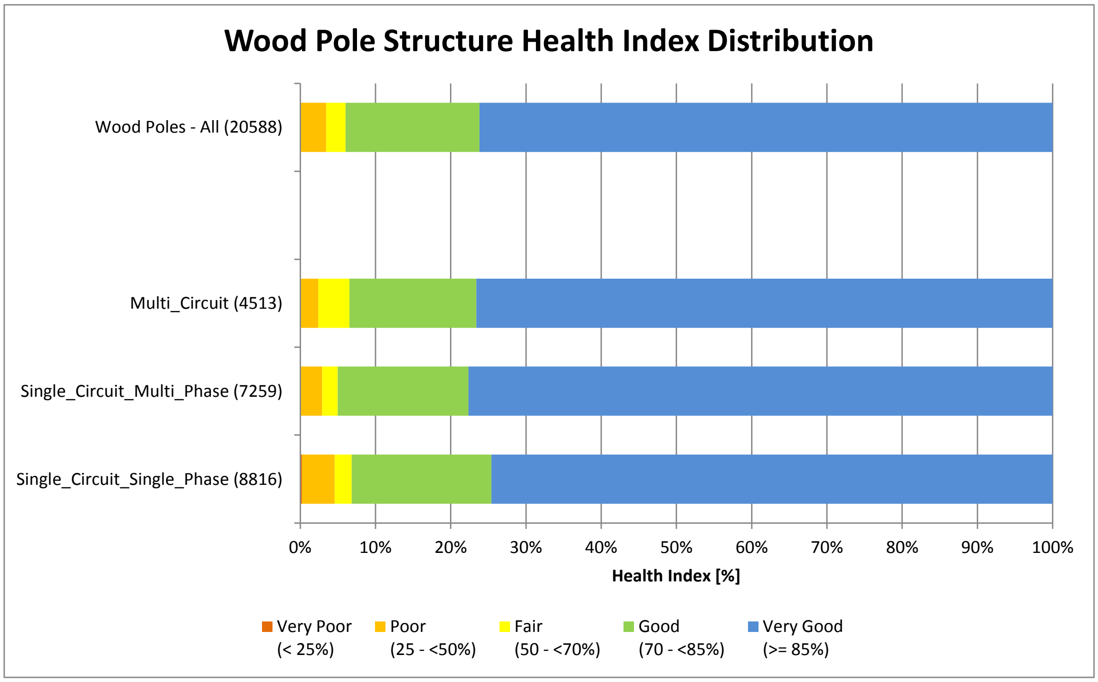


Figure 3-4: Wood Poles Health Index by Number of Circuits



In **Figure 3-3**, poles with a health index of "Very Poor" and poles with a remaining wood fibre strength of < 67% present a high risk of failure, and are recommended to be replaced within the next 12 months. Poles in "Poor" condition are recommended to be replaced during the next 1-2 years. Poles in "Fair" condition are expected to be replaced during the next 3-5 years depending on remaining fibre strength values. These numbers only represents the current health of WNH's pole population. With each passing year more assets will reach the same stage of deterioration and will need to be replaced.

Figure 3-4 breaks out the health indices of wood poles by number of circuits they can impact. In WNH's investment prioritization process, multi-circuit lines which have larger customer impact are weighted more heavily for replacement than single phase lines.

Over the last 10 years WNH has replaced approximately 560 poles per year due to age and condition. In addition WNH has also replaced approximately 100 poles per year due to relocations, motor vehicle accidents, new services, service upgrades and storm damage.

Based on the analysis of condition assessments performed by Kinectrics and WNH, WNH expects to replace approximately 550 – 650 poles per year during the 2016 – 2020 time frame.

Underground Primary Cable

WNH has adopted a TUL of 35 years for underground primary cable. This is consistent with the Kinectrics Report and WNH's own experience.

Table 3-26: Underground Primary Cable (TUL)

	KINECTRICS STUDY		**WNH**
Min UL	TUL	Max UL	**TUL**
35	40	55	**35**

WNH has approximately 517 km of underground primary cable. Location and operating voltage is known for 100% of the assets. Age and installation method is known for approximately 95% of the population. This is due to the lack of cable asset information prior to WNH's amalgamation in 1979. Based on the age of these assets, they are expected to be substantially replaced by 2020.

In 1989, WNH fully transitioned from direct buried to ducted underground primary cable systems. Since then, WNH has been installing all primary cable in duct for both new and replacement projects. Installation methods involved open trenching and directional drilling. Currently, WNH's population of ducted cable represents 67% of the total population. The remainder is either direct buried or assumed to be so.

Figure 3-5: Underground Primary Conductor by Age & Installation Type

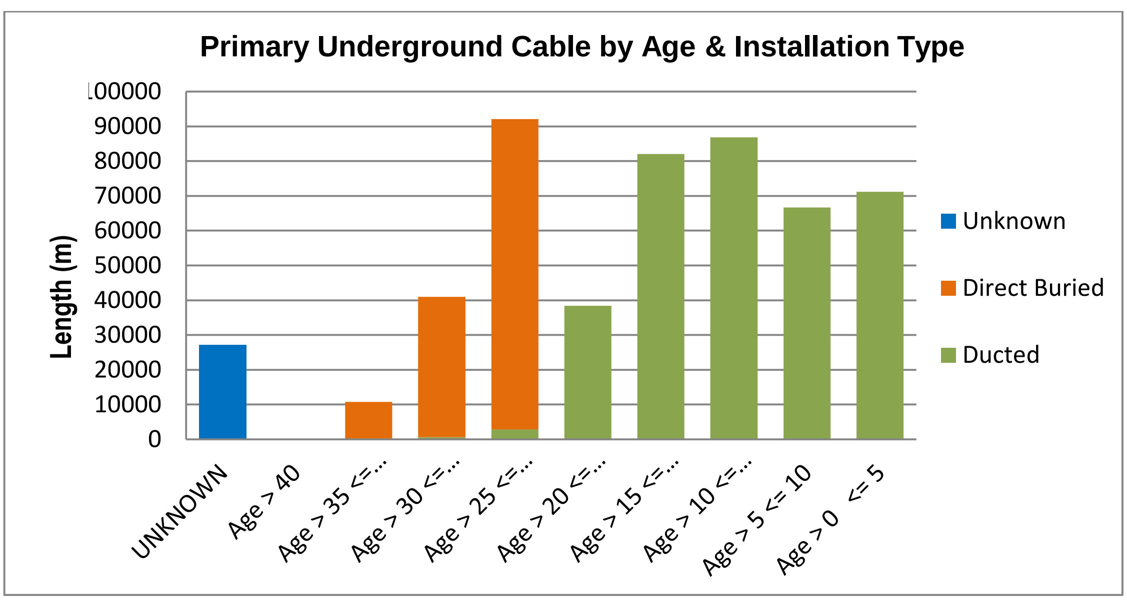


Table 3-27: Underground Primary Conductor by Age & Installation Type

AGE (yrs.)	ALL Units (m)	% POP	Ducted (m)	% POP	Direct Buried (m)	% POP	Unknown (m)	% POP
UNKNOWN	27,205	5.3%		0.0%		0.0%	27,205	100.0%
Age > 40	0		0		0		0	
Age > 35 <= 40	10,844	2.1%	257	2.4%	10,544	97.2%	43	0.4%
Age > 30 <= 35	41,230	8.0%	647	1.6%	40,290	97.7%	293	0.7%
Age > 25 <= 30	92,403	17.9%	2,821	3.1%	89,286	96.6%	296	0.3%
Age > 20 <= 25	38,377	7.4%	38,377	100.0%		0.0%		0.0%
Age > 15 <= 20	82,042	15.9%	82,042	100.0%		0.0%		0.0%
Age > 10 <= 15	86,819	16.8%	86,819	100.0%		0.0%		0.0%
Age > 5 <= 10	66,647	12.9%	66,647	100.0%		0.0%		0.0%
Age > 0 <= 5	71,144	13.8%	71,144	100.0%		0.0%		0.0%
Total	516,711	100%	348,754		140,120		27,837	
	100.0%		67.5%		27.1%		5.4%	

All cable from the mid-1960s to 1977 has been replaced as part of WNH's renewal investments. This population consisted mostly of 5 kV butyl rubber cable operating on the 4.16 kV system.

Currently at 36-37 years of age and past their TUL, the oldest sections of WNH's 15 kV direct buried underground distribution has been experiencing an increase in condition and reliability problems. Proposed investments for the replacement of these assets are included in WNH's DS Plan.

Table 3-28 provides cable profile by age and condition.

Table 3-28: Underground Primary Conductor Age & Condition Profile

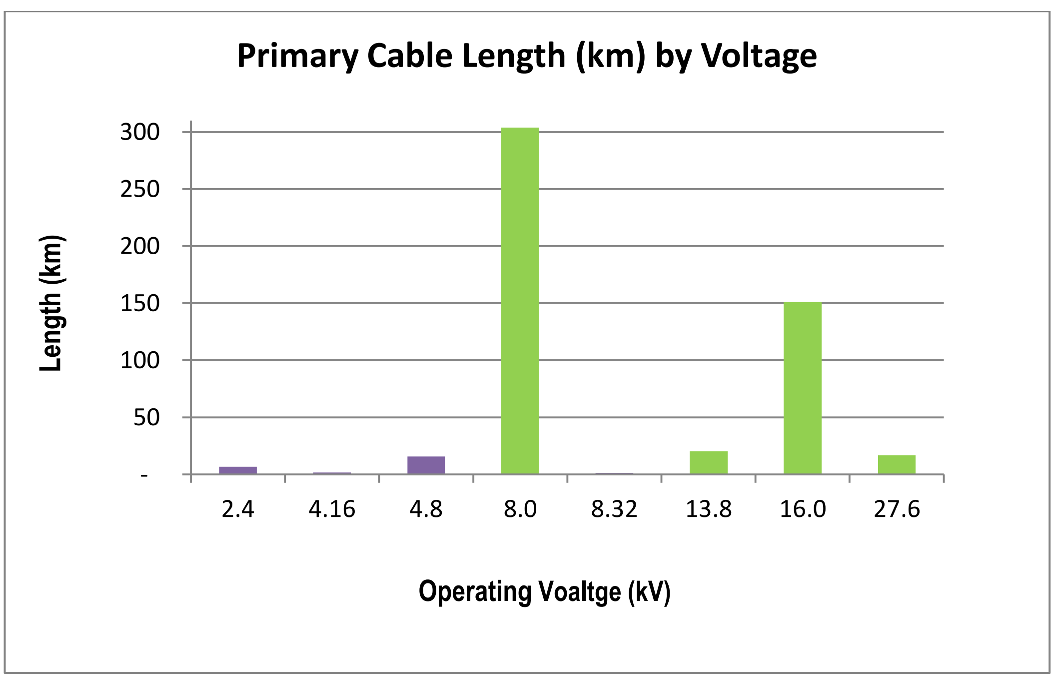
Year	Total (m)	%	Duct (m)		DB (m)		Unknown (m)	Age	Condition
1978	616	0.12%			604		12	37	Poor
1979	10,228	1.98%	257		9,940		31	36	Poor
1980	386	0.07%			386			35	Fair
1981	15,911	3.08%	139		15,772			34	Fair
1982	1,672	0.32%	327		1,345			33	Fair
1983	4,308	0.83%			4,308			32	Fair
1984	18,953	3.67%	181		18,479		293	31	Fair
1985	14,042	2.72%	247		13,792		3	30	Fair
1986	22,795	4.41%	667		22,121		7	29	Fair
1987	29,539	5.72%	559		28,964		16	28	Fair
1988	13,621	2.64%	550		12,952		119	27	Fair
1989	12,406	2.40%	798		11,457		151	26	Fair
1990	5,167	1.00%	5,167					25	Good
1991	13,208	2.56%	13,208					24	Good
1992	8,197	1.59%	8,197					23	Good
1993	7,205	1.39%	7,205					22	Good
1994	4,600	0.89%	4,600					21	Good
1995	14,115	2.73%	14,115					20	Good
1996	10,993	2.13%	10,993					19	Good
1997	12,621	2.44%	12,621					18	Good
1998	19,389	3.75%	19,389					17	Good
1999	24,924	4.82%	24,924					16	Good
2000	23,553	4.56%	23,553					15	Very Good
2001	15,778	3.05%	15,778					14	Very Good
2002	14,420	2.79%	14,420					13	Very Good
2003	13,241	2.56%	13,241					12	Very Good
2004	19,827	3.84%	19,827					11	Very Good
2005	13,109	2.54%	13,109					10	Very Good
2006	11,834	2.29%	11,834					9	Very Good
2007	10,792	2.09%	10,792					8	Very Good
2008	12,535	2.43%	12,535					7	Very Good
2009	18,377	3.56%	18,377					6	Very Good
2010	17,584	3.40%	17,584					5	Very Good
2011	14,991	2.90%	14,991					4	Very Good
2012	10,857	2.10%	10,857					3	Very Good
2013	14,182	2.74%	14,182					2	Very Good
2014	12,737	2.47%	12,737					1	Very Good
Unknown	27,205	5.27%			27,205				Unknown

By voltage, WNH's largest population of cables operate on the 13.8 kV distribution system (includes 8.0 kV) and the 27.6 kV distribution system (includes 16 kV). WNH's 4.16 kV distribution system cable (includes 2.4 kV) will be fully replaced by 2018.

Table 3-29: Underground Primary Conductor by Voltage Profile

Operating Voltage (kV)	Length (m)	%
2.4	6,595	1.3%
4.16	1,783	0.3%
4.8	15,687	3.0%
8.0	303,983	58.8%
8.32	1,385	0.3%
13.8	20,129	3.9%
16.0	150,612	29.1%
27.6	16,536	3.2%
Total	516,710	100%

Figure 3-6: Underground Primary Conductor by Voltage Profile



Distribution Transformers

WNH has a population of approximately 8,300 distribution transformers. Of these, approximately 325 are in inventory at any one time; most in advance of System Renewal and System Access projects. WNH has separated underground (padmount) and overhead (polemount) distribution transformers into 2 separate asset groups as they have distinctly different deterioration and failure modes. **Table 3-30** provides a breakdown between these two groups.

WNH does not produce specific health indices for distribution transformers. Transformers found in poor condition through WNH's regular inspection programs are replaced. Typically distribution transformers have a slightly longer TUL than wood poles. Many transformers are replaced during renewal projects. They may or may not be reused depending on age, condition and conformance to O Reg. 22/04. Otherwise, WNH's strategy is to run the transformers to failure.

Table 3-30: WNH Distribution Transformer Population

Total Population	Units	%
Overhead Tx's	4956	59.7%
Underground Tx's		
Padmount	3199	38.5%
Vault	5	0.1%
Submersible	140	1.7%
Total Underground	3344	40.3%
Total Population	8300	100.0%

WNH has adopted a TUL of 45 years for overhead transformers and 35 years for underground transformers (**Table 3-31**). This is consistent with the Kinectrics Report and WNH's own experience.

Table 3-31: WNH Distribution Transformer TUL's

		KINECTRICS STUDY		***WNH***
Notes:	*Min UL*	*TUL*	*Max UL*	***TUL***
OH - EOL (yrs)	30	40	60	**45**
UG - EOL (yrs)	25	40	45	**35**

WNH has found that underground transformers (padmount and submersible) have shorter TUL's primarily due the extensive corrosion from salt and moisture at and below ground level (**Appendix H, Figure AH-2)**. Overhead transformers are less susceptible to this deterioration due to their height above ground.

WNH maintains an active program to eliminate PCB's from all of its distribution equipment. Regulations enacted under the Canadian Environmental Protection Act, 1999 have set a target of eliminating all concentrations of PCB's greater than 2 ppm by the year 2025. Transformers are the last asset class known to contain PCB's. Of the 5 remaining units known to have had concentrations > 50 ppm, all will be removed from service in 2015. WNH anticipates that most if not all of the remaining 308 transformers will be removed through normal attrition before the 2025.

Table 3-32: WNH Transformer PCB

PCB's (ppm)	Units	% of Tx Population	Retrofilled Units	% of Units
ppm => 500	0	0.0%	0	
ppm => 50 < 500	5	0.1%	5	100.0%
ppm > 2 < 50	308	3.7%	50	16.2%
Total	313	3.8%	55	17.6%

Overhead Distribution Transformers (OH Tx)

Overhead transformers represent approximately 60% of the distribution transformer population. **Table 3-33** illustrates the split between single and polyphase units. The population has an average and median age of 22.3 years and 21 years respectively.

Table 3-33: WNH OH Transformer Population

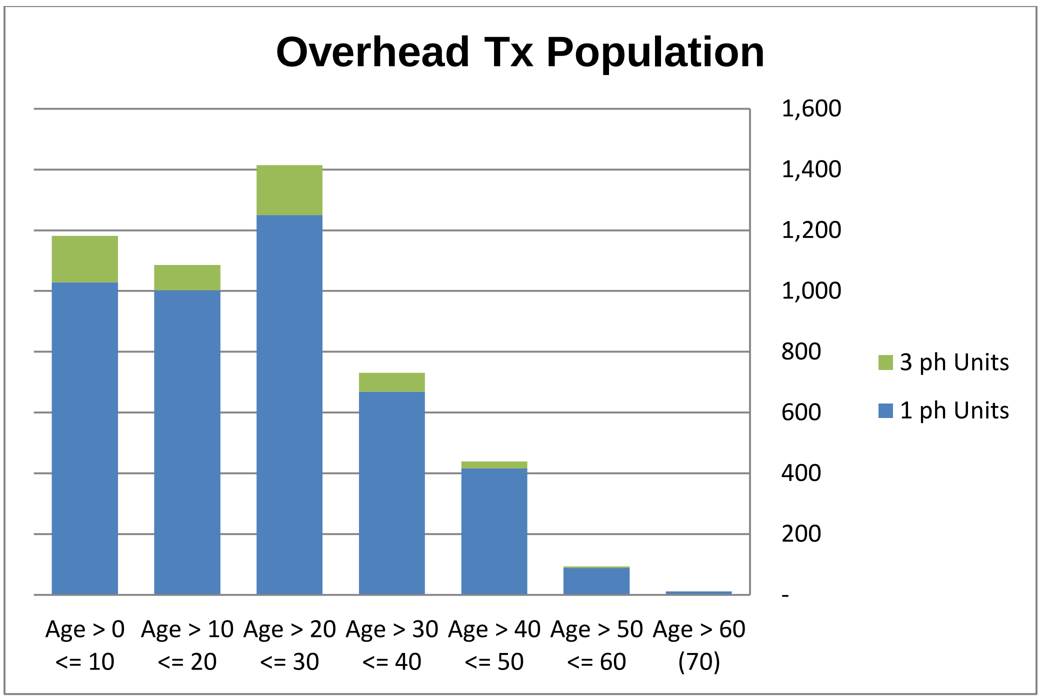
Transformer Type	Units	%
Single Phase Tx's	4464	90.1%
Poly Phase Tx's	492	9.9%
	4956	100.0%

Table 3-34: WNH Transformer Average Age

Total Population	Years	% TUL
Average Age (yrs)	22.3	50%
Median Age	21.0	47%

Figure 3-7 illustrates the breakdown of the population by age.

Figure 3-7: WNH OH Transformer by Age



Underground Distribution Transformers

Underground transformers represent approximately 40% of WNH's distribution transformer population. The population has an average age of 16.8 years and it is noteworthy that only 1% is over the TUL of 35 years (**Table 3-37). Table 3-40** provides a more detailed breakdown of the population by age**.**

Table 3-35: WNH UG Transformer TUL

		KINECTRICS STUDY		***WNH***
Notes:	*Min UL*	*TUL*	*Max UL*	***TUL***
UG - EOL (yrs)	25	40	45	**35**

Table 3-36: WNH UG Transformer Average Age

Total Population	Units	% TUL
Average Age (yrs)	16.8	48%

Table 3-37: WNH UG Transformer Average Age

AGE (yrs)	Padmount	% POP	Submersible	% POP	Padmount	% POP	Total	% POP
Age > 35	20	0.6%	17	12.1%	2	40.0%	39	1.2%
Age <= 35	3,179	99.4%	123	87.9%	3	60.0%	3,305	98.8%
Total	3,199	100%	140	100%	5	100%	3,344	100%

Table 3-38 illustrates the split between single and polyphase units. Padmount transformers account for almost 96% of the transformers in this group. Reliability and operational problems with submersible transformers are the drivers for their removal and the installation of the padmount transformers in their place.

Table 3-38: WNH UG Transformer by Phase

Transformer Type	Units	%
Single Phase Tx's	3044	95.2%
Poly Phase Tx's	155	4.8%
	3199	100.0%

Table 3-39: WNH UG Transformer by Type

Total Population	Units	%
Padmount	3199	95.7%
Submersible	140	4.2%
Vault	5	0.1%
Total Population	3,344	100.0%

Table 3-40: Padmount Transformers by Age

AGE (yrs)	Single Phase	% POP	Poly Phase	% POP	Total	% POP
Age > 60	-	0.0%	-	0.0%	-	0.0%
Age > 55 <= 60	-	0.0%	-	0.0%	-	0.0%
Age > 50 <= 55	-	0.0%	-	0.0%	-	0.0%
Age > 45 <= 50	1	0.0%	1	0.6%	2	0.1%
Age > 40 <= 45	13	0.4%	1	0.6%	14	0.4%
Age > 35 <= 40	2	0.1%	2	1.3%	4	0.1%
Age > 30 <= 35	108	3.5%	3	1.9%	111	3.5%
Age > 25 <= 30	554	18.2%	10	6.4%	564	17.6%
Age > 20 <= 25	496	16.3%	1	0.6%	497	15.5%
Age > 15 <= 20	516	17.0%	-	0.0%	516	16.1%
Age > 10 <= 15	442	14.5%	6	3.8%	448	14.0%
Age > 5 <= 10	473	15.5%	38	24.4%	511	16.0%
Age > 0 <= 5	438	14.4%	94	60.3%	532	16.6%
	3,043	100%	156	100%	3,199	100%

Revenue Meters

WNH's meter population is divided into 3 groups:

1. Residential
2. Commercial & Industrial (C&I)
3. Wholesale

The meter population is then further subdivided into self-contained and transformer rated meters. This categorization is important due to the fact that transformer rated meters are used as part of a metering installation that includes additional equipment such as instrument transformers, communications and auxiliary equipment. Metering installations generally live through several generations of meters and have a longer TUL (**Table 3-41**). **Table 3-42** provides a high level listing of WNH metering assets.

Table 3-41: Metering Asset TUL's

Asset Type		KINECTRICS STUDY		**WNH**
	Min UL	TUL	Max UL	**TUL**
Smart Meters (Res)	5	(*)	15	**15**
Smart Meters (C&I)	5	(*)	15	**15**
Wholesale Meters	15	(*)	30	**15**
Metering Installations	30	(*)	60	**50**
TGB / Repeaters	15	(*)	20	**15**

(*) Not defined in Kinectrics Study

Table 3-42: Metering Asset Quantities

Asset Type	#	1 Ø	3 Ø	**Total**
Smart Meters (Res)		48,527		
Smart Meters (C&I)			5,695	**54,222**
Demand		1	834	**835**
Load Monitoring Meters			71	**71**
Wholesale Meters				
Metering Installations	2148			
TGB / Repeaters	4			
Total		48,528	6,600	**55128**

As can be seen in **Table 3-43**, the Smart Metering initiative has resulted in WNH having a meter population where 99.8 % of the population is 6 years old or less. The lack of diversity of age in the population presents a significant challenge for WNH when those 2009 and 2010 meter populations come due for Measurement Canada seal renewal in 2019 and 2020. WNH has been taking steps to mitigate the impact of potential O&M and capital investment costs, however the actual impact will not be known for another 2 -3 years.

Table 3-43: WNH Meters by Age

AGE (yrs)	Meters	% POP	Condition
< 2003	10	0.0%	Very Good
2003	14	0.0%	Very Good
2004	6	0.0%	Very Good
2005	30	0.1%	Very Good
2006	1	0.0%	Very Good
2007	15	0.0%	Very Good
2008	39	0.1%	Very Good
2009	35,733	64.8%	Very Good
2010	13,182	23.9%	Very Good
2011	990	1.8%	Very Good
2012	4,188	7.6%	Very Good
2013	712	1.3%	Very Good
2014	208	0.4%	Very Good
Total	55,128	100.0%	

For commercial and industrial customers >50kW and wholesale metering points, additional equipment is required, and along with the meter itself, is referred to as a metering installation. Comprised of current and voltage transformers, communications and auxiliary equipment the condition of these assets is key to the accuracy of the metered quantities. **Table 3-44** and **Figure 3-8** provide a breakdown of metering installation assets by year and it can be seen that less than 1% of the population is over 50 years of age. Metering installations are inspected for condition and tested for accuracy every 6 years. Detailed records are maintained to comply with Measurement Canada regulations. Normally, metering installations are replaced during customer service upgrades. Those that exceed the 50 years of age are more closely monitored and scheduled for replacement based on their condition.

Table 3-44: WNH Meter Installations by Age

AGE (yrs)	Meter Installations	% POP	Condition
Age > 60	3	0.1%	Poor
Age > 55 <= 60	3	0.1%	Poor
Age > 50 <= 55	28	1.3%	Fair
Age > 45 <= 50	146	6.8%	Fair
Age > 40 <= 45	158	7.4%	Good
Age > 35 <= 40	113	5.3%	Good
Age > 30 <= 35	140	6.5%	Good
Age > 25 <= 30	174	8.1%	Good
Age > 20 <= 25	177	8.2%	Very Good
Age > 15 <= 20	244	11.4%	Very Good
Age > 10 <= 15	318	14.8%	Very Good
Age > 5 <= 10	259	12.1%	Very Good
Age > 0 <= 5	385	17.9%	Very Good
	2,148	100%	

Figure 3-8: WNH Meter Installations by Age

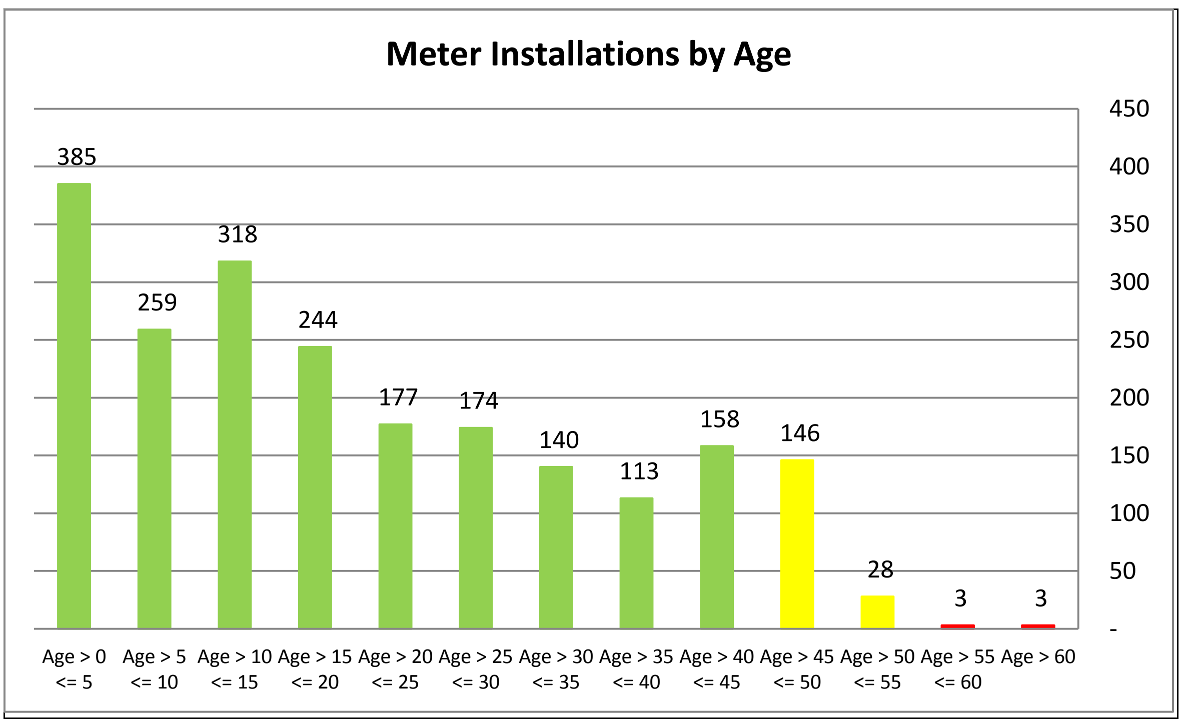


Table 3-45 provides a break down by customer class.

Table 3-45: Meters by Customer Class

Customer Class	Meter #	%
Residential	48,527	88.1%
GS < 50	5,695	10.3%
GS => 50	834	1.5%
Large User => 5000	1	0.0%
TOTAL	55,057	100%

Information Systems Technology

For most of its major software systems (**Table 3-46**) WNH uses a 3 part strategy in managing these assets.

1) use of vendor recommended upgrades after initial purchase;
2) use of in house or external resources to modify software to meet regulatory or public policy requirements and to improve operational effectiveness;
3) replacement of software when O&M costs exceed reasonable capital replacement costs (typically payback < 5 years) or when functional obsolescence cannot be cost effectively overcome by upgrades or modifications.

Greater detail regarding IT strategy and investments can be found in **Appendix C** and **Appendix G** of this DS Plan.

Table 3-46: Major Information Technology Software Systems

Core System	Business Owner	Original In Service	Last Major Upgrade	Future Direction
Customer Information System (CIS)	Finance	2000	2005	New purchase 2015. Implementation 2015. Production Cutover 2016.
Enterprise Resource Planning (ERP) (Inv Control / Purchasing /Work / Order Processing/ A/R, G/L, A/P, Payroll, Fixed Assets)	Finance/ Engineering / Operations/ Admin	2005	2005	a) New purchase 2015/2016 b) Implementation 2016/2017 c) Production Cutover 2017/ 2018
ODS - Operational Data Store	Billing / Engineering	2009	2015	Routine Upgrades 2016 - 2020
Outage Management System	Operations	2015	2015	Routine Upgrades 2016 - 2020
SCADA	Engineering	2011	2014	Routine Upgrades 2016 – 2020 FDIR - 2017-2020
AMI - Regional Network Interface (Smart Meters)	Billing / Metering	2009	2014	Routine Upgrades 2016 - 2020
Geographic Information Systems (GIS)	Engineering	2005	2013	Routine Upgrades 2016 - 2020
Asset Management Software	Engineering & Operations	2016	2016	In service 2016. Routine Upgrades 2017 - 2020

Although WNH attempts to utilize the aforementioned strategies for all of its software systems, options 1 and 2 may not be available or may not be cost effective with less expensive and off-the-shelf products. **Table 3-47a** provides a listing of smaller software systems WNH maintains.

Table 3-47a: Information Technology Software Systems (other)

Core System	Business Owner	Original In Service	Future Direction
Project Budgeting System	Finance	2010	Replaced as part of ERP in 2017/2018
Web Presentment / Online Account Inquiry & eBill Presentment	Billing	2011	Routine Upgrades 2016 - 2020
Electronic Document Records Management Software	Corporate	2009	Routine Upgrades 2016 - 2020
Automatic Vehicle Locator S/W	Operations - Control Room	2009	Routine Upgrades 2016 - 2020
AS2 Client (Transfer agent for info to/from Provincial MDM/R)	Billing	2009	Routine Upgrades 2016 - 2020
Operational Reporting Tool & Business Intelligence Platform	Corporate	2009	Routine Upgrades 2016 - 2020
HR Module	Finance/Admin	2015	a) HR Implementation 2014/2015 b) HR Production Cutover 2015
Power Interruption Tracking System	Operations - Control Room	2010	Replaced as part of OMS in 2015
Retailer Electronic Business Transaction Software	Billing	2007	Routine Upgrades 2016 - 2020
Field Inspection Tools	Engineering & Operations	2016	Routine Upgrades 2017 - 2020
Web Content & URL Filtering	IT	2010	Routine Upgrades 2016 - 2020
Network Intrusion Prevention	IT	2012	Routine Upgrades 2016 - 2020
Firewall Protection	IT	2011	Routine Upgrades 2016 - 2020
AntiVirus	IT	2000	Routine Upgrades 2016 - 2020

Table 3-47b: Information Technology Software Systems (other)

Core System	Business Owner	Original In Service	Future Direction
Corporate Phone System Software	IT	2011	Routine Upgrades 2016 - 2020
Interactive Voice Recording	Billing	2009	Routine Upgrades 2016 - 2020
Call Recording Software	Billing / Control Room	2010	Routine Upgrades 2016 - 2020
eMail	Corporate	2011	Routine Upgrades 2016 - 2020
Building Security System	Corporate	2011	Routine Upgrades 2016 - 2020
Server Monitoring Software (Disk Usage, CPU Usage, Memory Utilization, Services Status)	Information Technology Services	2014	Routine Upgrades 2016 - 2020

Fleet / Rolling Stock

WNH's fleet and rolling stock assets consists of 23 larger vehicles (primarily work platforms) used for the construction and maintenance of the distribution system as well as 36 small trucks and vans that are used for light construction, field inspection and general use. The fleet also includes 19 trailers (pole trailers, reel trailers, stringing trailers, material trailers and tension stringing machines).

WNH's experience with the fleet equipment has led it to adopt the following TUL's:

Large Vehicles – Work platforms – 12 years

Small Trucks / Vans – 8 years

Transportation Equipment – Trailers – 15 years

The actual vehicle replacement is determined through analysis of condition assessments, costing information (operation & maintenance), utilization, and asset age.

Every WNH vehicle and trailer is inspected annually in compliance with the Ontario Ministry of Transportation safety requirements by WNH's two in-house mechanics. As part of these inspections, the mechanics complete a condition assessment of the vehicle or trailer.

WNH tracks vehicle maintenance costs and fuel consumption by vehicle. These costs are summarized annually and analyzed to determine maintenance cost trends by vehicle and equipment type. However, it is important to plan to replace aging vehicles and equipment before any major repairs (engine or transmission replacement, or the need to overhaul the aerial device) are required.

The VP of Operations reviews the WNH fleet records regularly. This analysis results in the prioritization of vehicles and equipment that is targeted to be replaced in the following year's capital budget as well as the following 5 year period. The factors that go into this prioritization include the vehicle's age, condition assessment, annual operating and maintenance costs, total engine operating hours and total kilometers driven. A copy of the WNH's Fleet/Rolling Stock Inventory is provided in **Table 3-48.**

Table 3-48: Fleet / Rolling Stock Inventory

Fleet ID	Vehicle Type	Model Year	TUL	Current Age
R65	RBD	1996	12	19
O154	Cargo Van	2005	8	10
O150	Pickup	2005	8	10
T-539	Pole Trailer	1979	15	36
R86	Knuckle Crane	1999	12	16
R9	Single Bucket MHAD	2001	12	14
B109	Mini Van	2010	8	5
R98	Double Bucket MHAD	2000	12	15
R31	Single Bucket MHAD	2003	12	12
R115	Pickup	2011	8	4
R116	Pickup	2011	8	4
O172	Cargo Van	2007	8	8
R40	RBD	2004	12	11
O51	Workbody Step Van	2005	12	10
R133	Mini Van	2013	8	2
R127	Pickup	2012	8	3
R128	Pickup	2012	8	3
O189	Cargo Van	2008	8	7
R180	Pickup	2008	8	7
R89	Single Bucket	2008	12	7
R99	Dump Truck	2009	12	6
Y124	Cargo Van	2012	8	3
Y125	Cargo Van	2012	8	3
R132	Pickup	2013	8	2
R190	SUV	2009	8	6
R183	Pickup	2008	8	7
G186	Mini Van	2008	8	7
G100	Mini Van	2010	8	5
T-532	Reel Trailer	1968	15	47
T-533	Material Trailer	1989	15	26
T-521	Pole Trailer	1985	15	30
T-540	Stringing Trailer	1999	15	16
R92	Double Bucket MHAD	2009	12	6
O118	Cargo Van	2011	8	4
R191	Pickup	2009	8	6
G110	Mini Van	2010	8	5
R188	SUV	2008	8	7
P117	Mini Van	2010	8	5

3.2.4 (5.3.2d) assessment of the degree to which the capacity of existing system assets is utilized relative to planning criteria:

The tables provided in this section provide an overview of capacity and system utilization of WNH's points of supply and major facilities as of the end of 2014. Analysis indicates that there is sufficient capacity to connect anticipated load and generation customers over the next 5 years. Accordingly, WNH does not anticipate capacity to be a significant driver of material investments included in the capital expenditure plan.

Supply Point Capacity Utilization

WNH receives approximately 92% of its total electrical supply through HONI transmission circuits identified in **Table 3-49**. The KWCG IRRP has not identified any constraints on the 230 kV D6V and D7V transmission circuits feeding WNH Stations within the 2016 – 20120 time frame.

Table 3-49: WNH Points of Supply Capacity Utilization

HONI Transmission	HV (kV)	WNH Capacity
D6V	230	No Constraints
D7V	230	No Constraints
D10H	115	WNH Limited to 71MVA @ ERTS
D8S	115	WNH Limited to 71MVA @ ERTS

HONI's 115 kV D10H and D8S transmission lines are near capacity. WNH is able to utilize 100% capacity of the ERTS and 90% of the ELTS stations, however future supply increases may be limited without an upgrade of these lines. This is not anticipated within the 2016 – 2020 time frame.

Transformer Station Capacity Utilization

WNH has limited time ratings (LTR) for all of it TS's. In the event of a loss of significant element (N-1) this rating represents the load that can be placed on a DESN station for a period of time. WNH uses 10-day summer LTR's in its capacity and contingency planning. A loss of transformer life of 2 % per day is borne during this scenario.

Table 3-50, provides WNH's station capacities and 2014 peak stations demands. WNH believes there is sufficient capacity to serve the area during the 2016 – 2020 forecast period.

Table 3-50: WNH Transformer Station Capacity Utilization

	Transformer Stations	Owned & Operated by	Supplied By	HONI TX Line	Station Location	HV (kV)	LV (kV)	Tx ID	Tx ONAF Rating (MVA)	10 day LTR (MVA)	2014 Peak Demand	% Capacity Utilization
1	HMSTS “A”	WNH	HONI Tx	D6V	Waterloo	230	13.8	T1	50.0	69	60	87%
				D7V				T2	50.0			
2	HMSTS “B”	WNH	HONI Tx	D7V	Waterloo	230	13.8	T3	83.0	110	92	84%
				D6V				T4	83.0			
3	MTS #3	WNH	HONI Tx	D6V	Waterloo	230	27.6	T1	67.0	85	55	65%
				D7V				T2	67.0			
4	ERTS	WNH	HONI Tx	D10H	Waterloo	115	13.8	T1	50.0	69	43	62%
				D8S				T2	50.0			
5	ELTS(*)	HONI	HONI Tx	D10H	Woolwich	115	27.6	T1	2 x 41.7	57	37	64%
								T2	2 x 41.7			

(*)WNH load accounts for approximately 90% of ELTS load

Transformer Station Feeder Capacity Utilization

WNH’s 13.8 kV and 27.6 kV feeder capacities are 600A, however WNH uses a planning criterion of 400A per feeder. This allows for the load of a feeder that is planned or forced out of service to be moved to 2 adjacent feeders and remain within loading limits. The following tables provide capacity utilizations for WNH’s 44 TS feeders.

Table 3-51: Capacity Utilization HMSTS”A”

Facility	LTR (MVA)	Rating (Amps)	Peak (Amps)	Peak (MVA)	Peak (Month)	% Loading
HMSTS"A" Station	HS07	600	315	7.7	May	53%
	HS08	600	492	12.2	Sep	82%
	HS09	600	445	11.0	Dec	74%
	HS10	600	367	8.9	Jun	61%
	HS11	600	425	10.4	Feb	71%
	HS12	600	444	10.8	Jan	74%
	HS13	600	398	9.6	Jan	66%
	HS14	600	450	11.1	Aug	75%
Average Feeder Loading		600	417	10		70%

Table 3-52: Capacity Utilization HMSTS"B"

Facility	LTR (MVA)	Rating (Amps)	Peak (Amps)	Peak (MVA)	Peak (Month)	% Loading
HMSTS"B" Station	HS15	600	410	9.9	Feb	68%
	HS16	600	264	6.4	Jun	44%
	HS17	600	386	9.4	Jun	64%
	HS18	600	178	4.3	Jan	30%
	HS19	600	274	13.3	Apr	46%
	HS20	600	493	12.0	Mar	82%
	HS21	600	445	10.9	Nov	74%
	HS22	600	410	10.0	Mar	68%
	HS23	600	251	6.2	Sep	42%
	HS24	600	408	9.9	Aug	68%
	HS25	600	115	2.8	Feb	19%
	HS26	600	367	17.8	Sep	61%
	HS27	600	454	11.0	Jan	76%
	HS28	600	367	8.9	Jun	61%
	HS29	600	277	6.8	Feb	46%
	HS30	600	447	10.8	Dec	75%
Average Feeder Loading		600	347	9.4		58%

Table 3-53: Capacity Utilization MTS#3

Facility	LTR (MVA)	Rating (Amps)	Peak (Amps)	Peak (MVA)	Peak (Month)	% Loading
MTS#3	3F60	600	52	2.6	Sep	9%
	3F61	600	232	11.4	Nov	39%
	3F62 (3F50)	600	448	11.2	Mar	75%
	3F63	600	352	17.5	Apr	59%
	3F64	600			Spare	
	3F65	600	133	6.5	Jul	22%
	3F66	600	0	0.0	Jan	0%
	3F67 (3F51)	600	356	8.7	Mar	59%
	3F68	600	344	17.0	May	57%
	3F69	600			Spare	
Average Feeder Loading		600	240	9.4		40%

Table 3-54: Capacity Utilization ERTS

Facility	LTR (MVA)	Rating (Amps)	Peak (Amps)	Peak (MVA)	Peak (Month)	% Loading
ERTS	ER41	600	476	11.6	Jun	79%
	ER42	600	532	12.9	Feb	89%
	ER43	600			Spare	
	ER44	600	301	7.3	Sep	50%
	ER45	600	508	12.4	Jan	85%
	ER46	600	142	3.5	Jan	24%
	ER47	600	175	4.3	Jun	29%
	ER48	600	402	9.5	Mar	67%
Average Feeder Loading		600	317	7.7		53%

Table 3-55: Capacity Utilization ELTS

Facility		Rating (Amps)	Peak (Amps)	Peak (MVA)	Peak (Month)	% Loading
ELTS	33M1	650/530	533	25.9	Feb	82%
	33M2	650/530	641	31.8	Mar	99%
	33M3	650/530	301	14.6	Jan	46%
Average Feeder Loading		650	492	24		76%

MS/DS Station Capacity Utilization

Table 3-56, provides WNH's MS/DS station capacities and 2014 peak station demands. In the event of a loss of a significant element such as a transformer, there is capacity available in WNH's distribution system through the interconnectivity with other stations or the use of WNH's MUS.

WNH believes there is sufficient capacity to serve the area during the 2016 – 2020 forecast period.

Table 3-56: WNH MS/DS Station Capacity Utilization

	MS/DS	Owned & Operated by	Supplied By	Location	HV (kV)	LV (kV)	Tx ID	Transformer Rating (MVA)	2014 Peak Demand	% Capacity Utilization
1	MS#1	WNH	WNH Dx	Waterloo	13.8	4.16	T1	3.0	1.5	49%
2					13.8	4.16	T2	3.0	1.5	49%
3	MS#5	WNH	WNH Dx	Waterloo	13.8	4.16	T1	6.0	2.1	35%
4	MS#22	WNH	WNH Dx	Elmira	27.6	4.16	T1	3.6	2.3	64%
5	MS#23	WNH	WNH Dx	Elmira	27.6	4.16	T1	6.7	1.7	25%
6	MS#24	WNH	WNH Dx	Elmira	27.6	4.16	T1	5.0	3.4	68%
7	DS#26	WNH	WNH Dx	Wellesley	27.6	8.32	T1	5.0	3.4	68%
8	DS#27	WNH	WNH Dx	Wallenstein	27.6	8.32	T1	3.6	2.7	75%
9	DS#28	WNH	WNH Dx	Floradale	27.6	8.32	T1	5.0	3.0	60%
10	DS#29	WNH	WNH Dx	St Jacobs	27.6	8.32	T1	3.6	2.0	56%
11					27.6	8.32	T2	3.6	2.0	56%
12	DS#30	WNH	WNH Dx	Zubers Corners	44.0	8.32	T1	5.0	3.3	66%
13	DS#31	WNH	WNH Dx	Bloomingdale	27.6	8.32	T1	5.0	5.2	104%
14	DS#32	WNH	WNH Dx	Breslau	27.6	8.32	T1	5.0	2.0	40%
15	DS#34	WNH	WNH Dx	South Woolwich	27.6	8.32	T1	2.0	0.8	40%
							Total	67.1	36.8	56%

3.3 Asset Lifecycle Optimization Policies and Practices (5.3.3)

3.3.1 (5.3.3a) a description of asset lifecycle optimization policies and practices:

- **a description of asset replacement and refurbishment policies, including an explanation of how (e.g. processes; tools) system renewal program spending is optimized, prioritized and scheduled to align with budget envelopes; and how the impact of system renewal investments on routine system O&M is assessed;**
- **a description of maintenance planning criteria and assumptions; and**
- **a description of routine and preventative inspection and maintenance policies, practices and programmes (can include references to the DSC).**

3.3.1.1 Asset Replacement vs Asset Refurbishment

WNH's maintenance programs are one part of a three part strategy to minimize the lifecycle cost of an asset.

1. Asset Maintenance
2. Asset Refurbishment
3. Asset Replacement

One or more of these strategies can be employed depending on the type of asset, and its condition, cost effectiveness of each strategy. WNH has an extensive collection of asset data and employs a maintenance strategy for each asset. WNH evaluates the costs of maintenance with that of refurbishment and replacement along with the risk of asset failure, to determine a least cost approach.

An overview of WNH's asset management objectives, process for asset replacement and prioritization investments is provided in **Section 3.1.1** and **Section 3.1.2.**

As assets approach the end of their TUL or as condition assessments indicate need for action, WNH begins to examine replacement / refurbishment options to minimize over all life-cycle cost. Relevant technical and economic considerations that are integrated into this approach include; asset performance; condition; age; probability of failure; criticality or consequence of failure; replacement and refurbishment cost and lead time options. Refurbishments also involve extensive feasibility discussions with third party vendors or suppliers.

For most of WNH assets, replacement is the only option. Assets such as wire, insulators, lightning arrestors and poles for example do not lend themselves to refurbishment. Assets such as distribution transformers can be refurbished but generally not in a cost effective manner. WNH has found that refurbishment tends to be a viable and cost effective option to extend the life of high value assets; most of which reside in the stations area. WNH has performed cost effective life extending refurbishments on assets such as station transformers, circuit breakers, tap changers, voltage regulators, switchgear and fleet. The savings that accrue from the refurbishment of assets are highly dependent on the asset, surrounding conditions and performance. WNH's current investments in HMSTS"B" station circuit breaker refurbishments represent a saving of approximately 40% over a replacement option.

The impact of functional obsolescence on typical asset life is becoming more of a concern for WNH. Distribution assets whose functions rely on specialized electronic components, firmware or software are particularly susceptible to shorter lifecycles than their predecessors due to the rapid change in these technologies. Many of these components cannot be refurbished. For other components, their shelf life and the time frame under which vendor support is available is becoming increasing shorter. Smart Grid technologies are particularly susceptible due to the use of highly specialized software, firmware and hardware. In addition, for a growing number of assets where refurbishment could be viable, higher standards, performance requirements or customer expectations force the utility into a procurement only option. The requirements of Reg 22/04 and the need for certified test records for refurbished equipment to be used on new construction is such an example.

3.3.1.2 System Renewal Program Optimization, Prioritization and Scheduling to align with Budget Envelopes

An overview of WNH's asset management objectives, process for asset replacement and prioritization investments is provided in **Section 3.1.1** and **Section 3.1.2.**

SR investment proposals are mainly identified from WNH's condition and reliability assessment programs. WNH's condition assessments, condition ratings and health indices identify assets in poor condition. WNH's performance assessment metrics may also identify assets in need of replacement.

WNH assesses the risk of failure of an asset by comparing condition and performance assessments relative to condition and performance targets. This assessment is then used to rank the timing of replacements. High probability of failure assets with large associated costs of failure are prioritized for replacement. WNH also considers the potential number of customers impacted by an asset failure in the ranking process. SR projects with similar rankings may also align themselves with multiple asset management objectives. Investments that achieve multiple objectives within a risk of failure/cost class receive a higher ranking and also aid in maximizing the value of investments.

In developing its investment plan, WNH strives to pace condition and performance investments (SR, SS and GP) with mandated and customer-driven investments (SA).

3.3.1.3 Impact of System Renewal Investments on Routine O&M

WNH believes that SR investments are effective at keeping routine O&M (inspection and maintenance) costs from increasing. WNH's experience has been that assets in poor condition attract more reactive maintenance or reactive capital replacement costs due to sudden failure. It is also WNH's experience that unplanned reactive work, whether it be maintenance or capital is almost always more expensive and more disruptive than planned work to both WNH and its customers. WNH does not have a metric to capture the impact of System Renewal Investments on routine O&M costs. WNH does not have historical data available to capture the performance of such an index.

3.3.1.4 Maintenance Planning Criteria and Assumptions

WNH's maintenance programs are one part of a three part strategy to minimize the lifecycle cost of an asset.

1. Asset Maintenance
2. Asset Refurbishment
3. Asset Replacement

One or more of these strategies can be employed depending on the type of asset, and its condition, cost effectiveness of each strategy. WNH has an extensive collection of asset data and employs a maintenance strategy for each asset. WNH evaluates the costs of maintenance with that of refurbishment and replacement along with the risk of asset failure, to determine a least cost approach.

WNH's approach to maintenance planning is asset and location specific. An asset's economic life can vary due to factors such as production quality, service, environmental factors, performance and its unique role in the operation of the distribution system. WNH's maintenance program employs certain assumptions to inform when maintenance is likely to be required, including assumptions based on equipment manufacturer's recommendations as well as best industry practices in determining the scope and frequency of maintenance on distribution equipment. Maintenance programs also comply with the regulated requirements for maintenance established by the DSC and TSC.

The range of WNH's maintenance activities varies greatly. For some assets there is no cost-effective maintenance that can be performed. This is particularly true for many electronic devices and components (Smart Meters). These assets are either replaced on a performance or time basis, or run to failure.

WNH employs three maintenance strategies:

Condition-based maintenance (CBM) – often defined as predictive maintenance, is a maintenance technique that involves testing and monitoring in order to predict end of life or failure of the asset. This technique is more often used with large value assets such as those in the stations area.

Preventative maintenance (PM) – is a proactive, time-based or scheduled-based approach for maintenance of assets before equipment or system failures occur; PM programs may also be extended to include remediation of deficiencies identified during routine inspections and visual patrols.

PM generally comprises more structured and comprehensive routine maintenance activities to extend the service life of an asset. The frequency and extent to which PM is performed varies, but generally considers available and emerging technology, best practices, manufacturer specifications, relative impact to operational safety and system reliability.

Reactive maintenance (RM) – often defined as ‘breakdown’ maintenance, provides for unscheduled remediation of deficiencies after a system or asset failure.

WNH has and will continue to embrace new techniques and technologies to improve the effectiveness of its inspection and maintenance programs. WNH believes its inspection and maintenance programs are comprehensive and does not anticipate any major changes through the forecast period. WNH anticipates no material changes in O&M expenditures due to capital investments proposed during the forecast period.

3.3.1.5 WNH Inspection and Maintenance Programs

<u>Introduction</u>

The Minimum Inspection Requirements of the OEB's DSC outline the minimum inspection standards and intervals required for the distribution system. Specifically, Appendix C - Minimum Inspection Requirements, Table C-1 of the DSC identifies the maximum intervals, in years, for visual patrols, which for most urban facilities is 3 years, rural facilities is 6 years and stations is 1 month, 6 months, 1 year or 3 years. A definition of Patrol Inspection is also included within the requirements of the DSC.

In addition, WNH has grid connected transformer stations which have inspection standards identified in the OEB Transmission Code.

WNH's distribution system is divided into one urban region, serving the City of Waterloo, and two rural regions, serving the Township of Wellesley and the Township of Woolwich, as illustrated in **Figure 1-2.** These regions form the basis for implementation of systematic and routine visual patrols for compliance with the OEB inspection requirements, as a minimum. The visual patrols of the major distribution facilities, noted below, are comprehensive and the level of detail is beyond the Patrol Inspection definition. In addition to fulfilling the requirements, the inspections allow for identification and documentation of condition-related deficiencies, with subsequent analysis to support maintenance and capital expenditures concerning various assets such as transformers, stations, switching cubicles, poles/supports/attachments, etc.

A. <u>WNH Inspection Programs</u>

i. Inspection of Overhead Systems

WNH currently inspects the overhead distribution system in each region, completing approximately one-third of the urban region and one-sixth of rural regions on an annual basis, in accordance with Appendix C 'Minimum Inspection Requirements' of the DSC. The visual patrol serves as a condition-based assessment of overhead assets, including poles and their supports and attachments, pole-mount distribution transformers, switches and other protective devices, conductor, grounding and surrounding vegetation. The inspection further serves to confirm the existence of other assets on the overhead distribution system such as third party communications equipment. GIS based maps of the region subject to inspection are provided to the power line maintainer (PLM) or qualified PLM contractor for identification and location of assets during the visual patrol. Within the inspection, PLMs identify deficiencies or concerns regarding the condition of an asset. **Table 3-57** presents the conventional deficiencies, characteristic of each asset, which may be routinely identified during the visual patrol.

Table 3-57: Conventional Asset Deficiencies

ASSET	CONVENTIONAL DEFICIENCIES
Pole	Rotting, cracked, feathering, insect damage, leaning
Cross Arm	Rotting, twisted
Insulator	Flashed, broken, loose/tipped down
Arrester	Blown, flashed
Switch	Loose, flashed, old
Grounding	Not connected, exposed ground rod
Guying	Loose, broken, damaged, anchor pulled, insulator broken
Guy Guard	Missing, cracked
Conductor	Frayed, broken, old, tie wire broken
Cable Guard	Loose, exposed conductor
Transformer	Rusted, leaking
Vegetation	Overgrown, interference

All deficiencies are documented with a location and description. The overall condition of each asset, follow-up action (for example refurbishment, replacement or further testing) required to address the deficiency, and the inspector and date of inspection are also recorded.

Completed assessments are submitted to the line superintendent and the data is compiled for subsequent review and analysis. Recommendations for refurbishment or replacement are brought to the attention of the engineering department. Additionally, inspection data is archived within inspection databases for general documentation and reporting purposes.

Crossings

Inspection and condition assessment of all expressway, railway and river crossings is performed annually. The greater frequency reflects the greater risk associated with these parts of the distribution systems. Crossings typically have longer spans and taller poles making them more susceptible to wind and ice loading damage. Along major roadways there is greater exposure to salt contamination and corrosion. River crossings also tend to be more remote making deterioration or damage less likely to be observed.

All crossings are identified on the GIS system and inspections are initiated by the line superintendent. A Reporting form allows for documentation of the crossing location, attributes of the pole(s), guys/anchors, insulators and cross arms, as well as the condition of each. Any deficiencies, including evidence of tracking or lightning strikes, related to the attributes noted above are thoroughly documented. Furthermore, critical deficiencies presenting a risk to safety or reliability are reported immediately and addressed through preventative maintenance as described in 'Maintenance of Overhead Systems' discussed below. Completed reporting forms are returned to the line superintendent following completion of the inspection and condition assessment.

Parks, Playgrounds & Schoolyards

The inspection of overhead line assets in or near parks, playground and schoolyards is performed annually. The greater frequency reflects the greater risk associated with these parts of the distribution systems. Visible hazards such as broken ground wire, missing guy guards, inadequate signage on pad-mount transformers or indications of tampering or climbing are identified. Such deficiencies are documented and remediated at the time of inspection if possible. Those deficiencies for which corrective action could not be immediately performed are also documented for review and prioritization by the line superintendent.

Capacitors

Capacitor banks are currently visually inspected on an annual basis. Within the visual patrol, capacitors are inspected primarily for condition and operation of fused switches and hot-line clamps. All deficiencies and corrective action performed (typically concurrent with inspections) are documented and subsequently reviewed by the line superintendent.

Load-Break Switches

All load-break switches on the WNH distribution system are inspected according to the DSC inspection requirements. Within the inspection, PLMs identify switch deficiencies. All deficiencies identified during the inspection are documented and prioritized. Those deficiencies presenting risk to safety, reliability, or those affecting operations, are deemed highest priority and therefore categorized as critical. Such deficiencies are also immediately reported to the line superintendent for corrective action.

ii. Inspection of Underground Systems

The underground distribution system spans WNH's three geographic distribution service areas, of which one is urban and two are rural. Unless otherwise noted the inspection frequency is derived from Appendix C of the DSC whereby approximately one-third of urban area and one-sixth of rural area are scheduled to be inspected annually on a three and six year cyclical basis, respectively.

The patrol serves as a visual inspection to identify obvious structural problems and hazards and to assess the condition of major distribution system assets. With respect to the underground distribution system, these assets include distribution transformers, switching cubicles, vault rooms and vegetation surrounding these assets.

Distribution Transformers

WNH's underground distribution system incorporates numerous distribution transformers, comprised primarily of pad-mounts, but also includes a small population of submersibles. In addition to the inspection frequency, WNH's condition assessment is also based on Appendix C of the DSC, as reflected in the reporting form, 'Inspection of Underground Transformer and Switching Units'. This form provides a guideline for the condition assessment (for which the structure is opened) and allows for documentation of deficiencies (or lack thereof) concerning the physical condition, placement of pad, locks and locking mechanisms, grading, access changes, phasing indicators, nomenclature and internal/external apparatus, such as a cracked elbow connectors.

As with inspection of the overhead system, critical deficiencies identified during the inspection are documented, immediately reported and addressed through maintenance as described in the section ‘Maintenance of Underground Systems’. Completed assessment reports, identifying both critical and non-critical deficiencies, are returned to the line superintendent for review and scheduling of follow-up action. Recommendations for replacement are followed up with the engineering department. Assessment reports are also archived within the appropriate inspections database.

Switching Cubicles

As with distribution transformers, the frequency of inspection and condition assessment is based on the DSC’s Minimum Inspection Requirements for switching kiosks and includes, at a minimum, identification of deficiencies concerning paint, locking mechanisms, accessibility and the structure. The full list of deficiencies for which WNH, and more generally LDCs, should be aware is available in Appendix C of the DSC. Following the general practice of deficiency identification, all deficiencies are documented and archived within the appropriate inspections database for review and scheduling of corrective action. Furthermore, critical deficiencies are both immediately reported and addressed through preventative maintenance.

Vault Rooms

Inspection of vault rooms occurs on an annual basis and in conjunction with IR thermography. The greater frequency reflects the greater risk associated with these parts of the distribution systems. Deficiencies, typically concerning accessibility, are identified, documented and submitted to the appropriate supervisor for subsequent remediation and to the GIS group for archival of data within the inspections database. It should also be noted that, while infrequent, any critical deficiencies are immediately reported to coordinate remediation as soon as possible.

iii. Inspection of Stations

As with the overhead and underground distribution system, WNH performs comprehensive station inspections and condition assessments as described below. In addition, WNH complies with grid connected inspection and reverification standards identified in the OEB Transmission Code.

Transformer Stations

WNH incorporates the requirements of the OEB's DSC, Transmission Code and industry best practices as the basis for its TS inspection and maintenance program. Under the direction of the Protection & Control (P&C) supervisor, TS inspections incorporating several activities on a weekly, monthly and yearly basis are subsequently performed by the substation maintenance electrician or the P&C technologists. **Table 3-58** outlines the inspection frequency at each of the transformer stations.

Table 3-58: TS inspection program and frequency

TRANSFORMER STATION ITEM	FREQUENCY
Transformer Equipment	Weekly
Tap Changer Operation	Weekly
Battery Chargers	Weekly
Miscellaneous (eg. yard, lighting, alarms)	Weekly
Station Equipment (e.g. transformer, switchgear, reclosers, fans, fencing)	Monthly
Transformer Oil Testing	Yearly
Transformer cooling fan and pump vibration analysis	Yearly
Infrared Thermography	Yearly

To facilitate inspections, guidelines have been developed by the stations department and elaborate on the monthly station equipment inspection and condition assessment, providing specific items to be verified. These forms are based, in part, on the OEB, IESO guidelines, but further incorporate items specific to these stations. During the inspection, deficiencies observed are noted on the corresponding inspection form. Documented deficiencies are reviewed by the P&C supervisor and further prioritized whereby those impacting health and safety or the reliability of the system are deemed critical and subsequently scheduled for corrective action. Records of inspection and test dates are maintained electronically by the P&C supervisor while reporting forms are largely paper-based. Deficiencies of a more serious nature that require capital replacement or refurbishment are also assessed by the stations engineering department.

Municipal Stations and Distribution

Inspections of MS/DSs occur on a monthly basis, as scheduled by the P&C supervisor, and incorporate several activities as outlined in **Table 3-59**. As with inspections of TSs, guidelines have been developed and are based on the DSC Minimum Inspection Guidelines and industry best practices.

Table 3-59: DS/MS inspection program and frequency

DISTRIBUTION AND/OR MUNICIPAL STATION ITEM	FREQUENCY
Reclosers	Monthly
Transformer Equipment	Monthly
Station Equipment (e.g. switchgear, capacitor bank, fencing, lighting, radio/RTU)	Monthly
Transformer Oil Testing	Yearly
Infrared Thermography	Yearly

Deficiencies that have been identified, either pertaining to the above items or otherwise, are noted on the appropriate station deficiency reporting form and assigned a priority level, indicative of response time for remediation. These deficiencies are reviewed by the P&C supervisor, compiled into a single deficiency list and prioritized as critical or non-critical, based on impact to health/safety, system reliability or impact to equipment. Similar to documentation for TSs, records of MS/DS inspection and test dates are maintained electronically by the P&C supervisor while reporting forms are largely paper-based.

B. WNH Maintenance Programs

As previously noted in **Section 3.3.1.4**, WNH employs three maintenance strategies, Condition-based maintenance, Preventative maintenance and Reactive maintenance.

i. Maintenance of Overhead Systems

Generally, deficiencies discovered during regularly scheduled inspections are corrected to remediate the deficiency either at the time of inspection, or as soon as possible following inspection. If further corrective action is required, or cannot be performed concurrently with the inspection, the line superintendent is immediately notified to allow for the required lead-time to procure materials or coordinate with third parties. Additionally, corrective action to remediate minor deficiencies may also be performed during the visual patrol. This may include replacement of broken guy guards or missing phase markers. Remaining deficiencies are reviewed by the line superintendent and prioritized for corrective action. The inspections database is subsequently updated to reflect remediation.

All maintenance performed is documented for review and analysis by the line superintendent and for archival within the inspections database. Through analysis of maintenance data (further elaborated below), recurring deficiencies may be identified and channeled into a capital program for asset replacement.

Crossings

The type of deficiencies found at crossings and the maintenance performed to remediate the deficiencies is no different than in other parts of the overhead distribution system. Crossings however are unique in the challenges they present to complete the work. River crossings have accessibility challenges due to terrain and seasonal conditions. Some require specialized equipment for access. Work on highway crossings can require extensive coordination of police and ministry of transportation (MOT) staff if road closure is required. Deficiencies are documented, reviewed by the line superintendent and prioritized for corrective action. Remediation is scheduled allowing time for coordination with appropriate authorities and seasonal conditions.

Parks, Playgrounds & Schoolyards

If possible, deficiencies are remediated during the time of the visual patrol. Corrective action is documented to allow for subsequent review and/or reporting. Remaining deficiencies are also documented, reviewed by the line superintendent and prioritized for corrective action. Critical deficiencies are reported immediately and typically remediated within one week, allowing for coordination with appropriate parties; non-critical deficiencies may be remediated in coordination with other maintenance programs.

Load-Break Switches

Preventative maintenance of load-break switches includes replacement of nomenclature, phase markers, arresters, porcelain insulators with composite insulators and replacement or repair of switch components; also included is cleaning, lubrication and testing of switching operation. All preventative maintenance activities are documented on the appropriate reporting form, as well as surrounding or non-related deficiencies which required corrective action.

Preventative maintenance to address critical deficiencies is typically performed within 24 hours of the inspection and entails either refurbishment or complete replacement of the switch, depending on the nature of the deficiency. Refurbishment is the preferred methodology where peripheral or secondary components to the switch are critically deficient, for example a corroded connector with the potential to burn the line. In the event of extensive damage the switch will need to be replaced. WNH also has implemented an annual program to replace the worst performing load-break switches, as found through inspection and maintenance activities.

Vegetation Management

Vegetation management, or tree trimming, is a preventative maintenance program scheduled on a 2 - and 5-year cycle, where one of each of 2 urban zones and 5 rural zones of the distribution system is completed annually. This work represents approximately 80% of the annual vegetation management program. This activity is executed according to the previously established Ontario Hydro guidelines and completed by in-house utility arborists and qualified contractors that have specialized knowledge of growth rates of various vegetation. As such, arborists may either trim more or less growth than as outlined by the guidelines to account for varying growth rates and in consideration of the line clearing cycle.

Approximately 20% of the annual program is comprised of reactive line clearing work to trim or remove trees in proximity to power lines, in response to storms, customer requests or as identified by WNH staff observations. Such requests are documented via customer request sheets or work orders and prioritized following an inspection by the utility's lead arborist. Vegetation that has caused an outage is deemed critical and addressed immediately whereas tree growth with the potential to cause an outage is addressed within one week. WNH takes additional preventative maintenance initiatives in their vegetation management program including tree-trimming during the implementation of capital build/rebuild projects.

Infrared Thermography

Infrared (IR) thermography is completed annually on the three phase portion of the overhead distribution system by a qualified contractor. This non-destructive, non-invasive condition assessment of three-phase conductors and primary and secondary connections and tie-points at distribution equipment allows for deficiencies (thermal anomalies) to be identified. Throughout this process, severe thermal anomalies, representing dangerous overheating with potential to disrupt supply or damage equipment, are reported on a daily basis to the line superintendent. Critical deficiencies are generally remediated within 24 to 48 hours, allowing for customer and/or outage coordination where applicable.

A summary report, following completion of IR thermography, is prepared and outlines fault locations, severity of the fault (prioritized based on thermal anomaly) and notes and recommendations. In addition to the severe thermal anomalies previously identified, the report also identifies intermediate and minor hot spots. Maintenance to address the faults, as noted in the report, is subsequently prioritized and scheduled based on fault severity; temperature rise above ambient temperature. Remediation work may be grouped together based on deficiency location as a cost savings measure. All anomalies are remediated within the calendar year in which they were first identified. The line supervisor subsequently documents the date of remediation on the original summary report.

Insulator Washing

Insulator washing is typically performed annually on 27.6 kV and 44 kV insulators in areas known to have high salt contamination, for example at expressway crossings, as identified through previous washings and general reporting. The frequency of insulator washing may be prompted by other environmental factors such as industrial contamination.

Insulator washing is performed by a qualified contractor who, during the washing, will also report general insulator concerns such as broken or damaged insulators. Because of the contractor's experience and qualifications, he/she is able to prioritize deficiencies whereby critical concerns, such as those resulting in an outage, are immediately reported to control room and internally remediated within 24 hours. Less critical damage is reported to the line superintendent and remediated within one week.

Pole Testing

WNH has a Pole Testing Program in place whereby poles are tested for baseline fibre strength. Poles chosen for testing are determined by age, risk to public safety and potential impact on system reliability. GIS produced maps are provided to qualified testing contractors to identify and locate the poles to be tested. Results are provided in an electronic database, analyzed and determinations made as to the action required to be taken. Poles with remaining fibre strength less than 50% are scheduled for immediate replacement. Poles with remaining fibre strength between 50% and 67 % are scheduled to be replaced in 1 - 3 years. Poles with remaining fibre strength between 67 % and 75% are scheduled to be retested in 5 years. During the testing procedure a detailed visual inspection is also completed. Serious observed defects may require replacement of the pole irrespective of the fibre testing results.

In addition, poles with incipient decay, hollow heart or shell rotting annually are treated with a borate based preservative to prolong the life of existing poles. This pole testing program is in addition to the general patrol and inspection of the overhead system previously noted. Inspection and testing data is archived in WNH's GIS database for analysis and development of future inspection programs.

ii. Maintenance of Underground Systems

Distribution Transformers

While maintenance is performed on pad-mount and submersible distribution transformers during inspections, it is generally limited to renumbering elbow tags for visibility, installing new exterior or interior nomenclature where absent or remediation of critical deficiencies, provided this may be done at the time. Where such remediation of critical deficiencies cannot be done, due to outage coordination requirements with a customer for example, corrective action is scheduled for the earliest opportunity; until then, the distribution transformer is secured.

Deficiencies are prioritized by the line superintendent and scheduled along with other corrective maintenance work. All corrective action is documented and archived within the inspections database. Through analysis of maintenance data, recurring deficiencies may be identified and channeled into a capital program, as required, for asset replacement.

Switching Cubicles

Remediation of critical deficiencies involving access and security such as temporarily securing lids with broken hinges or locks, are performed at the time of inspection to provide adequate safety and/or reliability until replacement can be coordinated. Deficiencies of a lower priority, as identified during the inspection and condition assessment, are documented and further archived within the inspections database. A report of outstanding deficiencies is subsequently prepared whereby deficiencies are categorized according to the corrective action required and channeled into maintenance programs for rehabilitation, such as painting, or into a capital program for replacement.

Vault Rooms

Deficiencies specific to vault rooms are documented and reported to the line superintendent for prioritization and remediation, typically as soon as possible allowing for coordination and outage scheduling. Deficiencies involving security such as door and lock conditions are dealt with immediately.

Infrared Thermography

IR thermography on the underground distribution system is completed annually in conjunction with the overhead system and includes identification of thermal anomalies at transformer vault rooms, pad-mounted, switching cubicles, transformers and underground risers.

As with the IR thermography of the overhead system, severe deficiencies presenting an immediate safety or reliability concern are reported on a daily basis to the line superintendent and remediated within 48 hours, or at the earliest opportune time, allowing for outage coordination where required. Following a review of the summary report outlining IR thermography activities and thermal anomalies, corrective action to remediate intermediate and minor deficiencies is prioritized and scheduled based on the severity of a deficiency.

iii. Maintenance of Substations

WNH has well established and comprehensive preventative and condition-based maintenance programs that provide the basis for condition assessment and remediation, with respect to Transformer Stations, Distribution Stations and/or Municipal Stations. In addition to satisfying the reporting requirements of the OEB’s DSC, and the application of industry best practices, the IESO mandates additional requirements for grid connected Transformer Stations that are met by the LDC.

Deficiencies that have been identified during the inspection and condition assessment of stations are documented and categorized as critical or non-critical, whereby the former impact health/safety and reliability, and the latter have the potential to impact these items or the equipment itself. Critical or non-critical minor deficiencies may be remediated during the inspection, provided materials are on-hand or as warranted. Those not remediated at the time are subsequently reviewed by the P&C supervisor and compiled into a single deficiency list. Critical deficiencies are addressed at the earliest opportunity, accounting for material lead-times or outage coordination. Conversely, non-critical deficiencies are addressed within one year or coordinated with preventative maintenance activities for the station to mitigate outage time, if required. Following remediation, specific information about corrective action taken and the completion date is documented.

The decision of whether corrective action is best exercised through maintenance or capital replacement is made through analysis by the P&C Supervisor and engineering. The majority of results and actions are recorded in electronic format as P&C technologists utilize laptops during preventative maintenance.

Table 3-60a: MS/DS Maintenance Activities and Intervals

MAINTENANCE COMPONENT	1 YEAR INTERVAL	2 YEAR INTERVAL	4 YEAR INTERVAL	5 YEAR INTERVAL	10 YEAR INTERVAL
Transformers & Line Switches				X	
Switchgear Bus					X
Station 24/48 Battery Banks	X				
Capacitor Banks & Switches				X	
SCADA/Local Alarms		X			
Feeders				X	
Transformer Oil Testing	X				
IR Thermography	X				
Painting					X

Table 3-60b: TS Maintenance Activities and Intervals

MAINTENANCE COMPONENT	1 YEAR INTERVAL	2 YEAR INTERVAL	4 YEAR INTERVAL	5 YEAR INTERVAL	10 YEAR INTERVAL
Transformer & Line Switches			X		
Vibration Analysis (Tx oil cooling fans and pumps)	X				
Switchgear Bus					X
Transformer/Line/CBF		X			
Bus/Transformer/Line Protections		X			
Bank and Tie Breakers		X			
Feeders (breakers/cables/protections)			X		
Battery Banks	X				
Sustained Alarms		X			
Full SCADA Check		X			
IR Thermography	X				
Transformer Oil Testing	X				
Painting					X

These programs provide for continuous system improvement and performance reliability, ensuring long term capacity, supply availability/reliability to meet customer demands. These programs further contribute to the effective and successful management of these assets.

WNH maintains electronic records of past maintenance activities and future condition-based maintenance intervals for specific equipment at each TS, MS and DS. Although WNH follows IESO mandated fixed maintenance frequencies with TS assets, the LDC also utilizes a predictive maintenance approach based on this testing and data analysis, WNH's maintenance practices in this area are also founded in industry best practices, consultation with neighbouring utilities and manufacturers. **Table 3-60a&b** above outlines major components and intervals of planned maintenance on TS, DS and MS assets.

Infrared Thermography

IR thermography of all stations is completed annually and coordinated with thermography of the overhead and underground distribution system, following the IR processes previously described for preventative maintenance on the overhead and underground system. Following the IR thermography inspection, a report is produced outlining inspection activities, thermal anomalies and recommendations. The report is reviewed by the P&C supervisor and recommendations may be implemented for remediation of anomalies or, if more extensive, coordinated with engineering.

Vegetation Management

Vegetation control around transformer stations, rural distribution stations and transformer enclosures is carried out annually under the direction of the P&C supervisor by WNH stations staff or a qualified contractor. The main activities consist of the control of vegetation in the station granular material to reduce step potential hazards, the prevention of climbing access into station yards and the creation of clear sight lines along station fence lines for security reasons.

Insulator Washing

Insulator washing is typically performed on selected 27.6 kV and 44 kV station structures in areas known to have high salt contamination (mostly from roadway spray), as identified through previous inspections. The work is coordinated with the annual overhead lines insulator washing program.

Vibration Monitoring

In addition to regular visual inspections, WNH performs annual vibration analysis to assess the condition of oil cooling fans and oil circulation pumps associated with grid connected transformers. Vibration analysis aids in the prediction of impending failures that can directly lead to derating of the transformers. WNH contracts this specialized work with a third party. A report is produced outlining anomalies and recommendations. The report is reviewed by the P&C Supervisor and recommendations may be implemented for remediation of anomalies or, if more extensive, coordinated with engineering.

Transformer Oil Testing

Transformer oil condition and dissolved gas analysis (DGA) is performed on all power substation transformers on an annual basis. Oil sampling is coordinated by the P&C supervisor using internal staff. WNH contracts the specialized work of oil testing and analysis with a third party. A report is produced outlining anomalies and recommendations. The VP of Engineering & Stations reviews the report and provides direction for remediation of anomalies.

3.3.2 (5.3.3b) a description of asset life cycle risk management policies and practices

- **assessment methods and approaches to mitigation, including but not necessarily limited to the methods used; types of information inputs and outputs; and how conclusions of risk analyses are used to select and prioritize projects**

For WNH, risk management is about using a systematic approach to understanding risks that can impact WNH's strategic imperatives and implementing strategies to mitigate and manage those risks.

WNH uses the approach of asset inspection, condition and performance assessment to inform its asset management process and understand the asset risk. Inputs include:

- Condition
- Age and TUL
- Location
- Operational performance (reliability)
- Maintenance activity
- Customer impacts

The details of this systematic approach are documented in Sections 3.1.1, 3.1.2, 3.3.1. WNH uses its industry best practices along with its expertise and judgment to assess the relative risk of failure to its assets. WNH then prioritizes, or ranks, each risk for significance and likelihood. WNH then determines the best strategy that will be most effective in mitigating the risk. Strategies such as risk avoidance, acceptance, transference, and limitation are all used in varying degrees. WNH considers the cost of the risk mitigation strategies and the risk it is willing to accept before selecting and prioritizing the projects.

4.0 Detailed Capital Investment Plan (5.4)

4.1 Summary (5.4.1)

4.1.1 (5.4.1a) information on the capability of the distributor's system to connect new load or generation customers

Based on WNH's evaluation of its distribution system, it is expected to have sufficient capacity to accommodate new Renewable Energy Generators and new load connections forecast for the years 2016 - 2020. Load and Renewable Energy Generation is expected to increase throughout the forecast period, however, not at a pace that would impose any capacity constraints or any changes in loading requirements of the system.

There are no investment requirements for any expansion or reinforcement necessary to remove grid constraints to accommodate the connections of renewable energy generation under the province's Feed-in-Tariff (FIT) and microFIT programs for the period 2016 - 2020.

There are investments outlined in this DS Plan that will provide WNH with a greater flexibility in respect of existing capacity to keep generators and load customers connected to the distribution system under a wider range of abnormal system conditions. These investments will also allow a greater and timelier ability to restore power.

The capabilities of the WNH's distribution system are presented in detail in the following sections of this DS Plan;

1) Section 1.2
2) Section 3.1.2
3) Section 3.2.4
4) Appendix A – WNH Renewable Energy Generation Plan

4.1.2 (5.4.1b) Total annual capital expenditures over the forecast period, by investment category.

Table 4-1: Summary of Capital Spending for Forecast Period

OEB Investment Category	Forecast Period					% of Annual Investment	Average Annual Investment
	2016	2017	2018	2019	2020	2016 - 2020	2016 - 2020
System Access	$ 6,622,858	$ 5,892,104	$ 6,020,046	$ 5,946,859	$ 6,085,796	33.1%	$ 6,113,533
System Renewal	$ 8,181,031	$ 8,545,000	$ 9,438,200	$ 8,800,764	$ 8,975,779	47.6%	$ 8,788,155
System Service	$ 2,405,950	$ 1,680,000	$ 1,725,200	$ 1,175,404	$ 1,175,612	8.8%	$ 1,632,433
General Plant	$ 1,869,078	$ 2,813,765	$ 1,661,176	$ 1,670,309	$ 1,649,525	10.5%	$ 1,932,771
Totals	$ 19,078,917	$ 18,930,869	$ 18,844,622	$ 17,593,336	$ 17,886,713	100.0%	$ 18,466,891

4.1.3 (5.4.1c) A brief description of how for each category of investment

- **the outputs of the distributor's asset management and capital expenditure planning process have affected capital expenditures in that category and the allocation of the capital budget among categories.**

From **Table 4-1** it can be seen that the key elements of WNH's investment plans are in the areas of System Access and System Renewal. Over the entire forecast period these two categories account for 81% of the total planned investments. It can also be seen that the level investment in 2016 is relatively consistent with the average level of investment over forecast period. This investment plan is reflective of the inputs/outputs of WNH's asset management and capital expenditure planning process.

4.1.3.1 System Access (SA)

Most, if not all of WNH's SA investments are investments required in order to be compliant with regulations, meaning that WNH has only limited influence on the magnitude and timing of the required investments.

Many of WNH's System Access investments are driven by growth. As previously mentioned WNH operates in a region that continues to be one of the fastest growing communities in the province. As described in **Section 2.2**, WNH maintains an extensive and continuous consultation program with the municipal planning staff, developers, builders, real estate agencies, and major customers to determine the level expected and timing of growth related projects. These consultations inform WNH's annual budget, long term load forecast and 5 year capital forecast which form part of WNH's capital expenditure planning process. These consultations have a direct impact on WNH's proposed investment plan.

Regulatory requirements form a much smaller but no less important component of SA investments. WNH keeps well abreast of current and impending regulatory requirements and considers those as an input into WNH's capital expenditure planning process. In this DS plan investments into Interval Metering for >50kW commercial customers is included in WNH's proposed investment plan.

Specific SA projects that have been identified for investment in 2016 are identified in **Table 4-2b** and **Appendix G.**

4.1.3.2 System Renewal (SR)

WNH's SR projects represent investments required due to assets reaching the end of their TUL, found to be in poor condition or exhibit poor performance. WNH maintains an extensive asset register and has established comprehensive data collection, asset inspection, testing and maintenance programs to provide for continuous condition assessment and remediation of distribution system assets. Specific outputs of these condition assessment processes feed into WNH's asset management process. Outputs from asset management directly feed into both WNH's O&M and capital expenditure planning processes.

Specific SR projects that have been identified for investment in 2016 are identified in **Table 4-2a** and **Appendix G.**

4.1.3.3 System Service (SS)

WNH's System Service projects represent investments aimed at improving system operations, reliability and efficiencies through distribution automation, intelligent devices or equipment.

WNH monitors distribution system reliability on a close and continuous basis. Events impacting reliability are recorded and the data is analyzed by cause and geospatially referenced to identify patterns in frequency and location of events. WNH considers quantitative metrics such as SAIDI, SAIFI, CAIDI, worst performing feeders as well as more qualitative feedback from customer consultations. These reliability assessments feed into WNH's asset management process from which O&M or capital investment proposals are developed. Specific SS projects that have been identified for investment in 2016 are identified in **Table 4-2a** and **Appendix G.**

4.1.3.4 General Plant (GP)

The capital investments in GP include investments into fleet/rolling stock, equipment and tools, buildings and facilities, computer hardware and software systems. These investments are driven by the objectives of improving employee safety, worker productivity and operating efficiency. A number of these expenditures tend to fluctuate and WNH attempts to apply smoothing to these expenditures on a year to year basis.

WNH performs condition/operational assessments on many of the assets in this category. Typically the assets were identified based on age, condition, cost of operation and performance.

The assessment of fleet/rolling stock is determined through analysis of condition assessments, compliance with the Ontario Ministry of Transportation safety requirements, maintenance and fuel consumption costing information (operation & maintenance), utilization (operating hours and total kilometers driven), and asset age. This analysis results in the prioritization of vehicles and equipment that is targeted to be replaced in the following year's capital budget as well as the following 5 year period.

WNH's Information Technology Services (IT) department reviews IT assets on a regular basis with the goal to align with WNH's strategic objectives. One such investment in 2016 will be the acquisition and implementation of a new Customer information System (CIS) to replace the current CIS system. This project will reduce CIS costs and provide for better customer service while delivering improved productivity and organizational effectiveness. The current CIS system purchased in 2000 is based on outdated technology, which is difficult and costly to modify. This compromises WNH's ability to efficiently and cost effectively deploy the necessary CIS enhancements as required for new regulatory and public policy initiatives. WNH performed a cost/benefit analysis and determined a 3 year payback for this investment based on reduction of annual maintenance fees alone. The new software will have improved customer support capabilities, enhanced field based service order processing, and streamlined and automated billing related routines leading to improved productivity and organizational effectiveness with a measurable annual reduction of $100,000 in maintenance fees.

The assessment of building and property condition and cost of ownership helps determine maintenance and capital replacement schedules and priority of assets. WNH staff perform regular inspections and minor maintenance. WNH also retains a number of contractors and consultants in civil, mechanical and construction disciplines to provide assessments and advise on investment plans.

Tools and equipment are typically not material expenditures. Assessments are performed by staff and first line supervisors. Small hand tools are expensed. Requests for larger tool and equipment expenditures (>$1000) go through a formal approval and evaluation process with more senior management at budget time.

Specific GP projects that have been identified for investment in 2016 are identified in **Table 4-2b** and **Appendix G.**

4.1.4 (5.4.1d) A list and brief description including total capital cost of material, capital expenditure projects/activities, sorted by category

Table 4-2a&b provides a listing of WNH's 2016 proposed material investments. Detailed descriptions of each 2016 material project are provided in **Appendix G.**

Table: 4-2a: 2016 Material Capital Investments

WNH Project	OEB Cat	Activity	Project Name	Total	Driver
06EN06	**SS**	New Distribution Automation	2016 Recloser Program	**$1,035,635**	Reliability
06EN06	**SS**	New OH Tie Line	Huntsberger Rd - Katherine St to Golf Course Rd	**$407,011**	Capacity Transfer
06EN06	**SS**	New OH Tie Line	Northfield Dr - Weber St to Westmount Rd	**$401,821**	Capacity Transfer
06EN04	**SR**	Replace OH Line	Chilligo Rd - Kossuth Rd to Woolwich/Guelph Townline	**$692,257**	OH Renewal
06EN04	**SR**	Replace OH Line	#6: Buehler Ln - Lavery Rd to Lichty Rd	**$578,988**	OH Renewal
06EN09	**SR**	Replace UG Line	2016 Lakeshore North Ph 9	**$558,293**	UG Renewal
06EN04	**SR**	Replace OH Line	City 4kV - Union St - King St to Weber St	**$431,717**	OH Renewal
06EN04	**SR**	Replace OH Line	Scotch Line, New Jerusalem Rd to Arthur St	**$385,294**	OH Renewal
06EN04	**SR**	Replace OH Line	#6: Sawmill Rd, Conestogo - side streets	**$330,981**	OH Renewal
06EN04	**SR**	Replace OH Line	Deborah Glaister Ln - Chalmers Forest to Rd 116	**$295,897**	OH Renewal
06EN04	**SR**	Replace OH Line	City 4kV - Weber St - Allen St to Hartwood Ave	**$271,184**	OH Renewal
06EN04	**SR**	Replace OH Line	Nafziger Rd - Gerber Rd to Queen's Bush Rd	**$268,740**	OH Renewal
06EN04	**SR**	Replace OH Line	City 4kV - Allen St - Railway to Weber St & side streets	**$264,024**	OH Renewal
06EN04	**SR**	Replace OH Line	William Hastings, Manser to Lichty	**$262,223**	OH Renewal
06EN09	**SR**	Replace UG Line	2016 Lakeshore North Ph 8	**$250,824**	UG Renewal
06EN04	**SR**	Replace OH Line	2016 Storm and Equipment Damage	**$228,539**	OH Renewal
06EN04	**SR**	Replace OH Line	City 4kV - William St & Willow Sts - Regina St to Allen St	**$210,022**	OH Renewal
06EN04	**SR**	Replace OH Line	4kV OH Conversions	**$205,390**	OH Renewal
06EN04	**SR**	Replace OH Line	Woolwich/Guelph Townline - Victoria St to Chilligo Rd	**$199,335**	OH Renewal
06SN04	**SR**	Replace OH Line	HSB Breaker Refurbishment Option - 2 Buses, Phase 2 of 2	**$193,611**	TS Renewal
06EN04	**SR**	Replace OH Line	City 4kV - John St - King St to Moore Ave	**$184,736**	OH Renewal

Table: 4-2b: 2016 Material Capital Investments (continued)

WNH Project	OEB Cat	Activity	Project Name	Total	Driver
06EN11	SA	New UG Connections	New Underground Service Connections/Upgrades	$1,429,245	Customer Requests
06EN07	SA	New OH Connections	New Overhead Service Connections/Upgrades	$727,131	Customer Requests
06EN10	SA	New UG Expansion	Subdivisions - 200 lots	$593,795	Customer Requests
06EN08	SA	OH Line Relocation	2016 - LRT - 13.8 kV - Northfield Dr. - Conestogo Rd.	$460,277	Relocation
13MT07	SA	New & Replacement Meters	C&I Meters > 50kW (Retail)	$306,402	Meters
06EN08	SA	OH Line Relocation	Erb St. - HONI to Costco	$286,095	Relocation
06EN08	SA	OH Line Relocation	2016 - LRT - University Ave. Spur- Westmount Rd.	$245,642	Relocation
06EN05	SA	OH Line Relocation	Bridgeport Rd/Caroline St, King St to Erb St	$237,956	Relocation
06EN08	SA	OH Line Relocation	2016 - LRT - Spur - Kumpf Dr.	$222,154	Relocation
06EN08	SA	OH Line Relocation	2016 - LRT - 27.6 kV - King St.- Northfield Dr.	$221,444	Relocation
06EN08	SA	OH Line Relocation	2016 - LRT - 13.8 kV - King St.- Northfield Dr.	$221,444	Relocation
13MT06	SA	New & Replacement Meters	Residential Meters (Retail)	$210,467	Meters
06EN08	SA	OH Line Relocation	2016 - LRT - Spur - Quiet Pl.	$202,079	Relocation
06EN08	SA	OH Line Relocation	2016 - LRT - 13.8 kV - King St.- Conestogo Rd.	$195,059	Relocation
06EN05	SA	OH Line Relocation	Hutchinson Rd - Through Crosshill	$179,643	Relocation
06FL02	GP	Fleet Replacement	R60 - RBD	$454,513	Fleet / Rolling Stock
06SS03	GP	Software Replacement	New CIS System, in service 2016	$340,779	Computer Software
06SS03	GP	New Software	Asset Management S/W Implementation	$277,128	Computer Software

4.1.5 (5.4.1e) information related to a Regional Planning Process

- **or contained in a Regional Infrastructure Plan that had a material impact on the distributor's capital expenditure plan, with a brief explanation as to how the information is reflected in the plan**

Since 2010, WNH has been an active participant in the KWCG IRRP. The planning activity for the KWCG Region was already underway prior to the new regional planning process (RPP) and was deemed to be in the Integrated Regional Resource Plan ("IRRP") phase of the process. This IRRP phase, led by the IESO (formerly OPA), is expected to be completed by Q2 2015.

WNH anticipates that there will be no material impact arising from any recommendations that may flow out of the IRRP. The KWCG IRRP has no material impact on this DS Plan.

Detailed information is provided in **Section 2.1.6** and IESO and HONI letters of comment **(Appendix A & B)** of this DS Plan.

4.1.6 (5.4.1f) a brief description of customer engagement activities

- **to obtain information on their preferences and how the results of assessing this information are reflected in the plan**

Detailed information is provided in **Section 2.2.1** of this DS Plan.

4.1.7 (5.4.1g) a brief description of how the distributor expects its system to develop over the next five years

- **including in relation to load and customer growth, smart grid development and/or the accommodation of forecasted renewable energy generation projects**

Growth – WNH expects annual growth in peak load (2%) and customers (1.3%) to continue over the next 5 years. WNH does not anticipate any constraints on overall supply or the ability to connect new load and generation customers.

Transformer Stations – For grid connected stations (TS's), WNH will be continuing to renew station assets due to age and condition. The need for a new transformer station is beyond the 2016–2020 time period. All 4.16 kV municipal transformer stations (MS's) and two 8.32 kV distribution stations (DS's) will be retired within the next 5 years as a result of line renewal projects. Due to the age of the DS Transformer assets, WNH expects 1 DS power transformer will need to be replaced before 2020. WNH will need to renew some DS assets such as station reclosers and protections to keep reliability from deteriorating. Although outside of the 2016–2020 timeframe, WNH expects to retire all of its 8.32 kV stations by 2030.

Overhead and Underground Lines – There will be new lines needed for growth and to improve the use or transfer of existing capacity. Most of the work with existing lines will be in renewing due to age and condition and uprating to higher and more efficient voltages. The uprating of lines during the renewal process increases line capacity and efficiency, reducing the need to construct more lines. The 4.16 kV distribution system will be eliminated and the 8.32 kV distribution system will be reduced in size over the next 5 years. More intelligent switching devices, communications and sensory devices will be installed to meet reliability expectations and reduce O&M labour costs.

Smart Grid - Over the next 5 years, WNH's distribution system will see continued investments in the deployment of advanced distribution automation devices and technologies. SCADA connected electronic reclosers and fault indicators, enhances distribution protection relays, SCADA improvements such as FDIR, Outage Management System enhancements and advanced communications infrastructure to support these technologies. These investments are focused on reliability and capacity utilization improvements.

Renewable Energy Generation – As previously stated, WNH has sufficient capacity on its distribution system to accommodate REG. Many of the investments previously stated also have the benefit of facilitating the connection of REG. Detailed information is provided in **Appendix A** of this DS Plan.

4.1.8 (5.4.1h) A list and brief description including where applicable total capital cost of projects/activities planned:

- **in response to customer preferences (e.g., data access and visibility; participation in distributed generation; load management);**
- **to take advantage of technology-based opportunities to improve operational efficiency, asset management and the integration of distributed generation and complex loads; and**
- **to study or demonstrate innovative processes, services, business models, or technologies.**

4.1.8.1 Customer Preference

It can be seen by the main drivers listed in **Table 4-3** these SA investments are required in order to be compliant with regulations.

Detailed descriptions of each 2016 material project are provided in **Appendix G.**

Table: 4-3: 2016 Material Capital Investments (Customer Driven)

WNH Project	OEB Cat	Activity	Project Name	Total	Driver
06EN11	**SA**	New UG Connections	New Underground Service Connections/Upgrades	**$1,429,245**	Customer Requests
06EN07	**SA**	New OH Connections	New Overhead Service Connections/Upgrades	**$727,131**	Customer Requests
06EN10	**SA**	New UG Expansion	Subdivisions - 200 lots	**$593,795**	Customer Requests
06EN08	**SA**	OH Line Relocation	2016 - LRT - 13.8 kV - Northfield Dr. - Conestogo Rd.	**$460,277**	Relocation
13MT07	**SA**	New & Replacement Meters	C&I Meters > 50kW (Retail)	**$306,402**	Meters
06EN08	**SA**	OH Line Relocation	Erb St. - HONI to Costco	**$286,095**	Relocation
06EN08	**SA**	OH Line Relocation	2016 - LRT - University Ave. Spur- Westmount Rd.	**$245,642**	Relocation
06EN05	**SA**	OH Line Relocation	Bridgeport Rd/Caroline St, King St to Erb St	**$237,956**	Relocation
06EN08	**SA**	OH Line Relocation	2016 - LRT - Spur - Kumpf Dr.	**$222,154**	Relocation
06EN08	**SA**	OH Line Relocation	2016 - LRT - 27.6 kV - King St.- Northfield Dr.	**$221,444**	Relocation
06EN08	**SA**	OH Line Relocation	2016 - LRT - 13.8 kV - King St.- Northfield Dr.	**$221,444**	Relocation
13MT06	**SA**	New &Replacement Meters	Residential Meters (Retail)	**$210,467**	Meters
06EN08	**SA**	OH Line Relocation	2016 - LRT - Spur - Quiet Pl.	**$202,079**	Relocation
06EN08	**SA**	OH Line Relocation	2016 - LRT - 13.8 kV - King St.- Conestogo Rd.	**$195,059**	Relocation
06EN05	**SA**	OH Line Relocation	Hutchinson Rd - Through Crosshill	**$179,643**	Relocation

4.1.8.2 *Technology Based Opportunities*

The projects listed in **Table 4-4** represent SS and GP technology based investments. The SS investments are in Smart Grid type lines and stations equipment. The GP investments are in system software. Detailed descriptions of each 2016 material project are provided in **Appendix G.**

Table: 4-4: 2016 Material Capital Investments (Technology Based)

WNH Project	OEB Cat	Activity	Project Name	Total	Driver
06EN06	**SS**	New Distribution Automation	2016 Recloser Program	**$1,035,635**	Reliability
06EN06	**SS**	New OH Tie Line	New Tie Line - Huntsberger Rd - Katherine St to Golf Course Rd	**$407,011**	Capacity Transfer
06EN06	**SS**	New OH Tie Line	New Tie Line - Northfield Dr - Weber St to Westmount Rd	**$401,821**	Capacity Transfer
06FL02	**GP**	Fleet Replacement	R60 - RBD	**$454,513**	Fleet / Rolling Stock
06SS03	**GP**	Software Replacement	New CIS System, in service 2016	**$340,779**	Computer Software
06SS03	**GP**	New Software	Asset Management S/W Implementation	**$277,128**	Computer Software

4.1.8.3 *Innovative Processes, Services, Business Models or Technologies*

There are no material projects proposed for 2016 that fall into this category.

4.2 Capital Expenditure Planning Process Overview (5.4.2)

4.2.1 (5.4.2a) a description of the distributor’s capital expenditure planning objectives

- **planning criteria and assumptions used, explaining relationships with asset management objectives, and including where applicable, its outlook and objectives for accommodating the connection of renewable generation facilities**

WNH’s Mission, Vision, Corporate Values and Strategic Imperatives are the guiding principles that shape both its Asset management and Investment planning process.

The assumptions made in WNH’s investment decisions are based on the best available data that WNH has obtained through the many and various data collection, data analysis and consultations described in this DS Plan. Significant assumptions that shape WNH’s investment plan include:

- growth forecasts, load and customer;
- asset condition;
- reliability and customer impact;
- CDM and REG impact;
- Impact of regulatory changes or mandated initiatives
- revenue projections; and
- customer bill impact.

The capital expenditure planning process employed by WNH consists of the following steps:

Identification of investments required to be compliant with regulations are considered first. These investments normally fall into the category of System Access and include customer connections and expansions, third party requests and mandated services. The level of expenditure on these investments is determined through growth forecasts, various consultations and historical activity.

Secondly, WNH determines system supply and reliability investments to meet growth and performance targets. These are aligned with WNH’s top two strategic imperatives. These investments normally fall into the category of System Service and include reliability and capacity upgrades. The level of expenditure on these investments is determined through load forecasts, performance indices and customer consultations and system capacity constraints.

WNH then considers System Renewal investments which support reliability, safety and O&M cost control. The level of expenditure on these investments is determined through WNH's condition assessments and asset management process.

WNH then determines the level of investments required to maintain general plant, operating safely, organizational effectiveness and customer service. The level of expenditure on these investments is determined through condition assessments of motor vehicles, building facilities and cost/benefit analysis for IT systems.

Once all of the amounts have been determined, WNH assesses the impact of the total investment plan on rates. Where possible, WNH will identify opportunities to pace investments to moderate sharp bill impacts.

With respect to the accommodation of new REG projects, WNH's objective is to facilitate such requests up to the capacity limit of its distribution system and without detriment to existing load and REG customers. Based on WNH's evaluation of its distribution system, there exists considerable capacity to connect REG throughout the forecast period. In addition, no distribution or grid constraints have been identified which would prevent the connection of REG installations under the province's Feed-in-Tariff (FIT) and microFIT programs. WNH is not proposing any capital investments to accommodate the connection of Renewable Energy Generation for the period 2015-2020.

4.2.2 (5.4.2b) the distributor's policy on and procedure whereby non-distribution system capacity or operational constraints

- **alternatives to relieving system capacity or operational constraints are considered, including the role of RPP in identifying and assessing alternatives**

Although WNH is not expecting capacity constraints over the forecasted period, WNH nevertheless considers monitoring and maintaining system capacity to be essential. WNH looks for and considers all options available to maintain the required system capacity and addresses any operational constraints, including non-distribution system alternatives. As previously stated, this includes:

1. WNH's extensive consultation process with municipal planners, the development community and customers. **(Section 2.2)**
2. WNH's consultation with the IESO, Transmitter and host distributors during the RPP or IRRP process. **(Section 2.2, Appendix A and Appendix B).**
3. WNH's support of CDM initiatives.

These considerations are embedded in WNH's planning process.

4.2.3 (5.4.2c) Tools and Methods

- **Including where relevant linkages to the distributor's asset management process used to identify, select, prioritize and pace the execution of projects in each investment category**

A portfolio of proposed investments has been developed from all 4 investment categories, their ranking is based on their alignment with WNH's investment objectives, which are in turn aligned with WNH's Mission, Vision, Corporate Values and Strategic Imperatives. Investments that achieve multiple and/or higher ranked objectives have greater value. WNH also considers the probability and consequences of asset failure to aid in determining the pacing of these investments. Consideration of the impact of the investment plan on customer bills is part of the decision making process before the investment plan is finalized, approved by WNH senior management and the WNH Board of Directors.

4.2.3.1 System Access

WNH uses its consultation processes with municipal planners, the development community and customers to identify and perform advanced planning requirements for these projects. WNH also trends historical data to aid in forecasting activity. Most if not all of WNH's SA investments are required in order to be compliant with regulations, meaning that WNH has only limited influence on the magnitude and timing of the required investments. In the development of its overall capital investment plan, these investments take priority and WNH looks to adjust the pace of projects in other areas of the business to complete this work.

4.2.3.2 System Renewal

Sections 3.1.1 and 3.1.2 describe WNH's asset management process. System Renewal investment proposals are mainly identified from WNH's condition and reliability assessment programs. WNH's condition assessments, condition ratings and health indices identify assets in poor condition. WNH's prioritization process ranks these projects against WNH's asset management objectives and targets. WNH considers the probability and consequences of asset failure to determine the priority and pace of these investments.

Specifically, assets found at risk of imminent failure are prioritized for immediate replacement. To prioritize the replacement of the remaining assets in poor condition, WNH takes into account additional drivers or benefits of completing the project. This typically includes improvements in: safety, reliability, power quality, opportunity for loss reduction (voltage conversion), operational flexibility, accessibility to operate and maintain, ability to address future system growth or restoration needs, and regulatory compliance. The more drivers or benefits that are attributed to a project, the higher its priority.

4.2.3.3 System Service

System Service investment proposals are mainly derived from WNH's assessment of distribution system performance; for example, reliability indices, system capacity/constraint analysis, voltage, power quality, and stray voltage. WNH's Annual Service Continuity Report **(Appendix F)** refers to a number of tools WNH utilizes to identify and select system performance projects. WNH's prioritization process ranks these projects against WNH's system performance targets. WNH considers the risk of poor system performance to determine the prioritization and pace of these investments.

Specifically, the solutions that can be implemented quickly and/or inexpensively are executed as soon as possible (for example, installation of additional load break switches or reconfiguration of existing circuitry and tap points). Service level issues which can only be solved by interconnect ability improvements require renewal of existing line sections or construction of new line sections. To decide which line sections should be selected to achieve the goal of improvement in interconnect ability, WNH takes into account additional drivers or benefits of constructing each line section. These typically include selecting line sections that; are at or near the end of their useful life, have safety issues associated with them (for example, failing conductors), provide opportunity for loss reduction (voltage uprating), call for additional circuitry from a long term system plan perspective, have experienced other power quality issues (for example, stray voltage or poor voltage regulation), are in need of relocation (either municipally driven or due to WNH's issues with accessibility), or require replacement for regulatory compliance. The more drivers or benefits are attributed to a solution, the higher priority of rebuilding the line sections forming part of that solution.

4.2.3.4 General Plant

Material building projects are identified and selected with the assistance of third part consultants in the building technologies and construction field.

For fleet/rolling stock, vehicle replacement is determined through analysis of condition assessments, compliance with the Ontario Ministry of Transportation (MOT) safety requirements, maintenance and fuel consumption costing information (operation & maintenance), utilization (operating hours and total kilometers driven), and asset age. Costs are summarized annually and analyzed to determine maintenance cost trends by vehicle and equipment type. This analysis results in the prioritization of vehicles and equipment that are targeted to be replaced in the following year’s capital budget as well as the following 5 year capital replacement program. Large vehicles are costly and WNH does attempt to pace these investments to ensure levelized expenditures.

Many new software/hardware investments result from functional obsolescence, meaning that as time passes, the asset will be unable to operate with other dependent technologies. This is especially true for assets that operate in an integrated environment. WNH times investments to maximize the use of the asset before operational failure. Other IT assets because of their age and technology are expensive to maintain and modify relative to the purchase of new technologies. Cost /benefit analysis considering performance gaps in operational efficiencies, the cost to maintain existing software and the cost to move to more efficient platforms are used to determine the timing of material investments.

Specifically, to prioritize the execution of these projects, WNH takes into account additional drivers or benefits of completing the project. This typically includes improvements in: worker safety, ability to continue to provide services to customers, opportunity for cost reduction, increase in productivity, operating efficiency, ability to operate and maintain, ability to adapt to future needs, and regulatory compliance. The more drivers or benefits are attributed to a project (other than asset age and condition), the higher its priority.

A number of these expenditures tend to fluctuate and cluster. WNH takes a levelling approach to moderate expenditure fluctuations on a year over year basis. WNH's strategic imperatives, corporate risk and impact on customer rates are considered before finalization.

A number of these expenditures tend to fluctuate and cluster. WNH takes a levelling approach to moderate expenditure fluctuations on a year over year basis. WNH's considers the effect of these investments on strategic imperatives, corporate risk and impact on customer rates are considered before finalization.

4.2.4 (5.4.2d) Details of mechanisms used to engage customers for the purpose of identifying their needs,

- **priorities and preferences (e.g. surveys, system data analytics, and analysis – by rate class – of customer feedback, inquiries, and complaints; the stages of the planning process at which this information is used; and the aspects of the DS PLAN that have been affected by consideration of this information**

The mechanisms for customer engagement are detailed in **Section 2.2**. They are various in their magnitude, timing and impact on WNH's planning process.

Customer surveys are performed every 2 years. This information tends to influence longer term investment plans. Current survey results from all customer classes support WNH's reliability centric and SR investments contained in WNH's 2016-2020 plan. WNH's past investment in SCADA, OMS and future investments in CIS also supports customer preferences for more and timelier information, especially during power outages.

System data analytics are used on a continuous basis. Their output can lead to increased current year O&M or small capital betterments, near term larger capital investments or the development of longer term capital plans. System reliability analysis (SAIDI, SAIFI, COM and worst performing feeders) have already led to changes in O&M programs (frequency of inspections, tree trimming) and past capital (SCADA, OMS) and future SA capital investments **(Table 4-3).**

Customer feedback through inquiries and complaints tend to be more ad hoc and result in immediate work plans such as inspections (power quality, stray voltage), and maintenance or small capital betterments (service or transformer change). Repeated unresolved concerns will raise the deficiency in priority and inform WNH's condition assessment and asset management process. Aspects of this DS PLAN that have been affected by consideration of this information include SS investments in reliability (electronic reclosers) which has a been a communicated as a top priority with customers (**Section 2.2.1.1).**

4.2.5 (5.4.2e) If different than above, the method and criteria used to prioritize REG investments

- **in accordance with the planned development of the system, including the impact if any of the distributor's plans to connect distributor-owned renewable generation projects.**

WNH does not use a separate prioritization for Renewable Energy Generation Investments. A more complete analysis of WNH's capability to connect Renewable Energy Generation is included **Appendix A**.

4.3 System Capability Assessment for Renewable Energy Generation (5.4.3)

Please refer to WNH's Renewable Energy Generation Plan included in **Appendix A**.

4.4 Capital Expenditure Summary (5.4.4)

Table 2AE - Capital Expenditure Summary from the OEB Chapter 5 Consolidated Distribution System Plan Filing Requirements is provided in **Appendix E.** Represented in this section is the same information with additional analysis provided. Due to the timing of the filing, no actual expenditures for 2015 are provided. WNH has made best efforts to map 2011–2015 data into the four OEB investment categories.

This is WNH's first DS Plan. As such no plan data is provided for 2011–2015.

4.4.1 Historical Period – Yearly Variation in Capital Expenditures

Table 4-5a provides a summary of historical expenditures from 2011–2015. In 2011, WNH made a substantial one-off investment in a new Service Centre and Administration building which is reflected in 2011 General Plant.

Table 4-5a: Historical Expenditures

OEB Investment Category	Historical Years				Bridge Year	Average	% of Total
	2011	2012	2013	2014	2015	2011 - 2015	
System Access	$ 5,616,458	$ 7,835,847	$ 8,667,885	$ 5,625,933	$ 11,084,508	$ 7,766,126	29.9%
System Renewal	$ 9,731,967	$ 9,253,544	$ 7,569,002	$ 9,711,737	$ 6,465,106	$ 8,546,271	32.9%
System Service	$ 1,832,799	$ 1,649,794	$ 1,573,868	$ 2,311,676	$ 1,526,548	$ 1,778,937	6.9%
General Plant	$ 29,572,430	$ 3,380,268	$ 2,140,562	$ 2,044,660	$ 2,232,450	$ 7,874,074	30.3%
Totals	$ 46,753,654	$ 22,119,452	$ 19,951,316	$ 19,694,006	$ 21,308,612	$ 25,965,408	100.0%

In **Table 4-5b,** expenditures in 2011 General Plant excludes the new Service Centre and Administration building. This allows the average expenditures to be normalized providing a better comparison of year to year variances.

Table 4-5b: Historical Expenditures (2011 GP Adjusted)

OEB Investment Category	Historical Years				Bridge Year	Average	% of Total
	2011	2012	2013	2014	2015	2011 - 2015	
System Access	$ 5,616,458	$ 7,835,847	$ 8,667,885	$ 5,625,933	$ 11,084,508	$ 7,766,126	37.8%
System Renewal	$ 9,731,967	$ 9,253,544	$ 7,569,002	$ 9,711,737	$ 6,465,106	$ 8,546,271	41.6%
System Service	$ 1,832,799	$ 1,649,794	$ 1,573,868	$ 2,311,676	$ 1,526,548	$ 1,778,937	8.7%
General Plant	$ 2,481,621	$ 3,380,268	$ 2,140,562	$ 2,044,660	$ 2,232,450	$ 2,455,912	12.0%
Totals	$ 19,662,845	$ 22,119,452	$ 19,951,316	$ 19,694,006	$ 21,308,612	$ 20,547,246	100.0%

4.4.1.1 Variation in Capital Expenditures between 2011-2012

Table 4-6: 2011 - 2012 Capital Variances by Investment Category

OEB Investment Category	General Plant			Historical Average	Variance to Historical Average
	2011	2012	2012-2011	2011 - 2015	2012 - AVE
	Actual	**Actual**	**Variance**		**Variance**
General Plant	$ 29,572,430	$ 3,380,268	$ (26,192,163)	$ 7,874,074	$ (4,493,806)
Totals	$ 46,753,654	$ 22,119,452	$ (24,634,202)	$ 25,965,408	$ (3,845,956)

OEB Investment Category	General Plant Adjusted			Historical Average	Variance to Historical Average
	2011	2012	2012-2011	2011 - 2015	2012 - AVE
	Actual	Actual	Variance		Variance
System Access	$ 5,616,458	$ 7,835,847	$ 2,219,389	$ 7,766,126	$ 69,721
System Renewal	$ 9,731,967	$ 9,253,544	$ (478,423)	$ 8,546,271	$ 707,272
System Service	$ 1,832,799	$ 1,649,794	$ (183,005)	$ 1,778,937	$ (129,143)
General Plant	$ 2,481,621	$ 3,380,268	$ 898,646	$ 2,455,912	$ 924,355
Totals	$ 19,662,845	$ 22,119,452	$ 2,456,607	$ 20,547,246	$ 1,572,206

System Access (SA)

In 2012, expenditure increases for the most part were due to the increase in new subdivision activity and the related system expansions required to connect new customers. Development of the Waterloo west side lands had been delayed for several years prior. The development obstacles were overcome and the developments moved forward in 2012.

In addition, a marked increase in brownfield redevelopment in Waterloo occurred, especially in the Northdale neighbourhood near the two local universities and the uptown core of Waterloo. Expansions and connections to new high density condominiums and apartment buildings began to increase.

System Renewal (SR)

In 2011, expenditures were higher than normal due to the advancement of underground system renewal projects to free up assets to help deal with ongoing reliability concerns with the overhead 44 kV supply circuit from HONI (73M7). This is a 50km radial feeder which was supplying two WNH distribution stations (DS 30 & DS 31). It is also WNH's only 44 kV supply. WNH advanced the planned renewal of 8.32 kV distribution in the Heidelberg/St Clements area with additional investments into renewal and voltage conversion of underground systems in 2011. This allowed for the decommissioning of the DS 33 (27.6 kV/8.32 kV). This would subsequently lead to DS 31 being converted from the 44 kV to 27.6 kV with the use of the DS 33 transformer reducing the number of customers exposed to the 44 kV supply. Increased connectivity between the 8.32 kV stations would improve the reliability of those remaining customers on the 44 kV supply. A number of 2011 SR investments were rescheduled by a few months to accommodate this work resulting in their completion in 2012.

In 2012, the high level of SR investments continued as work-in-progress from 2011 and scheduled 2012 projects were completed.

System Service (SS)

Expenditures in transformer station upgrades decreased slightly in 2012. This variance is well within the normal variability of expenditures in this category.

General Plant (GP)

The majority of the $26.2 million decrease in spending on General Plant between 2011 and 2012 was due to the WNH's new Service Centre and Administration building costs, the majority of which occurred in 2011.

4.4.1.2 Variation in Capital Expenditures between 2012-2013

Table 4-7: 2012 - 2013 Capital Variances by Investment Category

OEB Investment Category				Historical Average	Variance to Historical Average
	2012	2013	2013-2012	2011 - 2015	2013 - AVE
	Actual	Actual	Variance		Variance
System Access	$ 7,835,847	$ 8,667,885	$ 832,038	$ 7,766,126	$ 901,759
System Renewal	$ 9,253,544	$ 7,569,002	$ (1,684,542)	$ 8,546,271	$ (977,269)
System Service	$ 1,649,794	$ 1,573,868	$ (75,927)	$ 1,778,937	$ (205,070)
General Plant	$ 3,380,268	$ 2,140,562	$ (1,239,705)	$ 2,455,912	$ (315,350)
Totals	$ 22,119,452	$ 19,951,316	$ (2,168,136)	$ 20,547,246	$ (595,930)

System Access (SA)

In 2013, the increase in expenditures was due almost entirely to increased municipal roadway relocation activity.

System Renewal (SR)

In 2013, there was a large drop in expenditures in part due to the higher than average expenditure level in 2012 (**see section 4.4.1.1).** Also in 2013, adjustments in the timing of overhead SR investments were required to facilitate an unexpectedly large number of 2013 SA investments, resulting in the completion of some of the scheduled 2013 SR investments being delayed until 2014.

System Service (SS)

This variance is well within the normal variability of expenditures in this category and below the materiality threshold level.

General Plant (GP)

Expenditures in 2012 were higher than normal due to costs from WNH's new Service Centre and Administration building. The decrease in 2013 represents a return to more historical levels of expenditures.

4.4.1.3 Variation in Capital Expenditures between 2013-2014

Table 4-8: 2013 - 2014 Capital Variances by Investment Category

OEB Investment Category				Historical Average	Variance to Historical Average
	2013	2014	2014-2013	2011 - 2015	2014 - AVE
	Actual	Actual	Variance		Variance
System Access	$ 8,667,885	$ 5,625,933	$ (3,041,952)	$ 7,766,126	$ (2,140,193)
System Renewal	$ 7,569,002	$ 9,711,737	$ 2,142,735	$ 8,546,271	$ 1,165,466
System Service	$ 1,573,868	$ 2,311,676	$ 737,808	$ 1,778,937	$ 532,739
General Plant	$ 2,140,562	$ 2,044,660	$ (95,902)	$ 2,455,912	$ (411,252)
Totals	$ 19,951,316	$ 19,694,006	$ (257,311)	$ 20,547,246	$ (853,241)

<u>System Access (SA)</u>

In 2013, expenditures in SA were higher than average due to increased municipal roadway relocation activity and a continuation of new subdivision connections and line expansions from 2012.

In 2014, the sharp drop in expenditures reflects the completion of a number of major projects by the end of 2013, a drop in subdivision activity and also 3 major road relocation projects delayed by the municipalities.

<u>System Renewal (SR)</u>

In 2013, WNH was forced to prioritize completion of some SA investments over SR due to an influx of mandatory work such as customer connections and road relocations. To accomplish this, WNH was forced to reschedule the start of numerous 2013 SR projects to later in the year, which pushed the completion of these projects into early 2014.

<u>System Service (SS)</u>

The expenditure increase in 2014 reflects an increase in reliability centric investments, namely the deployment of SCADA controlled Electronic Reclosers and Fault indicators.

<u>General Plant (GP)</u>

This variance is well within the normal variability of expenditures in this category and below the materiality threshold level.

4.4.1.4 Variation in Capital Expenditures between 2014-2015

Table 4-9: 2014 - 2015 Capital Variances by Investment Category

OEB Investment Category				Historical Average	Variance to Historical Average
	2014	2015	2015-2014	2011 - 2015	2015 - AVE
	Actual	Forecast	Variance		Variance
System Access	$ 5,625,933	$ 11,084,508	$ 5,458,575	$ 7,766,126	$ 3,318,382
System Renewal	$ 9,711,737	$ 6,465,106	$ (3,246,631)	$ 8,546,271	$ (2,081,165)
System Service	$ 2,311,676	$ 1,526,548	$ (785,128)	$ 1,778,937	$ (252,389)
General Plant	$ 2,044,660	$ 2,232,450	$ 187,790	$ 2,455,912	$ (223,462)
Totals	$ 19,694,006	$ 21,308,612	$ 1,614,606	$ 20,547,246	$ 761,366

<u>System Access (SA)</u>

In 2015, the unusually large increase in expenditures on SA is the result of two separate events. Major relocations due to roadway widenings, deferred by the municipalities from 2014 are expected to materialize in 2015. In addition, relocations due to the LRT project are significant in 2015. Many of these relocations are required to occur ahead of the LRT construction and their timing is not at the discretion of WNH.

<u>System Renewal (SR)</u>

In 2014, expenditures were higher than average due to some projects initiated in 2013 not being completed until early 2014. As previously stated, WNH was forced to prioritize an unusually large number of SA investments in 2013.

In 2015, once again an unusually high volume of SA work due to the LRT construction is compelling WNH to reprioritize SA over SR investments. The volume and nature of the 2015 LRT projects (high volume of work at multiple locations over a relatively short period of time in tight coordination with a multitude of stakeholders) requires careful planning and coordination which is complicating the scheduling of WNH’s 2015 work program. In addition, the number of required circuit outages to complete the relocation work will be constraining portions of WNH’s distribution system near the City’s core. WNH examined the additional risk of having to coordinate circuit outages necessary to complete 2015 SR work, and determined that adjustments needed to be made to the 2015 program pace to closer reflect WNH’s ability to complete these projects without creating unnecessary outage risk to our customers.

System Service (SS)

Expenditures in transformer station upgrades will decrease in 2015 due to work completed in previous years. Current station condition assessments support a lower level of investment than in previous years.

General Plant (GP)

An increase in 2015 expenditures in General Plant is anticipated due to the purchase and implementation of OMS software.

4.4.2 Forecast Period – Yearly Variation in Capital Expenditures

4.4.2.1 Variation in Capital Expenditures between 2015-2016 (Forecast)

Table 4-10: 2015 - 2016 Capital Variances by Investment Category

OEB Investment Category	Bridge Year	Forecast Year		Historical Average	Variance to Historical Average
	2015	2016	2016-2015	2011 - 2015	2016 - AVE
	Forecast	Forecast	Variance		Variance
System Access	$ 11,084,508	$ 6,622,858	$ (4,461,650)	$ 7,766,126	$ (1,143,268)
System Renewal	$ 6,465,106	$ 8,181,031	$ 1,715,925	$ 8,546,271	$ (365,240)
System Service	$ 1,526,548	$ 2,405,950	$ 879,402	$ 1,778,937	$ 627,013
General Plant	$ 2,232,450	$ 1,869,078	$ (363,372)	$ 2,455,912	$ (586,834)
Totals	$ 21,308,612	$ 19,078,917	$ (2,229,695)	$ 20,547,246	$ (1,468,329)

System Access (SA)

Expenditures in 2015 are heavily weighted to relocations due to the Region of Waterloo LRT Project. While the LRT project still comprises a significant portion of the expected 2016 SA work program, there is expected to be a large drop in these expenditures from 2015. WNH is also expecting a decrease in major line expansions required for new customer connections due to previous work completed.

System Renewal (SR)

Expenditures in 2015 will be lower than average due to the sharp increase in LRT relocation work in 2015 SA. The impact of the outage requirements to complete the LRT work will limit WNH's ability to schedule renewal work in 2015 without placing unnecessary risk of power outages on our customers. This has resulted in WNH rescheduling the start of numerous 2015 SR projects until later in the year, which will push the completion of these projects into the early 2016.

System Service (SS)

The increase in expenditures is due to 2 reliability centric overhead line construction projects required to improve localized capacity under certain abnormal system conditions. The expected outcome will reduce prolonged outages experienced by a large group of customers.

General Plant (GP)

Expenditures in 2015 included the purchase of 2 replacement large line vehicles. Expenditures in 2016 include only 1 such replacement vehicle.

4.4.2.2 Variation in Capital Expenditures between 2017-2020 (Trending)

Table 4-11a: 2016 - 2020 Capital Variances by Investment Category

OEB Investment Category	Forecast Period					Total
	2016	2017	2018	2019	2020	2016 - 2020
System Access	$ 6,622,858	$ 5,892,104	$ 6,020,046	$ 5,946,859	$ 6,085,796	$ 30,567,663
System Renewal	$ 8,181,031	$ 8,545,000	$ 9,438,200	$ 8,800,764	$ 8,975,779	$ 43,940,774
System Service	$ 2,405,950	$ 1,680,000	$ 1,725,200	$ 1,175,404	$ 1,175,612	$ 8,162,166
General Plant	$ 1,869,078	$ 2,813,765	$ 1,661,176	$ 1,670,309	$ 1,649,525	$ 9,663,853
Totals	$ 19,078,917	$ 18,930,869	$ 18,844,622	$ 17,593,336	$ 17,886,713	$ 92,334,457

Table 4-11b: 2016 - 2020 Capital Variances by Investment Category

OEB Investment Category	Total	% of Annual Investment	Average Annual Investment	Average Annual Investment		Average Annual Variance
	2016 - 2020	2016 - 2020	2011 - 2015	2016 - 2020	Forecast vs Historical	% Variance
System Access	$ 30,567,663	33.1%	$ 7,766,126	$ 6,113,533	$ (1,652,593)	-21.3%
System Renewal	$ 43,940,774	47.6%	$ 8,546,271	$ 8,788,155	$ 241,884	2.8%
System Service	$ 8,162,166	8.8%	$ 1,778,937	$ 1,632,433	$ (146,504)	-8.2%
General Plant	$ 9,663,853	10.5%	$ 2,455,912	$ 1,932,771	$ (523,141)	-21.3%
Totals	$ 92,334,457	100.0%	$ 20,547,246	$ 18,466,891	$ (2,080,355)	-10.1%

The key elements of WNH investment plans over the forecast period are in the areas of System Renewal and System Access. Over the entire forecast period these two categories account for 81% of total planned investments.

System Access (SA)

System Access investments over the forecast period represent the second largest group of investments and the largest average decrease over the historical period.

From **Table 4-11a&b** it can be seen that SA investment levels are expected to remain relatively constant over the forecast period. They are also on average $1.65 million lower annually when compared to the historical period. This is due in part to the change from "Canadian generally accepted accounting principles" (CGAAP) to "revised CGAPP" (RCGAAP) in 2013 and the completion of a number of major roadway relocation projects, the largest being the LRT. Major investments are expected to be customer centric and are based on historical levels and municipal and developer consultation outcomes.

<u>System Renewal (SR)</u>

System Renewal investments over the forecast period represent the largest group of investments. From **Table 4-11a&b** it can be seen that SR investments are trending higher by an average of $240,000 annually from historical levels. Major investments are expected in overhead line, underground line and transformer station renewal. This slight increase reflects the increase in the asset population aging and requiring renewal.

<u>System Service (SS)</u>

From **Table 4-11a&b** it can be seen that investments in SS are trending lower by an average of $146,000 annually. This is due in part to the change from CGAAP to RCGAAP in 2013 and also in part to major investments in reliability WNH has previously made from 2013 – 2015. The majority of the investments are reliability centric in distribution automation and remotely controlled switching and fault indicating devices. Building and property upgrades at the transformer stations are also expected.

<u>General Plant (GP)</u>

From **Table 4-11a&b** it can be seen that average annual investments in GP are trending lower by an average of $523,000 annually. This is due in part to the change from GAAP to RCGAAP in 2013. Also by 2017, WNH will have upgraded or replaced a number of its major information systems such as CIS, ERP, and SCADA, and introduced enhanced software systems such as Outage Management, Asset Management, and Automated System Restoration (FDIR). Major investments in 2017 - 2020 are expected to include fleet replacement, a control room electronic wall projection system and building sanitary sewer connection.

4.5 Justifying Capital Expenditures (5.4.5)

This section provides information and analysis in support of WNH's investment plans and this DS Plan. References to previous sections of the DS Plan will be provided as necessary.

4.5.1 Overall Plan (5.4.5.1)

4.5.1.1 Comparative Expenditures over the Historical Period

In **Table 4-12a,** WNH's proposed capital investments from 2016 to 2020 are summarized and compared to historical capital expenditures from 2011 – 2015. Due to the timing of this filing, there are no actual 2015 expenditures available. The 2011 General Plant expenditure included in the averages is normalized by excluding the costs of WNH's one-off expenditure for a new Service Centre and Administration building, providing a better comparison of forecast to historical investment levels. Accounting rule changes from CGAAP to RCGAAP took effect in 2013 and have impacted the reporting of capital and O&M expenditures.

WNH's proposed investment plan provides for reductions in capital expenditures in 3 of the 4 OEB investment categories. Investment in System Renewal has increased marginally over historical levels reflecting the expected increase of the population of assets reaching their TUL. Full year over year analysis based on the 4 OEB investment categories can be found in **Section 4.4.**

Table 4-12a: Total Forecast vs Historical Capital Expenditures

OEB Investment Category	Total Investment	% of Total Investment	Total Investment	% of Total Investment	Total Investment	Variance
	2011 - 2015	2011 - 2015	2016 - 2020	2011 - 2015	Forecast - Historical	Forecast - Historical
System Access	$ 38,830,630	37.8%	$ 30,567,663	33.1%	$ (8,262,967)	-21.3%
System Renewal	$ 42,731,356	41.6%	$ 43,940,774	47.6%	$ 1,209,418	2.8%
System Service	$ 8,894,685	8.7%	$ 8,162,166	8.8%	$ (732,519)	-8.2%
General Plant	$ 12,279,561	12.0%	$ 9,663,853	10.5%	$ (2,615,707)	-21.3%
Totals	$ 102,736,232	100.0%	$ 92,334,457	100.0%	$ (10,401,775)	-10.1%

(*) General Plant normalized in 2011 for Service Centre and Administration building

From **Table 4-12b**, It can be seen that the average annual capital investment over the forecast period is expected to be in the order of $2 million per year lower than the historical period. The largest reduction comes from completion in 2017 of System Access investments such as the LRT System relocations.

Table 4-12b: Total Forecast vs Historical Capital Expenditures

OEB Investment Category	Average Annual Investment	Average Annual Investment	Average Annual Investment	Average Annual Investment	Average Annual Investment	Variance
	2011 - 2015	2011 - 2015	2016 - 2020	2011 - 2015	Forecast vs Historical	Forecast - Historical
System Access	$ 7,766,126	37.8%	$ 6,113,533	33.1%	$ (1,652,593)	-21.3%
System Renewal	$ 8,546,271	41.6%	$ 8,788,155	47.6%	$ 241,884	2.8%
System Service	$ 1,778,937	8.7%	$ 1,632,433	8.8%	$ (146,504)	-8.2%
General Plant	$ 2,455,912	12.0%	$ 1,932,771	10.5%	$ (523,141)	-21.3%
Totals	$ 20,547,246	100.0%	$ 18,466,891	100.0%	$ (2,080,355)	-10.1%

(*) General Plant normalized in 2011 for Service Centre and Administration building

4.5.1.2 Forecast Impact of System Capital Investment on System O&M costs

The impact of capital investments on system O&M vary from project to project. Reductions in future O&M costs are expected in the following areas.

Renewal of distribution line assets allows for the concurrent uprating to higher and more efficient voltages. A significant portion of WNH’s 4.16 kV distribution system has been replaced over time. This has allowed WNH to retire 11 of 16, 4.16 kV MS’s up to the end of 2014. The remaining five 4.16 kV stations are scheduled to come out of service over the next 5 years. Of the remaining eight 8.32 kV DS’s, WNH is planning to retire 1 DS in 2015 and 1 DS in 2018. For these 7 stations, O&M cost drivers can be seen in **Table 4-19.**

In addition the liability of oil filled equipment at these sites is eliminated and equipment failure repairs or recapitalization of these assets is avoided.

Investments in new technology such as solid dielectric reclosers and switches eliminate the liability and maintenance burden of oil filled equipment in the field.

Table 4-13: Station O&M Drivers

MS / DS Regular Station Inspection and Maintenance	Frequency
preventative maintenance & testing	4 years
lawn & grounds mtce	bi weekly in season
station inspections	monthly
replacement of silica gel	bi-annual
infrared scanning	annual
transformer oil sampling and testing	annual
battery testing	annual
vegetation control	annual
property Taxes (PILS)	annual
insurance	annual
yard cleanup, and minor repairs	as required
snow removal (sidewalk and driveway)	as required

Intelligent devices and communications allows for more information to be acquired and analyzed remotely with less labour resource input.

Remote system reconfiguration utilizing SCADA controlled switching devices can be accomplished faster and with less labour input.

New software systems will lower annual maintenance fees, reduce the manual efforts taken to deal with large amounts of data leading to productivity gains. These investments are also anticipated be more user configurable, allowing for lower costs of ownership.

Tools and equipment are replaced due to age and condition, providing greater safety and productivity.

4.5.1.3 Drivers of Investment

WNH expects many key drivers discussed in **Section 1.3** to remain relatively unchanged over the forecast period. The one exception will be road relocation expenditures which will moderate due to the completion of the LRT project in 2016.

4.5.1.4 Information related to WNH's system capability assessment

WNH's distribution system is expected to have sufficient capacity to accommodate new REG and new load connections forecast for the years 2016 - 2020. Load and REG is expected to increase throughout the forecast period however not at a pace that would impose any capacity constraints or any changes in loading requirements of the system.

Investments outlined in this DS Plan will provide WNH greater utilization of existing capacity and keep generators and load customers connected to the distribution system under a wider range of abnormal system conditions. These investments will also allow a greater and timelier ability to restore power.

The capabilities of WNH's distribution system are presented in detail in the following sections of this DS Plan;

1) Section 1.2
2) Section 3.1.2
3) Section 3.2.4
4) Appendix A – WNH Renewable Energy Generation Plan

4.5.2 Material Investments (5.4.5.2)

This section provides details for all WNH projects in 2016 that meet or exceed the materiality threshold of $175,000. The projects are detailed following the format presented in **Section 5.4.5.2** of the Chapter 5 Filing Requirements.

Part A provides general information on each project,
Part B provides evaluation criteria and information requirements for each project and
Part C provides category-specific requirements for each project.

Material Capital Project Summaries are provided as attached **Appendix G**.

Appendix A: WNH Renewable Energy Generation Plan & IESO Letter of Comment

Waterloo North Hydro Inc.

Renewable Energy Generation Investments Plan

Filed with

Waterloo North Hydro's

2016 COS Application

Table of Contents

1 Executive Summary

This Renewable Energy Generation (REG) Investments Plan provides information to the Ontario Energy Board (OEB) and interested stakeholders, regarding the readiness of Waterloo North Hydro Inc's (WNH) distribution system to connect Renewable Energy Generation, including investment requirements for any expansion or reinforcement necessary to remove grid constraints to accommodate the connections of renewable energy generation under the province's Feed-in-Tariff (FIT) and microFIT programs for the period 2015 to 2020. This Renewable Energy Generation Investments Plan will be filed with WNH's Distribution System Plan (DS Plan) and 2016 Cost of Service Application.

WNH's experience with Renewable Energy Generation has mostly been with a modest amount of small scale FIT and microFIT generators. One (1) Biogas generator (2.85 MW) has been connected and is the single largest Renewable Energy Generator connected within WNH's service area.

There are 371 Renewable Energy Generators totaling 8.17 MW connected to WNH's distribution system, under FIT and micro-Fit, RESOP and NET METERING programs, the majority of these being small scale solar. There are another 25 (2.08 MW) applications allocated and another 22 (3.67 MW) pending. There have been 114 applications totaling 1.28 MW that have expired.

Wind is of minor consequence due to the nature and geography of WNH's service area. Similarly, the high percentage of prime farm land and the high cost of land in general within WNH's service area, appear to be significant challenges for large scale solar. The result being that even though WNH has significant capacity to connect large scale (up to 10 MW) Renewable Energy Generation, WNH does not anticipate any such generators to be connected for the period 2015 to 2020.

Since 2010, WNH has averaged 3.4 (1.0 MW) FIT and 70 (0.6 MW) microFIT Renewable Energy Generator connections per year. WNH expects this level of connection activity to continue from 2015 to 2020. These connection costs will be fully recovered from the Renewable Energy Generation applicants.

Based on WNH's evaluation of its distribution system, there exists considerable capacity to connect Renewable Energy Generation. In addition, no distribution or grid constraints have been identified which would prevent the connection of Renewable Energy Generation installations under the province's Feed-in-Tariff (FIT) and microFIT programs.

WNH is therefore not proposing any capital investments to accommodate the connection of Renewable Energy Generation for the period 2015 to 2020.

2 Introduction

Waterloo North Hydro Inc. (WNH) is preparing the Cost of Service Rate Application as set out in the report of the Board: Renewed Regulatory Framework for Electricity (RRFE), for rates to be in effect January 01, 2016. In accordance with the Ontario Energy Board's (OEB) filing requirements for Electricity Transmission and Distribution Applications – Chapter 5 – Consolidated Distribution System Plan (DS Plan) Filing Requirements (EB-2010-377), WNH has prepared this Renewable Energy Generation Investments Plan, identifying the investment requirements for accommodating Renewable Energy Generation connections for its service territory for the period 2015 to 2020.

This Renewable Energy Generation Investments Plan, identifying investment requirements for accommodating Renewable Energy Generation connections provides information to the OEB and interested stakeholders, regarding the readiness of WNH's distribution system to connect Renewable Energy Generation, including any expansion or reinforcement necessary to remove grid constraints to accommodate the connections of Renewable Energy Generation for the period 2015 to 2020.

3 Waterloo North Hydro's Distribution System

WNH is a medium sized Local Distribution Company (LDC) regulated and licensed by the OEB. With predecessors that date back to 1905, WNH was created in 1979 as a result of Bill 55. Waterloo Public Utilities Commission and four other utilities were amalgamated creating a service territory that even today is still one of the largest in the province at 672 sq. km. Located within the Region of Waterloo (Region), WNH provides all regulated electricity distribution services to the City of Waterloo, the Township of Woolwich and the Township of Wellesley.

The urban and rural component of WNH's service area is illustrated in **Table 3-1** and **Figure 3-1**.

AREA (sq km)	URBAN	RURAL	TOTAL	%
City of Waterloo	65		65	9.7%
Township of Woolwich		329	329	49.0%
Township of Wellesley		278	278	41.4%
Total	65	607	672	100%

Table 3-1: WNH Service Area

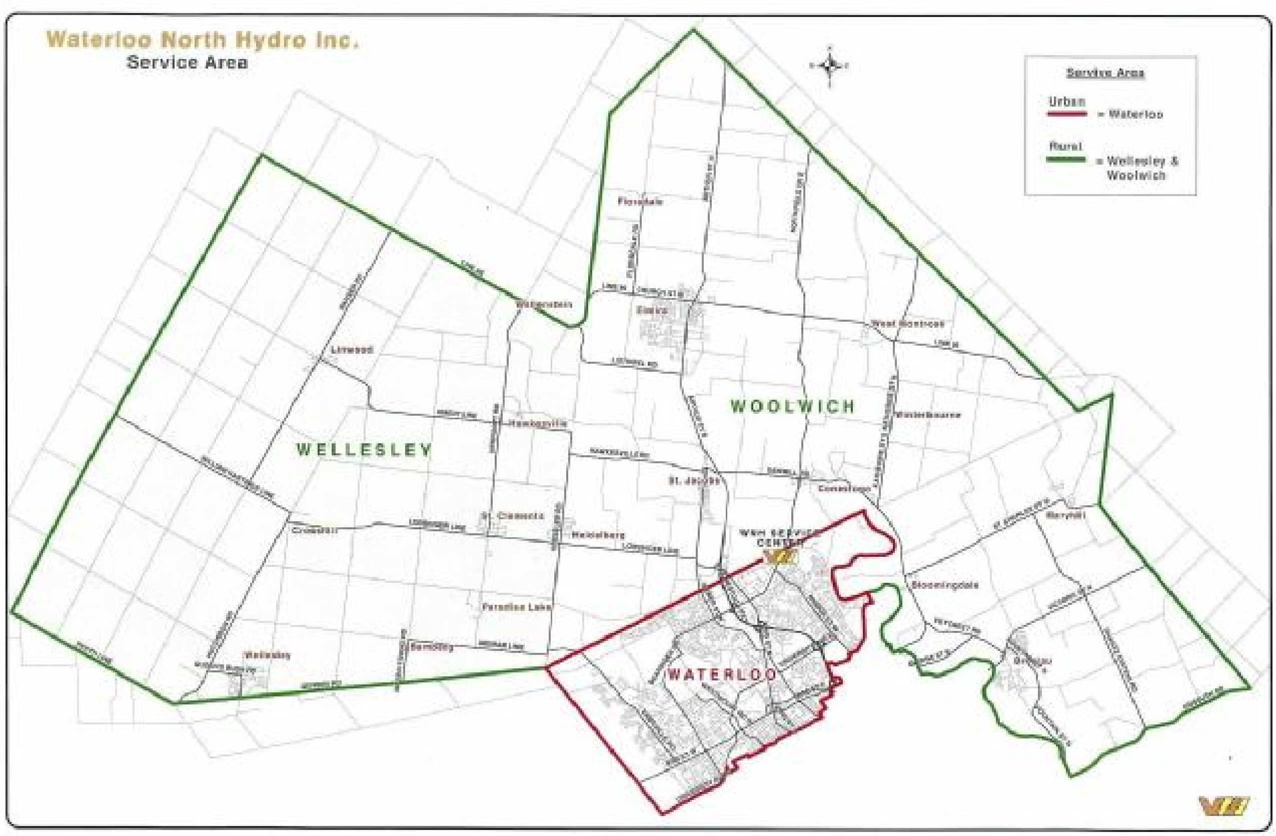


Figure 3-1: WNH Service Territory Urban / Rural Areas

WNH is connected to the Hydro One Transmission System (HO Tx) through 4 grid connected Dual Element Spot Network (DESN) Transformer Stations as illustrated in **Table 3-2**. HMSTS is a double DESN located on the same site. Three (3) of these are owned and operated by WNH. One (1), Elmira Transformer Station (ELTS), is owned and operated by HO and is embedded inside of WNH's service territory. WNH owns 2 and portions of the third feeder emanating from the ELTS. Approximately 90% of the ELTS load is supplied from WNH customers with the remaining load supplied from HO customers in nearby Wellington County.

	Transformer Stations	Owned & Operated by	Supplied By	Station Location	HV (kV)	LV (kV)	Transformer Rating (MVA)
1a	HMSTS 'A'	WNH	HO Tx	Waterloo	230	13.8	2 x 50
1b	HMSTS 'B'	WNH	HO Tx	Waterloo	230	13.8	2 x 83
2	MTS #3	WNH	HO Tx	Waterloo	230	27.6	2 x 67
3	ERTS	WNH	HO Tx	Waterloo	115	13.8	2 x 50
4	ELTS	HO	HO Tx	Woolwich	115	27.6	2 x 41.7

Table 3-2: WNH Transmission Points of Supply

WNH's grid connected transformer stations have all been constructed new or extensively refurbished over the last 20 years and provide a high degree of reliability, not only to its load customers but also to existing and future Renewable Energy Generation connections. **Table 3-3** illustrates the capacity that is available for Renewable Energy Generation at WNH owned and operated transformer stations and their associated feeders.

	Station	Station	Station	Feeder	Feeder	Feeder	Feeder
Transformer Stations	**Total Generation Capacity (kVA)**	**Remaining Generation Capacity (kVA)**	**Remaining Generation Capacity (%)**	**# Feeders in Service**	**Generation Capacity (kVA)**	**Remaining Generation Capacity (kVA)**	**Remaining Generation Capacity (%)**
HMSTS 'A'	30,000	29,475	98.3%	8	57,366	56,841	99.1%
HMSTS 'B' (1)	22,000	20,158	91.6%	17	127,560	125,719	98.6%
MTS #3	40,000	39,038	97.6%	10	100,390	99,428	99.0%
ERTS	30,000	29,701	99.0%	8	57,366	57,067	99.5%
TOTAL	122,000	118,372	97.0%	43	342,682	339,055	98.9%

(1) HMSTS 'B' has dual secondary winding transformers used in a Bermondsey configuration. Renewable Energy Capacity is currently limited to the minimum load on a single transformer due to concerns with reverse power in this type of transformer configuration. Station capacity is under review and may be increased upon further investigation.

Table 3-3: WNH Transformer Station Capacity

There is significant Remaining Generation Capacity at WNH's transformer stations. No constraints have been identified which would prevent the connection of Renewable Energy Generation installations under the province's Feed-in-Tariff (FIT) and microFIT programs.

WNH also receives electrical supply at < 50 kV (Dx) from 3 neighbouring LDCs; Hydro One Distribution (HO Dx), Kitchener Wilmot Hydro Inc (KWHI) and Cambridge North Dumfries Hydro Inc (CNDHI) as illustrated in **Table 3-4**.

	Feeders	Owned & Operated by	Supplied By	Station Location	HV (kV)	LV (kV)	Load Capacity at WNH Boundary (MVA)
1	73M7	HO Dx	HO Dx	Woolwich	N / A	44.0	8.0
2	9M4	KWH Dx	KWH Dx	Wellesley	N / A	27.6	6.0
3	21M25	CNDH Dx	CNDH Dx	Woolwich	N / A	27.6	8.0
4	33M1	WNH	HO Tx	Woolwich	N / A	27.6	14.3
5	33M2 (2)	WNH	HO Tx	Woolwich	N / A	27.6	6.3
6	33M3	WNH	HO Tx	Woolwich	N / A	27.6	14.3

(2) Subject to Hydro One loads.

Table 3-4: WNH Points of Supply < 50 kV

Capacity to connect Renewable Generation to these feeders is subject to activities outside of WNH's service territory and need to be determined on a case by case basis at the time of application.

In addition to the transformer stations noted in **Table 3-2**, WNH's distribution network consists of the following municipal and distribution stations operating at < 50 kV as illustrated in **Table 3-5** and **Figure 3-2.**

	Municipal / Distribution Stations	Owned & Operated by	Location	HV (kV)	LV (kV)	Transformer Rating (MVA)
1	MS#1	WNH	Waterloo	13.8	4.16	2 x 3.0
2	MS#5	WNH	Waterloo	13.8	4.16	8.0
3	MS#22	WNH	Elmira	27.6	4.16	3.6
4	MS#23	WNH	Elmira	27.6	4.16	6.7
5	MS#24	WNH	Elmira	27.6	4.16	5.0
6	DS#26	WNH	Wellesley	27.6	8.32	5.0
7	DS#27	WNH	Wallenstein	27.6	8.32	3.6
8	DS#28	WNH	Floradale	27.6	8.32	5.0
9	DS#29	WNH	St Jacobs	27.6	8.32	2 x 3.6
10	DS#30	WNH	Zubers Corners	44.0	8.32	5.0
11	DS#31	WNH	Bloomingdale	27.6	8.32	5.0
12	DS#32	WNH	Breslau	27.6	8.32	5.0
13	DS#34	WNH	South Woolwich	27.6	8.32	2.0

Table 3-5: WNH Municipal and Distribution Stations

WNH’s 4.16 kV and 8.32 kV distribution lines have the capacity to accept small to mid-sized Renewable Energy Generation. Large scale generation is required to connect to the higher 13.8 kV and 27.6 kV lines.

As WNH’s 4.16 kV and 8.32 kV distribution lines and/or stations reach end of life or where their capabilities have been surpassed by load growth, the stations are retired and lines are replaced with new assets that are more efficient and operate at the higher 13.8 kV or 27.6 kV voltages. WNH’s flexibility to connect large scale generation is increasing as the 4.16 kV and 8.32 kV distribution lines are replaced with and 13.8 kV and 27.6 kV lines.

WNH is supplied by 1 – 44 kV feeder from Hydro One Dx. WNH’s connection is at the end of a long radial feeder, out of phase with the rest of WNH’s distribution system and has limited capacity. It is not a significant contributor to WNH’s Renewable Generation Capacity but is noted only for completeness.

Table 3-6 provides a summary of WNH’s feeder capacity by voltage level. These feeders have various voltages and capacities to allow the connection of Renewable Generation facilities.

Feeder Voltages (kV)	# Feeders	Total Generation Capacity (kVA)	Remaining Generation Capacity (kVA)	Remaining Generation Capacity (%)
44.0	1	8,000	7,392	92.4%
27.6	13	169,072	163,937	97.0%
13.8	33	236,633	234,092	98.9%
	46	405,705	398,029	98.1%
8.32	22	47,555	46,120	97.0%
4.16	19	20,535	20,467	99.7%
	41	68,090	66,587	97.8%

Table 3-6: WNH Feeder Generation Capacity by Voltage

There is a significant Remaining Generation capacity on WNH feeders. Based on WNH’s evaluation of its feeders, no constraints have been identified which would prevent the connection of Renewable Energy Generation installations under the province’s Feed-in-Tariff (FIT) and microFIT programs.

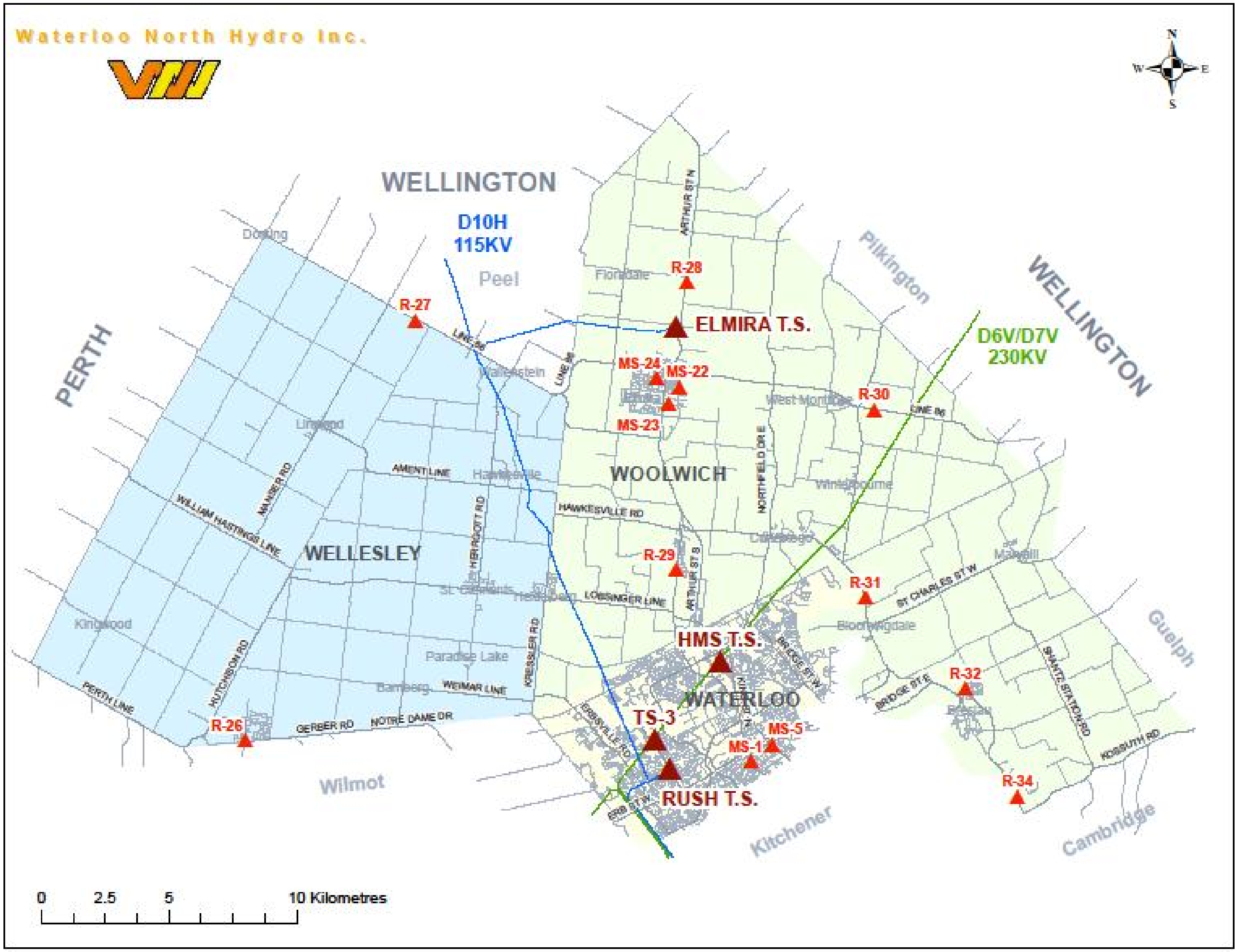


Figure 3-2: WNH Transformer, Municipal and Distribution Stations

4 Existing and Proposed Distributed Generating Connections

WNH's Renewable Energy Generation connection records date back to 2004 and include RESOP and NET METERED generators. **Table 4-1** provides a summary of these connections in various stages of development. A detailed listing of connected FIT generators can be found in **Appendix A.**

Total Renewable Generation Facilities (FIT)	Number of Generators	%	Total Renewable Generation (kVA)	%	Solar	Wind	Biogas
Connected	16	33%	5,150	47%	15		1
Allocated	10	20%	1,950	18%	9	1	
Pending	19	39%	3,526	32%	17		2
Expired	4	8%	435	4%	4		
Total	49	100%	11,061	100%	45	1	3

Total Renewable Generation Facilities (RESOP)	Number of Generators	%	Total Renewable Generation (kVA)	%	Solar	Wind	Biogas
Connected	1	100%	65	100%		1	
Allocated		0%	0	0%			
Pending		0%	0	0%			
Expired		0%	0	0%			
Total	1	100%	65	100%	0	1	0

Total Renewable Generation Facilities (NET METERED)	Number of Generators	%	Total Renewable Generation (kVA)	%	Solar	Wind	Biogas
Connected	2	50%	76	35%	1	1	
Allocated		0%	0	0%			
Pending	2	50%	140	65%	2		
Expired		0%		0%			
Total	4	100%	216	100%	3	1	0

Total Renewable Generation Facilities	Number of Generators	%	Total Renewable Generation (kVA)	%	Solar	Wind	Biogas
Connected	19	35%	5,291	47%	16	2	1
Allocated	10	19%	1,950	17%	9	1	
Pending	21	39%	3,666	32%	19		2
Expired	4	7%	435	4%	4		
Total	54	100%	11,342	100%	48	3	3

Table 4-1: Summary of FIT, RESOP and NET METERED Renewable Generation Facilities

Table 4-2 provides a summary of microFIT, RESOP and NET METERED Renewable Energy Generators in various stages of development. A detailed listing is available upon request.

Total Renewable Generation Facilities <= 10kW	Number of Generators	%	Total Renewable Generation (kVA)	%	Solar	Wind	Biogas
Connected	352	74%	2,877	75%	351	1	
Allocated	15	31%	134	3%	15		
Pending	1	2%	5	0%	1		
Expired	110	224%	845	22%	110		
Total	478	331%	3,861	100%	477	1	0

Table 4-2: Summary of microFIT Renewable Generation Facilities

WNH has facilitated the connection of 16 FIT and 340 microFIT Renewable Generators under the FIT and microFIT programs, as illustrated in **Table 4-3**. WNH's total Renewable Generation connected to its distribution system in provided in **Table 4-4**.

FIT CONNECTED	FIT CONNECTED (kW)	microFIT CONNECTED	microFIT CONNECTED (kW)	TOTAL CONNECTED	TOTAL CONNECTED (Kw)
16	5150	340	2821	356	7971

Table 4-3: WNH Distribution Connected FIT and microFIT Connections

TOTAL CONNECTED RENEWABLE ENERGY GENERATION					
> 10 kW	> 10 kW	< =10 kW	< =10 kW	TOTAL CONNECTED	TOTAL CONNECTED (Kw)
19	5291	352	2877	371	8168

Table 4-4: WNH Total Connected Renewable Generation

WNH has been connecting approximately 3.4 FIT (1.0 MVA) and 70 microFIT (0.6 MVA) Renewable Energy Generators per year. WNH expects this level of activity to continue for the period 2015 to 2020. Accordingly WNH has budgeted to support this level of activity and these connection costs will be recovered from the Renewable Energy Generator applicants. **Figure 4-1** illustrates WNH's growth in Renewable Generation since 2010.

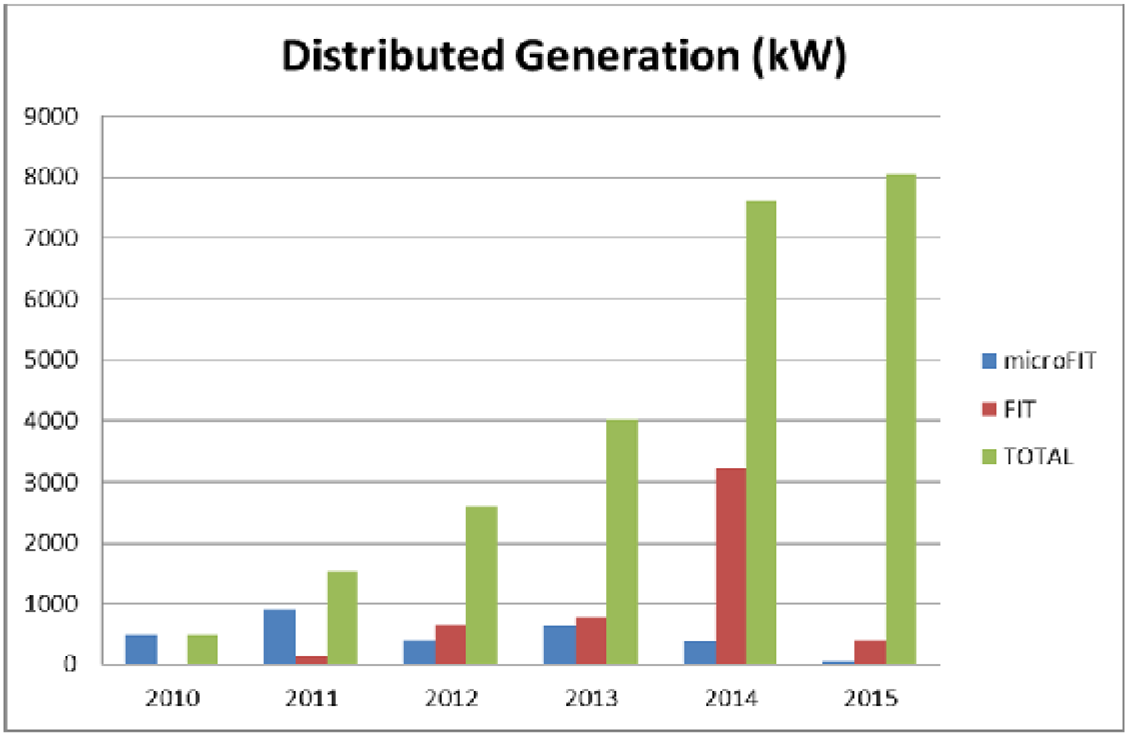


Figure 4-1: Growth in Renewable Generation

5 System Assessment to Identify Constraints

WNH's criteria for the maximum permissible generation capacity at a grid connected Transformer Station, Municipal Station or Distribution Stations is equal to 60% of the power transformer nameplate rating at 90% power factor.

An exception to this criteria exists at WNH's HMSTS 'B' Station which has dual secondary winding transformers used in a Bermondsey configuration. Renewable Energy Generation capacity is currently limited to the minimum loading of a single transformer at 90% power factor due to concerns with this type of transformer configuration. Station capacity is under review and may be increased upon further investigation.

There is significant Remaining Generation capacity at WNH's transformer stations. No constraints have been identified at WNH stations which would prevent the connection of Renewable Energy Generators under the province's Feed-in-Tariff (FIT) and microFIT programs.

WNH's 4.16 kV and 8.32 kV distribution systems currently have the capacity to accept small to mid-sized Renewable Energy Generation. These circuits and stations were never designed nor constructed to supply large loads or generation facilities. WNH's three phase 13.8 kV and 27.6 kV feeder circuits employ 556 kcmil conductors. These feeders have sufficient capacity to permit the connection of large Renewable Energy Generators up to 10 MW, allowed under the Ontario Power Authority's (OPA) FIT contracts. Based on WNH's evaluation of its feeders, no constraints have been identified which would prevent the connection of Renewable Energy Generation under the province's Feed-in-Tariff (FIT) and microFIT programs.

Figure 4-1, **Table 4-1** and **Table 4-2** illustrate the number, size and growth rate of Renewable Energy Generation FIT and microFIT projects. Based on WNH's evaluation of the current rate of connections and applications currently in hand or anticipated to be received from 2015 to 2020, no constraints have been identified which would prevent the connection of Renewable Energy Generation under the province's Feed-in-Tariff (FIT) and microFIT programs.

Since 2010, Waterloo North Hydro has been working with Kitchener Wilmot Hydro Inc (KWHI), Cambridge North Dumfries Hydro Inc (CNDHI), Guelph Hydro Electric System Inc (GHESI), Hydro One Distribution (HO Dx), Hydro One Transmission, (HO Tx) the OPA and the Independent Electricity System Operator (IESO) on the **KWCG Integrated Regional Resources Plan (IRRP).**

Nearing completion, WNH has participated in the planning meetings and consulted with all of the aforementioned stakeholders and determined that there are no expansion or reinforcement investments necessary to remove grid constraints to accommodate the connections of Renewable Energy Generation relating to WNH under the province's Feed-in-Tariff (FIT) and microFIT programs for the period 2015 to 2020. WNH believes its DS Plan is consistent with the KWCG IRRP.

6 Distribution Automation and Smart Grid Development

All WNH grid connected Transformer Stations, Municipal Stations, Distribution Stations have SCADA monitoring and control, programmable electronic protection systems and communication systems. The same is true of all < 50kV points for supply from HO Dx, KWHI and CNDHI.

WNH also has 36 electronic reclosers with SCADA monitoring and control, programmable electronic protection and communications installed at various locations on its distribution system. Similarly WNH has 12 sets of SCADA monitored, 3 phase fault indicators installed at various locations on its distribution system.

In addition, WNH has installed and is currently bringing on line, a Survalent Outage Management System.

Although Renewable Energy Generation has not been the primary driver for these Renewal and System Service investments, they have had the added benefit of facilitating the connection of Renewable Energy Generation.

7 Proposed Investments to Facilitate Renewable Energy Generation Connections

Based on WNH's evaluation of its distribution system, there exists considerable capacity to connect Renewable Energy Generation.

In addition, no distribution or grid constraints have been identified which would prevent the connection of Renewable Energy Generation installations under the province's Feed-in-Tariff (FIT) and microFIT programs.

WNH is therefore not proposing any capital investments to accommodate the connection of Renewable Energy Generation for the period 2015 to 2020.

Appendix A

	TOTALS	19	5291		
Engineering File No.	**Project ID#**	**Fuel Type**	**Generator Size (kW)**	**Feeder #**	**Capacity Status**
O14-NE-C2	NET METERED	solar PV	36	HS-24	Connected
O14-NE-M001	NET METERED	Wind	40	3F-63	Connected
O14-OP-H001	RESOP 11530	Wind	65	3F-68	Connected
O14-GE-002	FIT-F0MH1Z7	biogas	2850	33M1	Connected
O14-GE-005	FIT-FNF9BFF	solar PV	135	33M1	Connected
O14-GE-006	FIT-F8D899K	solar PV	200	HS-10	Connected
O14-GE-008	FIT-FDT42CX	solar PV	250	HS-10	Connected
O14-GE-009	FIT-F5F23J6	solar PV	250	HS-28	Connected
O14-GE-010	FIT-FXLWSVI	solar PV	75	R32-3	Connected
O14-GE-011	FIT-FR50DV3	solar PV	100	R28-2	Connected
O14-GE-013	FIT-FFXNWF3D	solar PV	45	R28-1	Connected
O14-GE-015	FIT-FP9RGAP	solar PV	60	3F-63	Connected
O14-GE-016	FIT-FJVRNYR	solar PV	20	R31-1	Connected
O14-GE-017	FIT-F83UY2L	solar PV	40	R28-2	Connected
O14-GE-018	FIT-F4XKW01	solar PV	250	HS-13	Connected
O14-GE-019	FIT-FMK5ZSR	solar PV	225	3F-61	Connected
O14-GE-021	FIT-FE6YSUK	solar PV	250	HS-23	Connected
O14-GE-030	FIT-GMK75B8	solar PV	200	HS-28	Connected
O14-GE-031	FIT-GTISXAP	solar PV	200	HS-21	Connected

Table A-1: WNH Connected Summary of FIT, RESOP and NET METERED Renewable Generation Facilities

IESO Letter of Comment

Waterloo North Hydro Inc.

Renewable Energy Generation Investments Plan 2015 – 2020

March 26, 2015

Independent Electricity System Operator

Introduction

On March 28, 2013, the Ontario Energy Board ("the OEB" or "Board") issued its Filing Requirements for Electricity Transmission and Distribution Applications; Chapter 5 – Consolidated Distribution System Plan Filing Requirements (EB-2010-0377). Chapter 5 implements the Board's policy direction on 'an integrated approach to distribution network planning', outlined in the Board's October 18, 2012 Report of the Board - A Renewed Regulatory Framework for Electricity Distributors: A Performance Based Approach.

As outlined in the Chapter 5 filing requirements, the Board expects that the Ontario Power Authority[1] ("OPA") comment letter will include:

- the applications it has received from renewable generators through the FIT program for connection in the distributor's service area;
- whether the distributor has consulted with the OPA, or participated in planning meetings with the OPA;
- the potential need for co-ordination with other distributors and/or transmitters or others on implementing elements of the REG investments; and
- whether the REG investments proposed in the DS Plan are consistent with any Regional Infrastructure Plan.

Waterloo North Hydro Inc. – Distribution System Plan

On March 2, 2015 Waterloo North Hydro Inc. ("Waterloo North Hydro") provided its Renewable Energy Generation Investments Plan ("Plan") to the IESO as part of its 5-year Distribution System Plan. The IESO has reviewed Waterloo North Hydro's Plan and has provided its comments below.

OPA FIT/microFIT Applications Received

Waterloo North Hydro's Plan indicates that it has 16 FIT projects for a total capacity of 5,150 kW, and 340 microFIT projects totalling 2,821 kW of capacity connected to its distribution system.

According to the IESO's information, as of February 28, 2015, the IESO offered contracts to 32 FIT projects representing a capacity of 8,157 kW, of which 17 FIT projects totalling 5,640 kW of capacity have come into operation. The IESO has also offered contracts to 349 microFIT projects totalling 2,856 kW of capacity in Waterloo North Hydro's service territory. The renewable energy generation connections information in Waterloo North Hydro's Plan is therefore reasonably consistent with that of the IESO.

[1] On January 1, 2015, the Ontario Power Authority ("OPA") merged with the Independent Electricity System Operator ("IESO") to create a new organization that will combine the OPA and IESO mandates. The new organization is called the Independent Electricity System Operator.

Independent Electricity System Operator
1600 – 120 Adelaide Street West, Toronto, ON M5H 1T1
t 416 967-7474 f 416 967-1947 toll free 1-800-797-9604 customer.relations@ieso.ca www.ieso.ca

Consultation / Participation in Planning Meetings; Coordination with Distributors / Transmitters / Others; Consistency with Regional Plans

The IESO notes that Waterloo North Hydro is part of "Group 1" and the Kitchener, Waterloo, Cambridge and Guelph ("KWCG") region for regional planning purposes. Waterloo North Hydro is one the 5 local distribution companies ("LDCs") serving the region and is part of the regional planning Working Group ("Working Group") for the Integrated Regional Resource Plan ("IRRP") that is underway in the area. This IRRP is to be finalized at the end of April, 2015 and is being led by the IESO in partnership with Hydro One Transmission, Hydro One Distribution, Kitchener-Wilmot Hydro Inc., Waterloo North Hydro Inc., Cambridge North Dumfries Hydro Inc., and Guelph Hydro Electric Systems Inc. Since 2010, Waterloo North Hydro has been participating in ongoing planning meetings related to the IRRP and therefore consults regularly with the IESO, the other LDCs and Hydro One on electricity and regional planning related matters.

Based on these consultations, Waterloo North Hydro indicates that it is not planning any capital investments over the 5-year period (2015 to 2020), stating that an evaluation of its distribution system has shown it to have considerable capacity remaining to connect renewable energy generation, and that no distribution or grid constraints have been identified for this purpose.

The IESO looks forward to continuing its work with Waterloo North Hydro on regional planning in the KWCG region and appreciates the opportunity to comment on the information provided as part of its Distribution System Plan at this time. More information on the IRRP may be obtained from the IESO's website at this link: http://www.powerauthority.on.ca/power-planning/regional-planning/kwcg .

Independent Electricity System Operator
1600 – 120 Adelaide Street West, Toronto, ON M5H 1T1
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Appendix B: HONI Letter of Comment (IRRP)

Hydro One Network Inc.
483 Bay Street
13th Floor, North Tower
Toronto, ON, M5G 2P5
www.HydroOne.com

Tel: (416) 345-5420
Fax: (416) 345-4141
ajay.garg@HydroOne.com

March 23, 2015

Herbert Haller, P.Eng.
Vice-President, Engineering & Stations
Waterloo North Hydro Inc.
526 Country Squire Road
Waterloo, ON, N2J 4A3

Dear Mr. Haller:

Subject: Regional Planning Status

In reference to your request for a Regional Planning Status Letter, please note that Waterloo North Hydro Inc. belongs to the Kitchener-Waterloo-Cambridge-Guelph ("KWCG") Region in Group 1. A map showing details with respect to the 21 Regions and Groups, and a list of Local Distribution Companies ("LDCs") in each Region is attached in Appendix A and B respectively.

The planning activity for the KWCG Region was already underway prior to the new regional planning process and was deemed to be in the Integrated Regional Resource Planning ("IRRP") phase of the process. This IRRP phase, led by the IESO (formerly OPA), is expected to be completed by Q2 2015.

Two transmission projects have been identified to address the near- and medium-term needs in this Region: the first being the Guelph Area Transmission Reinforcement ("GATR") project, and the second being the installation of switches on circuits M20D and M21D. Execution of the first project is already underway while the second in the project development phase.

The following stations that serve Waterloo North Hydro customers are affected by the GATR project: Waterloo North MTS #3, Scheifele MTS, and Fergus TS. Each of these stations is supplied by 230 kV 2-circuit D6V/D7V from Detweiler TS and Orangeville TS. In the event of the loss of both circuits customer loads supplied from these stations will be interrupted.

One component of the GATR project involves the installation of two load interrupter switches on 230 kV circuits D6V/D7V at Guelph North Junction. The switches will minimize the impact of interruptions to Waterloo North Hydro customers in the event of the loss of both circuits D6V and D7V.

Hydro One Network Inc.
483 Bay Street
13th Floor, North Tower
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ajay.garg@HydroOne.com

The investments associated with the GATR project are proposed as a network pool cost, and there is no cost implication for Waterloo North Hydro.

Hydro One looks forward to working with Waterloo North Hydro in executing the new regional planning process. If you have any further questions, please feel free to contact me.

Sincerely,

Ajay Garg, Manager – Regional Planning Coordination
Hydro One Networks Inc.

Appendix A: Map of Ontario's Planning Regions

Northern Ontario

Southern Ontario

Greater Toronto Area (GTA)

Group 1	Group 2	Group 3
Burlington to Nanticoke	East Lake Superior	Chatham/Lambton/Sarnia
Greater Ottawa	London area	Greater Bruce/Huron
GTA East	Peterborough to Kingston	Niagara
GTA North	South Georgian Bay/Muskoka	North of Moosonee
GTA West	Sudbury/Algoma	North/East of Sudbury
Kitchener- Waterloo-Cambridge-Guelph ("KWCG")		Renfrew
Metro Toronto		St. Lawrence
Northwest Ontario		
Windsor-Essex		

Appendix B: List of LDCs for Each Region

[Hydro One as Upstream Transmitter]

Region	LDCs
1. Burlington to Nanticoke	• Brant County Power Inc. • Brantford Power Inc. • Burlington Hydro Inc. • Haldimand County Hydro Inc. • Horizon Utilities Corporation • Hydro One Networks Inc. • Norfolk Power Distribution Inc. • Oakville Hydro Electricity Distribution Inc.
2. Greater Ottawa	• Hydro 2000 Inc. • Hydro Hawkesbury Inc. • Hydro One Networks Inc. • Hydro Ottawa Limited • Ottawa River Power Corporation • Renfrew Hydro Inc.
3. GTA North	• Enersource Hydro Mississauga Inc. • Hydro One Brampton Networks Inc. • Hydro One Networks Inc. • Newmarket-Tay Power Distribution Ltd. • PowerStream Inc. • PowerStream Inc. [Barrie] • Toronto Hydro Electric System Limited • Veridian Connections Inc.
4. GTA West	• Burlington Hydro Inc. • Enersource Hydro Mississauga Inc. • Halton Hills Hydro Inc. • Hydro One Brampton Networks Inc. • Hydro One Networks Inc. • Milton Hydro Distribution Inc. • Oakville Hydro Electricity Distribution Inc.

5. Kitchener- Waterloo-Cambridge-Guelph (“KWCG”)	• Cambridge and North Dumfries Hydro Inc. • Centre Wellington Hydro Ltd. • Guelph Hydro Electric System - Rockwood Division • Guelph Hydro Electric Systems Inc. • Halton Hills Hydro Inc. • Hydro One Networks Inc. • Kitchener-Wilmot Hydro Inc. • Milton Hydro Distribution Inc. • Waterloo North Hydro Inc. • Wellington North Power Inc.
6. Metro Toronto	• Enersource Hydro Mississauga Inc. • Hydro One Networks Inc. • PowerStream Inc. • Toronto Hydro Electric System Limited • Veridian Connections Inc.
7. Northwest Ontario	• Atikokan Hydro Inc. • Chapleau Public Utilities Corporation • Fort Frances Power Corporation • Hydro One Networks Inc. • Kenora Hydro Electric Corporation Ltd. • Sioux Lookout Hydro Inc. • Thunder Bay Hydro Electricity Distribution Inc.
8. Windsor-Essex	• E.L.K. Energy Inc. • Entegrus Power Lines Inc. [Chatham-Kent] • EnWin Utilities Ltd. • Essex Powerlines Corporation • Hydro One Networks Inc.
9. East Lake Superior	N/A → This region is not within Hydro One’s territory

10. GTA East	• Hydro One Networks Inc. • Oshawa PUC Networks Inc. • Veridian Connections Inc. • Whitby Hydro Electric Corporation
11. London area	• Entegrus Power Lines Inc. [Middlesex] • Erie Thames Power Lines Corporation • Hydro One Networks Inc. • London Hydro Inc. • Norfolk Power Distribution Inc. • St. Thomas Energy Inc. • Tillsonburg Hydro Inc. • Woodstock Hydro Services Inc.
12. Peterborough to Kingston	• Eastern Ontario Power Inc. • Hydro One Networks Inc. • Kingston Hydro Corporation • Lakefront Utilities Inc. • Peterborough Distribution Inc. • Veridian Connections Inc.
13. South Georgian Bay/Muskoka	• Collingwood PowerStream Utility Services Corp. (COLLUS PowerStream Corp.) • Hydro One Networks Inc. • Innisfil Hydro Distribution Systems Limited • Lakeland Power Distribution Ltd. • Midland Power Utility Corporation • Orangeville Hydro Limited • Orillia Power Distribution Corporation • Parry Sound Power Corp. • Powerstream Inc. [Barrie] • Tay Power • Veridian Connections Inc. • Veridian-Gravenhurst Hydro Electric Inc. • Wasaga Distribution Inc.

14. Sudbury/Algoma	• Espanola Regional Hydro Distribution Corp. • Greater Sudbury Hydro Inc. • Hydro One Networks Inc.
15. Chatham/Lambton/Sarnia	• Bluewater Power Distribution Corporation • Entegrus Power Lines Inc. [Chatham-Kent] • Hydro One Networks Inc.
16. Greater Bruce/Huron	• Entegrus Power Lines Inc. [Middlesex] • Erie Thames Power Lines Corporation • Festival Hydro Inc. • Hydro One Networks Inc. • Wellington North Power Inc. • West Coast Huron Energy Inc. • Westario Power Inc.
17. Niagara	• Canadian Niagara Power Inc. [Port Colborne] • Grimsby Power Inc. • Haldimand County Hydro Inc.* • Horizon Utilities Corporation • Hydro One Networks Inc. • Niagara Peninsula Energy Inc. • Niagara-On-The-Lake Hydro Inc. • Welland Hydro-Electric System Corp. • Niagara West Transformation Corporation* *Changes to the May 17, 2013 OEB Planning Process Working Group Report
18. North of Moosonee	N/A → This region is not within Hydro One's territory

19. North/East of Sudbury	• Greater Sudbury Hydro Inc. • Hearst Power Distribution Company Limited • Hydro One Networks Inc. • North Bay Hydro Distribution Ltd. • Northern Ontario Wires Inc.
20. Renfrew	• Hydro One Networks Inc. • Ottawa River Power Corporation • Renfrew Hydro Inc.
21. St. Lawrence	• Cooperative Hydro Embrun Inc. • Hydro One Networks Inc. • Rideau St. Lawrence Distribution Inc.

Appendix C: Information Technology Strategy

1. Information Technology Services Department - Corporate Role

The Information Technology Service department is responsible for providing both long term and short term strategic direction for Waterloo North Hydro's (WNH) information technology needs. This requires the IT department to be well versed on WNH's emerging business demands and the growing requirements of Smart Grid within the energy sector. This is achieved through participation as an active member of the Executive Team, regular engagement with all corporate departments and active participation with external key partners. WNH's corporate requirements are translated into an annual IT Corporate Capital and Operating Budget. IT is responsible for achieving these annual budget objectives through effective Project Management, efficient allocation of IT resources and routine monthly progress reviews with the Executive Team for effective organizational focus on corporate mandates.

Information Technology Services is fully engaged in many activities as noted below:

a. Business Process Streamlining – IT facilitates many core Business Process improvements across the corporation. This requires IT to be fully engaged on a daily basis in fostering corporate wide, collaborative cross-departmental business relationships as they engage in Business Process discussions and improvements.

b. Customer Facing Applications - IT works closely with Billing and Customer Service on a regular basis with the objective of understanding the Customer's growing needs for immediate and accurate information. This includes participation in the Customer Engagement Sessions as organized by WNH's Customer Service team.

c. Management of Key Business Partnerships – IT is responsible for fostering and managing 'Key' Business relationships with our outside partners including but not limited to:
    i. Technology vendors of choice
    ii. IESO (i.e. Smart Metering Entity)
    iii. OEB and other regulatory bodies
    iv. Other Utilities for the purpose of collaboration on technology based strategic direction and initiatives

d. Lead 'Corporate Integration' Team – IT leads and facilitates a collaborative 'WNH Corporate Integration Team' to achieve high quality, effective, successful corporate solutions for improved productivity & cost reduction and organizational effectiveness. This initiative promotes increased Employee engagement and internal collaboration.

e. Project Management Services – IT does not have a PMO but possesses a strong skill set of internal Project Management experience and capability.

f. Acquisition of Hardware / Software Assets – IT is responsible for the budgeting and subsequent acquisition of corporate hardware and software assets (with the exception of SCADA).

g. Management of Operational Costs – IT must perform within the same restrictions and demands as met by other corporate departments, striving to manage operational costs and attempting to achieve more value for lower cost wherever possible. This requires IT to manage and structure 'program' solutions, not just internal IT staff. WNH's IT strategies for operational cost management include but are not limited to the following:

   i. Achieve a balance with developing and leveraging internal IT skill sets complemented with the option to outsource on an 'as needed' basis for specialized 'Subject Matter Expertise'. (i.e. Security Audits and related best practises, advanced Operating System management, advanced dBase expertise). This strategy avoids the high cost of maintaining highly specialized IT skill sets on a long term basis and directly addresses necessary risk management related to the obsolescence of IT skills due to rapidly changing technology.
   ii. Seek to build partnerships with reliable, cost effective, innovative technology business partners.
   iii. Remain abreast of alternative technology deployment options (Cloud Computing vs. traditional on-premise services and licensing) and how they can be successfully deployed within the organization to achieve the following:
      1. Improved availability (24X7) and communication in response to Customers' increased mobility and access demands for information via smart phones, tablets
      2. Lower IT Total Cost of Ownership
         a. Education & Training
         b. Reduction of internal infrastructure
         c. Scalable, affordable, secure solutions
         d. Immediate extension of IT skill sets
      3. Provide for configurable, faster deployment of software solutions
      4. Address growing demand for collaboration and shared knowledge

5. Create reduced corporate risk due to IT turnover

h. Provide Corporate Wide Reporting Tools & Business Intelligence Platform – IT provides for robust reporting tools and related Business Intelligence capability. These tools are used by IT staff as well as 'Super Users'. Reporting of information is critical for all aspects of the organization as even the best systems can fail if the User cannot get the information that they require. IT has the critical role of simplifying the presentation of the 'data' to the end User so that departments can process it in a more 'User friendly' manner and transform it into useful information. With the delivery of effective training from IT to the end User for these toolsets, IT can successfully empower the User to be able to access the information independently, construct their own meaningful reports, dashboards and engage in constructive analytical assessments of the information in order to gain useful knowledge and insight into the operations of the corporation.

i. Supply and Maintain the Corporate Computing, Audio Visual & Telecommunications Environment – This area of responsibility includes the following:
   i. Corporate Telephone System & Corporate Mobile Phones
   ii. Corporate Internal Wireless (Voice & Data)
   iii. Corporate email System and Related Filtering
   iv. Corporate Intranet, Internet & Related Filtering
   v. Communications & 3rd Party Providers
   vi. Corporate Customer Facing Applications (24X7)
   vii. Head Office AV Management & Support

j. Protection of IT Assets – This aspect of IT incorporates all aspects of Security Administration including corporate server physical security, data access permissions, network intrusion prevention, web content filtering and Fire Wall protection.

k. Provide for Reliable Backups & Disaster Recovery Site – IT manages a regimented schedule of backups for corporate systems. IT is also responsible for the provision and routine testing of a reliable D/R plan that provides for the recovery of our core applications on a timely basis if a disaster were to occur. This D/R site also serves the purpose of providing an alternate recovery option for any hardware/software failure incident at the main office that may encounter a delay in a return to production state.

l. IT Support Desk – Provide our internal customers with hardware and software support using effective change management business practises for the timely identification, prioritization, delivery and ‘KPI’ tracking of support service. These support services apply include traditional desktop hardware/software issues as well as any other area of IT responsibility.

2. Core IT Strategy
WNH’s IT department continually seeks out solutions that allow us to achieve effective management and reduction of ‘Cost of Ownership’ for corporate hardware and software assets. This includes the replacement of software application solutions which are unable to be adapted to meet the requirements of public policy change, regulatory initiatives and new Customer driven functionality and are costly to maintain. This is evident in our 5 Year Capital IT plan. IT seeks to maintain a cost effective Operating and Capital pricing model on all software and hardware acquisitions.

Appendix D: Operations Distribution System Annual Maintenance Summary Report 2014

OPERATIONS DISTRIBUTION SYSTEM ANNUAL MAINTENANCE SUMMARY REPORT 2014

2014 | OEB Inspections and Maintenance

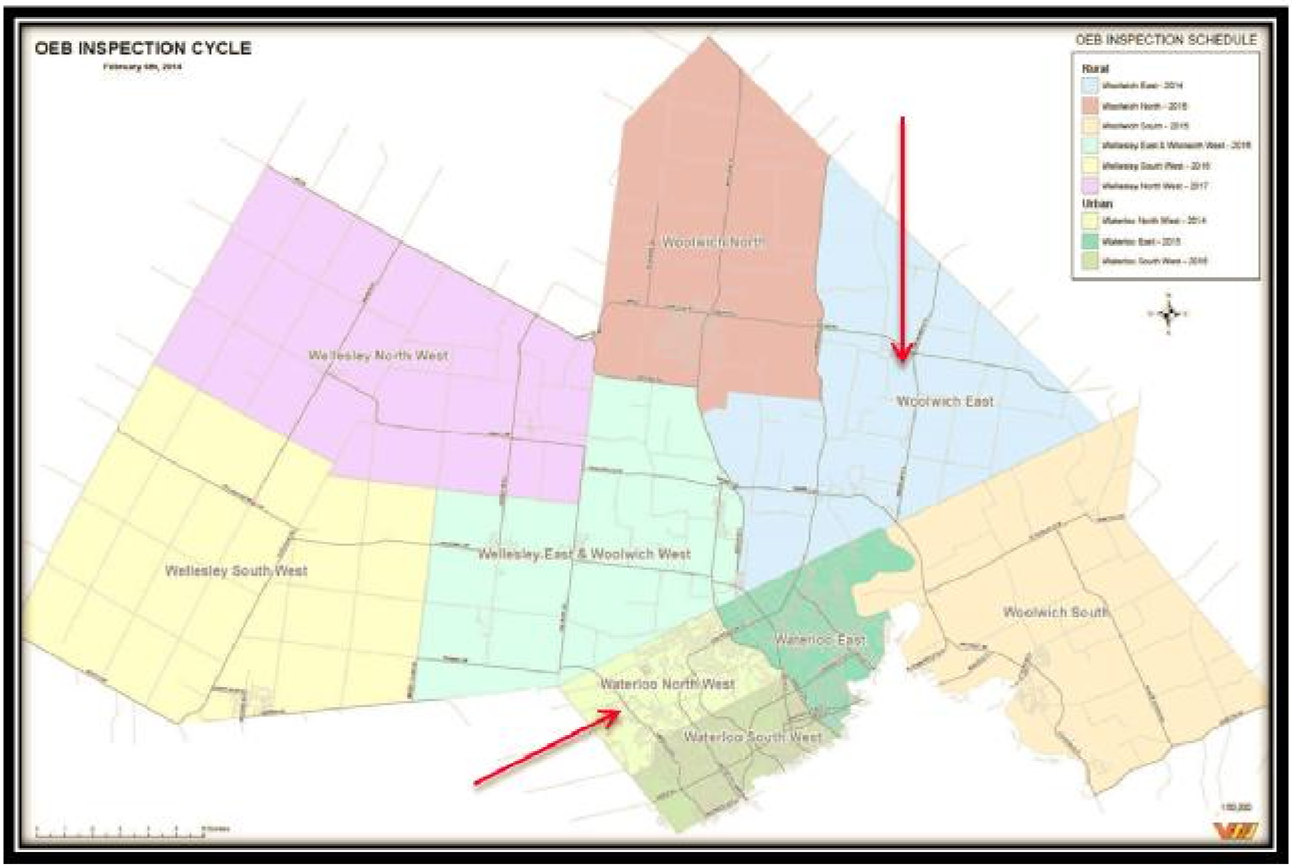
Prepared by: Rob Kroetsch

February 3, 2015

INTRODUCTION

For the year 2014 our OEB 3 year visual patrol for our urban area consisted of the Waterloo North West area, and our 6 year visual patrol for rural area consisted of the Woolwich East area.

In addition to the required OEB visual patrols, we completed 13 patrols on identified poor performing feeders. This resulted in preventative maintenance on overhead plant to aid in the reduction of unplanned outage minutes.



We were able to complete 100% of both urban and rural areas using both WNH staff and contracted services. Making use of in house staff on modified duty as well as recently retired line staff, gave us the expertise required for in depth and accurate inspections.

Included in this report is a summary spreadsheet indicating the types of required tasks with a date range and a group responsible for the inspections. The reports from GIS indicating actual sites and documentation of found deficiencies can be found in our GIS software.

OVERHEAD SYSTEMS

The visual overhead patrol consisted of the inspection of poles and hardware, transformers, switches, capacitors, regulators, conductors, crossings and vegetation. The majority of overhead inspections were completed by qualified WNH staff and contracted Powerline Maintainers. Electrical infrared thermographic inspections were conducted by a contractor. We completed infrared inspections surveying all of the 3 phase lines in our required inspection areas. 9 overhead equipment related issues were identified with follow up completed.

The problems were identified and repairs were completed and documented in the 2014 Electrical Infrared Thermographic Inspection Report dated February 3 to 14, 2014.

As part of our OEB inspections a total of 4,421 poles were inspected. This included 1/3 of our urban area, Waterloo North West and 1/6 of our rural area in Woolwich East. 77 issues were found in the urban inspection of which 73 required immediate attention. 312 issues were found in the rural inspection of which 307 required immediate attention. This report identified poles needing to be replaced, poles in poor condition, hardware replacement, repairs to conductors, and transformers needing attention or replacement.

We completed inspections of crossings, which include expressway, railway and river crossings, and found no major deficiencies.

Our inspections of overhead plant located in or adjacent to parks, playgrounds and school yards identified some minor repairs and corrective action was completed.

Our capacitor banks, a total of 52 for urban and rural, were inspected in 2014 and no deficiencies were identified.

As part of our overall overhead inspections we ensure proper nomenclature is of all major equipment including switches, transformers, capacitors etc. is documented and updated in our GIS system as required.

Documented repairs and replacement of identified deficiencies are on-going. Necessary repairs are recorded on our Urgent Repair Required form and assigned to a crew for repairs. *Attachment 1*

Load Break Switch Maintenance

A total of 154 load break switches in our entire service area were inspected and as a result 10 load break switches were identified to be replaced and 1 required maintenance. The determining factor on replace versus maintenance were conditions of switch and pole, damage identified to components of the switch (porcelain insulators, rusted operating devices) and age of switch. A newer style of switch with polymer insulators that would have had a report of an operating deficiency would be slated for maintenance.

Insulator Washing

We did not complete insulator washing in the 2014 cycle.

Pole Testing

Our Engineering department arranged for contractors to test 314 poles in 2014 resulting in a schedule for depreciated pole replacement. The majority of the replacements were completed by WNH contractors.

UNDERGROUND SYSTEMS

The visual inspection of the underground systems serves to identify obvious structural problems, hazards and is also used in verifying and updating nomenclature. Some typical deficiencies identified may include rusting pad-mounted equipment and requirements for painting, faulty locking mechanisms, identification of hot spots using infra-red cameras and mislabeling of nomenclature.

As part of our OEB underground inspection, 981 transformers and 81 switching cubicles were inspected. 343 issues were identified. All transformer vault room inspections were completed in conjunction with infrared thermography. These transformer vault rooms also included inspection of school facility vault rooms and identified issues such as door maintenance/replacement and nomenclature requirements. Multiple lock replacements were completed as a result of identified deficiencies. 2 door related issues were identified and repairs were completed. There were 9 transformer heat related issues identified during infrared inspections with follow up completed.

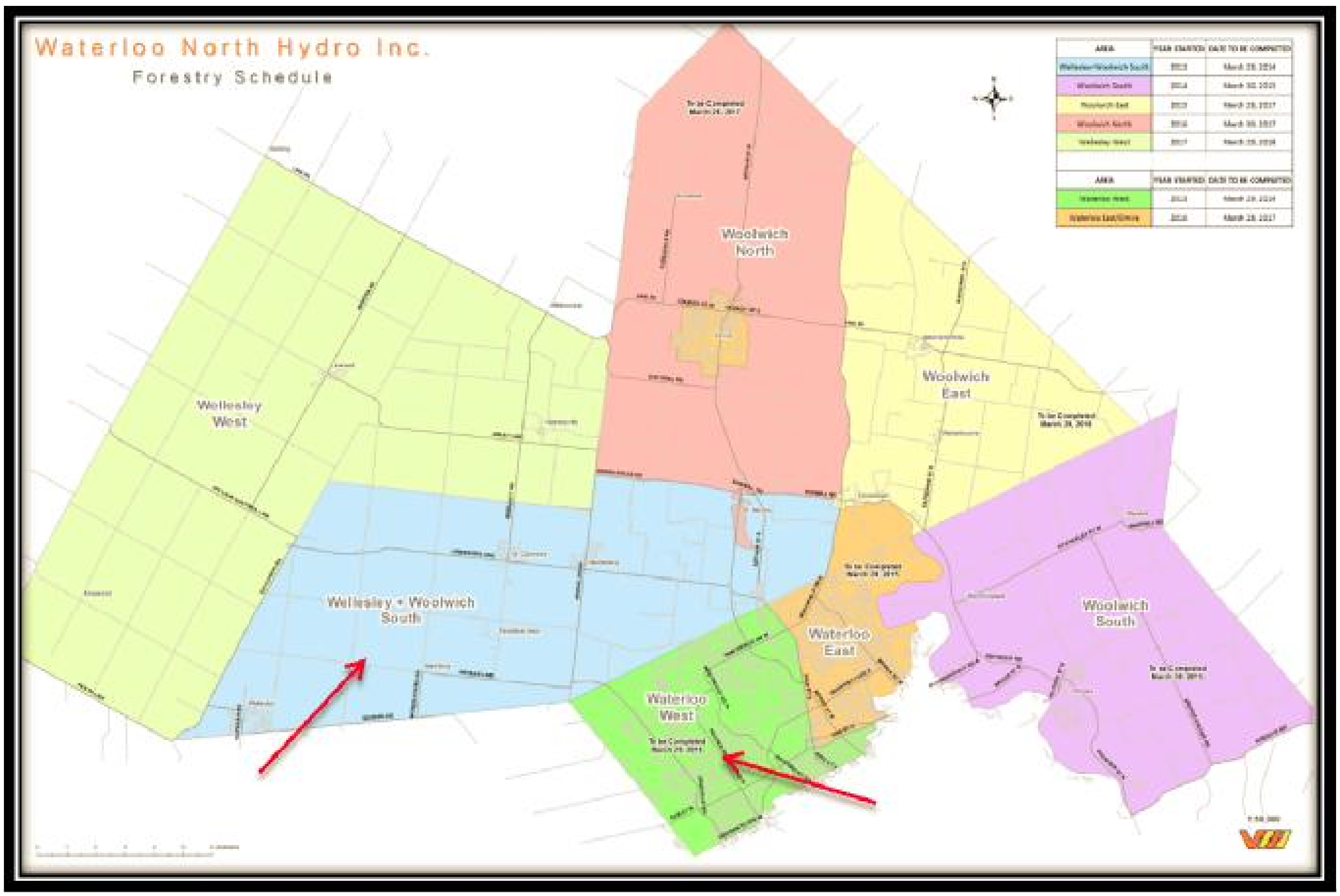
Documented repairs and replacement of found deficiencies are ongoing.

As part of our regular maintenance program for our underground system, 18 switching cubicles were identified to be replaced and 18 completed to date. 5 submersible vault lid replacements were identified, 2 lids were replaced due to age and wear with 3 remaining to be completed.

FORESTRY

In 2014 the urban, Waterloo West and rural, Wellesley and Woolwich South portion of the required trimming was 100% completed by contractors. The trimming cycle started in the fall of 2013 and was completed by late fall 2014. We completed and documented inspections for intrusive vegetation growth around padmounted transformers and underground plant, notifying customers of any required follow up. Customers were given the option to remove the vegetation obstructing the transformers themselves or a WNH contractor would remove any obstructions.

Remedial work to address the documented forestry deficiencies is on-going. Necessary tree trimming and line clearing locations are recorded on our Urgent Repair Required form and assigned to a contract forestry crew. *<u>Attachment 2</u>*



SPREADSHEET USED TO MONITOR PROGRESS OF ANNUAL MAINTENANCE PROGRAM

OPERATIONS 2014 PROJECT PLAN

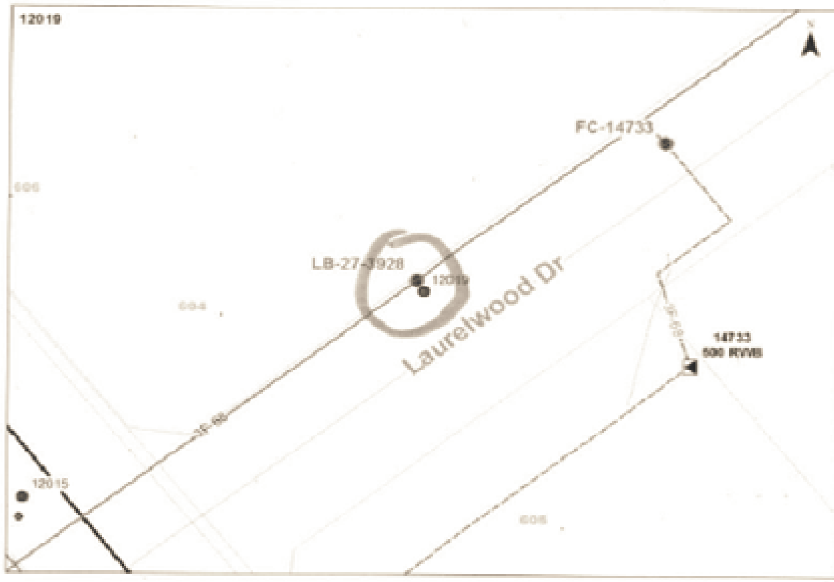
	OEB INSPECTIONS														FORESTY	
	Plant		Schools / Playgrounds		Transformers		Infrared		Railway & River Crossings	Expressway Crossings	Capacitors / Regulators	Pole Testing	HydroOne 3rd party agreement locks checked	LB Maint / Replacement	Rural	Urban
	OH	UG	OH	UG	OH	UG	OH	UG	OH	OH	OH	OH		OH	% complete	% complete
WNH / Contractor	Contractor	WNH	WNH	WNH	Contractor	WNH	Contractor	Contractor	Contractor	WNH	WNH	Contractor	WNH	WNH	Contractor	Contractor
January	January 14				January 14		February 3	February 3							10%	25%
February	30% rural				30% rural						RS February 28				70%	
March	60% rural		RP	RP	60% rural									RS March 5 list	100%	
April	100% rural		RP	RP	100% rural											75%
May	40% urban		RP	RP	40% urban											
June	70% urban		RP 50%	RP 50%	70% urban							Engineering				
July	100% urban				100% urban	70% all			RG 100%	RG 100%		314 poles	RK 100%			
August						100% all										
September																started secondary services
October			RG 100%	RG 100%												
November																
December														completed 10 repl/1 maint		100%

Attachment 1

Urgent Repair Report

Urgent Repair Required

Record in InspectionRecords



Facility ID: 12019

Date Inspected: 06/05/2014

Pole Condition: Good

Pole Problem: None

Transformer Issue:

TX Facility ID:

Condition:

		Repaired:
Anchors:	Good	
Guying:	Repair	
Guy Guards:	Good	
Cable Guard:	Good	
Grounding:	None	

		Repaired:
AnimalDamage:	No	
Vegetation:	No	
CrossArm:	None	
Arrestor:	None	
Insulators:	Polymer	
Primary Condition:	Good	

	Repaired:
Leaking:	
Bushings:	
Burning:	
Proper Nomencalture:	

Assigned To:

Repaired By: KS CH.

Repaired Date: Dec 30/14

Repair Comments:

Switch Issue:

Switch Facility ID: LB-27-3928

Condition: No

Problem: Good

Proper Nomenclature: Yes

Original Inspection Comments:

Johnny ball broke repair

Like For Like:

Eng. Input:

Eng. Tech:

K Shyl Dec 30-14

Site Left In Safe Condition, No Undue Hazards

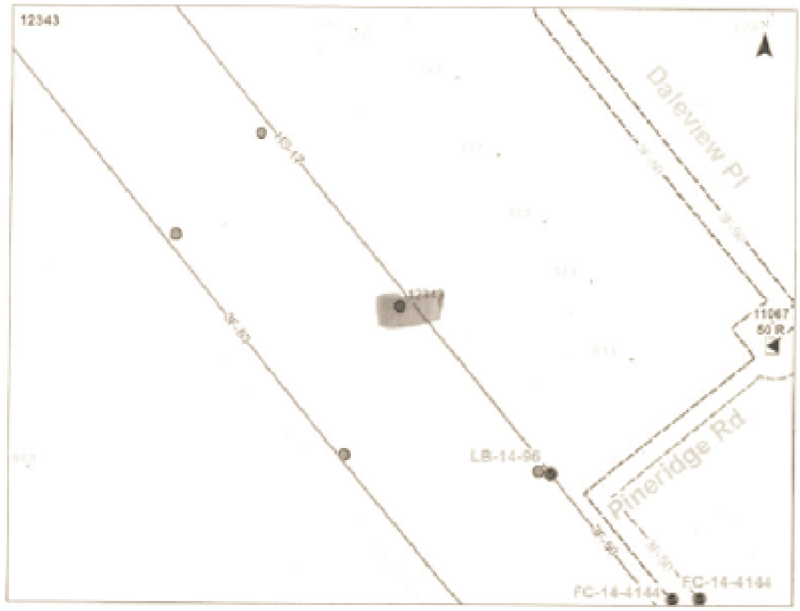
KS CH

Attachment 2

Urgent Repair Report – Trimming Required

Urgent Repair Required

Record in InspectionRecords



Facility ID: 12343

Date Inspected: 07/05/2014

Pole Condition: Replace

Pole Problem: None

		Repaired:
Anchors:	Good	
Guying:	Good	
Guy Guards:	Good	
Cable Guard:	Good	
Grounding:	Good	

		Repaired:
AnimalDamage:	No	
Vegetation:	Trim Needed	
CrossArm:	Good	
Arrestor:	Polymer	
Insulators:	Polymer	
Primary Condition:	Good	

Transformer Issue:

TX Facility ID:

Condition:

	Repaired:
Leaking:	
Bushings:	
Burning:	
Proper Nomencalture:	

Assigned To:

Repaired By: COLONIAL

Repaired Date: AUG 8, 2014

Repair Comments:

Switch Issue:

Switch Facility ID:

Condition:

Problem:

Proper Nomenclature:

Original Inspection Comments:

replace pole looks like it will blow away
excessive SHA LING

Like For Like:

Eng. Input:

Eng. Tech:

Appendix E: Table 2AE, Capital Expenditure Summary 2011 - 2020

Table 2AE - Capital Expenditure Summary from Chapter 5 Consolidated Distribution System Plan Filing Requirements

OEB Investment Category	Historical Period								Bridge Year		Test Year	Forecast Period				Average
	2011		2012		2013		2014		2015		2016	2017	2018	2019	2020	2016 - 2020
	Plan	Actual	Plan	Actual	Plan	Actual	Plan	Actual	Plan	Actual						
System Access	(1)	$ 5,616,458	(1)	$ 7,835,847	(1)	$ 8,667,885	(1)	$ 5,625,933	(1)	$ 11,084,508	$ 6,622,858	$ 5,892,104	$ 6,020,046	$ 5,946,859	$ 6,085,796	$ 6,113,533
System Renewal	(1)	$ 9,731,967	(1)	$ 9,253,544	(1)	$ 7,569,002	(1)	$ 9,711,737	(1)	$ 6,465,106	$ 8,181,031	$ 8,545,000	$ 9,438,200	$ 8,800,764	$ 8,975,779	$ 8,788,155
System Service	(1)	$ 1,832,799	(1)	$ 1,649,794	(1)	$ 1,573,868	(1)	$ 2,311,676	(1)	$ 1,526,548	$ 2,405,950	$ 1,680,000	$ 1,725,200	$ 1,175,404	$ 1,175,612	$ 1,632,433
General Plant	(1)	$ 29,572,430	(1)	$ 3,380,268	(1)	$ 2,140,562	(1)	$ 2,044,660	(1)	$ 2,232,450	$ 1,869,078	$ 2,813,765	$ 1,661,176	$ 1,670,309	$ 1,649,525	$ 1,932,771
Totals		$ 46,753,654		$ 22,119,452		$ 19,951,316		$ 19,694,006		$ 21,308,612	$ 19,078,917	$ 18,930,869	$ 18,844,622	$ 17,593,336	$ 17,886,713	$ 18,466,891
System Operations		$ 3,567,713		$ 4,464,684		$ 6,122,581		$ 6,246,577		$ 6,018,379	$ 5,934,832					
System Maintenance		$ 1,287,857		$ 1,266,289		$ 1,283,983		$ 1,845,659		$ 1,607,062	$ 1,613,140					
Total O&M		$ 4,855,570		$ 5,730,973		$ 7,406,564		$ 8,092,236		$ 7,625,441	$ 7,547,972					

Appendix F: Annual Service Continuity Report – Distribution Performance

Waterloo North Hydro Inc.

2014

Annual Service Continuity Report on

Distribution System Performance

Version 2.0

Table of Contents

Executive Summary

This report has captured 2014 distribution system outage details including sustained and momentary interruptions by feeder, cause code and location. Metrics are in place to identify worst performing feeders whereby maintenance and improvement efforts are prioritized. Supplementary maps are included to illustrate root cause clustering and trending.

2014 was exempt from Major Events.

Major Events by definition, also known as Prominent Events, are events where 10% of a Distributor's customer base is out of power for more than 24 hours and caused by a storm or event impacting more than one Distributor.

2013 remains noteworthy as a worst-ever year for WNH with customer outage minutes totaling 29,335,283. A five year annual history of annual customer outage minutes is summarized here:

- **2014 = 3,180,022**
- 2013 = 29,335,283
- 2012 = 10,714,478
- 2011 = 3,311,682
- 2010 = 2,248,352

The magnitude of the 2013 storms and the restoration afterwards raised awareness on many fronts. Most local Municipalities have Emergency Preparedness Plans that were exercised and/or refined during 2013.

The increase from 2012 to 2013 is attributable to three Major Events. All of the 2013 Major Events were weather related with an April ice storm, a July wind storm and a December ice storm. These three events contributed 24,960,714 customer outage minutes or 85% of the annual total.

The increase from 2011 to 2012 is attributable to two Major Events. On February 29, 2012 a Loss of Supply event and on October 29, 2012, a Defective Equipment event, contributing 8,119,210 customer outage minutes.

Waterloo North Hydro (WNH) joined the Canadian Electrical Association's (CEA) Service Continuity Program in the fall of 2010. The purpose of this program is to survey the performance of distribution systems in a cross section of Canadian Electrical Utilities in order to identify trends and opportunities for improving system reliability. WNH contributes source data to the survey that supports the continuous development of the annual CEA Service Continuity Report which is also reviewed at an annual conference.

WNH Control Room Representatives have attended the annual conference and workshop since 2011. WNH reliability reporting has improved year over year, in part because of our involvement in the CEA program.

Sustained Interruptions

Historical Comparison

In 2014, Waterloo North Hydro's distribution system performed in an expected or average manner with 838 sustained interruptions at 3,149,650 customer outage minutes (C.O.M.).

In 2013, Waterloo North Hydro's distribution system experienced 810 sustained interruptions totaling 29,335,283 C.O.M.

Code	2010				2011				2012				2013				2014			
	C.O.M.	%	Events	%	C.O.M.	%	Events	%	C.O.M.	%	Events	%	C.O.M.	%	Events	%	C.O.M.	%	Events	%
0	64,690	3%	63	10%	82,948	3%	34	5%	128,042	1%	34	4%	126,306	0%	37	5%	31,038	1%	28	3%
1	449,699	20%	284	47%	747,222	23%	406	55%	679,988	6%	440	58%	626,174	2%	394	49%	476,426	15%	476	57%
2	114,680	5%	4	1%	971,424	29%	5	1%	5,436,558	51%	6	1%	12,641,909	43%	29	4%	503,351	16%	16	2%
3	46,341	2%	27	4%	372,074	11%	38	5%	101,922	1%	26	3%	765,317	3%	37	5%	189,462	6%	17	2%
4	39,730	2%	14	2%	187,063	6%	37	5%	31,497	0%	29	4%	77,735	0%	23	3%	13,796	0%	30	4%
5	403,233	18%	92	15%	421,204	13%	85	11%	3,065,784	29%	95	13%	331,364	1%	83	10%	1,247,211	40%	126	15%
6	725,979	32%	20	3%	182,575	6%	22	3%	259,825	2%	13	2%	14,220,195	48%	101	12%	155,150	5%	31	4%
7	3,928	0%	9	1%		0%	-	0%	22,475	0%	4	1%	11,033	0%	3	0%	1,752	0%	2	0%
8	100,828	4%	7	1%	119,617	4%	10	1%	28,503	0%	10	1%	177,933	1%	14	2%	14,952	0%	11	1%
9	299,244	13%	81	13%	227,555	7%	106	14%	959,884	9%	99	13%	357,317	1%	89	11%	516,512	16%	101	12%
Total	**2,248,352**	**100%**	**601**	**100%**	**3,311,682**	**100%**	**743**	**100%**	**10,714,478**	**100%**	**756**	**100%**	**29,335,283**	**100%**	**810**	**100%**	**3,149,650**	**100%**	**838**	**100%**

The normalizing summary below excludes major events (EME).

In 2014 we did not have any Major Events by definition.

In 2013 we excluded an April 12th Ice Storm event (15,118,646 C.O.M.), a July 19th Wind Storm event (2,853,617 C.O.M.) and a December 22nd Ice Storm event (6,988,451 C.O.M.).

In 2012 we excluded a February 29 Loss of Supply event (5,368,709 C.O.M) and an October 29th Defective Equipment event (2,566,978 C.O.M.).

Code	2010				2011				2012 (2 EME)				2013 (3 EME)				2014 (0 EME)			
	C.O.M.	%	Events	%	C.O.M.	%	Events	%	C.O.M.	%	Events	%	C.O.M.	%	Events	%	C.O.M.	%	Events	%
0	64,690	3%	63	10%	82,948	3%	34	5%	128,042	5%	34	4%	126,306	3%	37	5%	31,038	1%	28	3%
1	449,699	20%	284	47%	747,222	23%	406	55%	679,988	24%	440	58%	626,174	14%	394	54%	476,426	15%	476	57%
2	114,680	5%	4	1%	971,424	29%	5	1%	67,849	2%	5	1%	1,564,997	36%	20	3%	503,351	16%	16	2%
3	46,341	2%	27	4%	372,074	11%	38	5%	101,922	4%	26	3%	466,100	11%	30	4%	189,462	6%	17	2%
4	39,730	2%	14	2%	187,063	6%	37	5%	31,497	1%	29	4%	77,735	2%	23	3%	13,796	0%	30	4%
5	403,233	18%	92	15%	421,204	13%	85	11%	498,806	18%	94	12%	328,727	8%	81	11%	1,247,211	40%	126	15%
6	725,979	32%	20	3%	182,575	6%	22	3%	259,825	9%	13	2%	640,207	15%	40	5%	155,150	5%	31	4%
7	3,928	0%	9	1%		0%	-	0%	22,475	1%	4	1%	11,033	0%	3	0%	1,752	0%	2	0%
8	100,828	4%	7	1%	119,617	4%	10	1%	28,503	1%	10	1%	177,933	4%	14	2%	14,952	0%	11	1%
9	299,244	13%	81	13%	227,555	7%	106	14%	959,884	35%	99	13%	355,283	8%	87	12%	516,512	16%	101	12%
Total	**2,248,352**	**100%**	**601**	**100%**	**3,311,682**	**100%**	**743**	**100%**	**2,778,791**	**100%**	**754**	**100%**	**4,374,569**	**100%**	**729**	**100%**	**3,149,650**	**100%**	**838**	**100%**

Legend for Outage Cause Codes

0 = Unknown
1 = Scheduled Outage
2 = Loss of Supply
3 = Tree Contacts
4 = Lightning
5 = Defective Equipment
6 = Adverse Weather
7 = Adverse Environment
8 = Human Element
9 = Foreign Interference

Top Contributing Events - 2014

It has proven useful to review the top contributing outage events each year in order to understand the main causes of total C.O.M. 2011 through 2014 are detailed below.

In 2014, the top seven contributing events make up 48% of the annual C.O.M. Defective Equipment is prominent in the top three events and details are available within this report. Refer to Cause Code 5 – Defective Equipment on page 13.

2014 Top Contributing Sustained Interruption Events

	ID	Event Date	Feeder	Effect	C.O.M.	
1	49082	2014-04-10	HS26	Defective Equipment	369,558	WØ of dielectric switch FC-27-3370. Defective vacuum bottle.
2	49527	2014-07-02	33M3	Defective Equipment	268,576	Customer owned pole fire. Chemtura Plant, Elmira.
3	50451	2014-12-18	DS26	Defective Equipment	241,982	27.6kV fuse and arrestor blew at DS26.
4	50349	2014-11-26	3F68	Foreign Interference	224,146	Motor vehicle accident, Erbsville Rd, Waterloo
5	49038	2014-04-07	M24-3	Tree Contact	142,340	Rear lot branches
6	50443	2014-12-15	33M2	Loss of Supply	138,777	Fallen primary conductor on Hydro One circuit
7	49708	2014-07-31	HS19	Foreign Interference	117,292	HSTS T5 differential from animal contact at Campbell TS

1,502,671	Subtotal
3,149,650	Annual Total
48%	Percentage

Top Contributing Events - 2013

In 2013, top contributing events had grown in severity, shown in order of outage minutes. The top three events are major events with seven additional, more typical outages shown afterwards.

2013 Top Contributing Sustained Interruption Events

	ID	Event Date	Feeder	Effect	C.O.M.	
1	28 SCs	2013-04-12	22 Fdrs	Adverse Weather, Loss of Supply	15,118,646	April 11, 12 and 13 Ice Storm, 3 day restore (EME)
2	18 SCs	2013-07-19	17 Fdrs	Adverse Weather	2,853,617	Summer wind storm, down burst, 3 day restore (EME)
3	28 SCs	2013-12-22	25 Fdrs	Adverse Weather, Loss of Supply	6,988,451	December 22, 23, 24 Ice Storm, 3 day restore (EME)
4	23 SCs	2013-11-18	16 Fds	Loss of Supply, Adverse Weather	1,315,277	November 18, D10H Outage, 1 day restore with rolling black outs in Elmira area
5	SC47418	2013-05-20	1 Fdr	Adverse Weather, Loss of Supply	389,223	May 20, 9 poles fell in Winterbourne, 44kV + 8kV, tripping out 73M7
6	SC48612	2013-12-29	1 Fdr	Adverse Weather	265,106	3F68 tripped, suspected damage from ice
7	SC47756	2013-06-15	1 Fdr	Loss of Supply	226,800	73M7 trips with faulty EVR on HO side
8	SC4669	2013-02-27	1 Fdr	Human Element	116,556	3F63 A/R/A, Operator missed alarm for breaker open in storm conditions
9	SC47397	2013-05-15	1 Fdr	Loss of Supply	78,416	Actually WNH Human Element, contractor tripped feeder under Hold Off
10	SC48258	2013-11-01	1 Fdr	Adverse Weather	77,099	Winds causing A/R/A, sectionalized and restored

27,429,191	Subtotal
29,335,283	Annual Total
94%	Percentage

Top Contributing Events – 2012 and 2011

In 2012, sorting by the top 7 events resulted in outage events ranging from 63,309 to 5,368,709 C.O.M. and shows again that just a few events, seven, make up 86% of the annual sustained interruptions.

2012 Top Contributing Sustained Interruption Events

	ID	Event Date	Feeder	Effect	C.O.M.	
1	45227	2012-01-12	HS20	Defective Equipment	119,954	Failed x-arm and faulted conductor, Regina St at Young St
2	45408	2012-02-29	D6V	Loss of Supply	4,295,731	**5,368,709**
	45409	2012-02-29	D6V	Loss of Supply	668,499	D6V Loss of Supply at same that all WNH substations were isolated from D7V supplies
	45406	2012-02-29	D6V	Loss of Supply	303,417	
	45410	2012-02-29	D6V	Loss of Supply	101,062	
3	45777	2012-05-20	RUSH T1	Foreign Interference	621,285	Squirrel across LB-14-82 causing feeder lockouts and B1B2 and T1B1 lockouts
4	45922	2012-06-18	HS20	Defective Equipment	64,336	Broken arrestor caused A/R/A
5	45937	2012-06-20	73M7	Loss of Supply	63,309	MVA in Hydro One area near Fergus
6	46058	2012-07-10	3F68	Foreign Interference	194,576	Moter Vehicle Accident, Hessen Strasse
7	46584	2012-10-29	ER48	Adverse Weather	185,523	**2,752,501**
	46579	2012-10-29	RUSH T1	Defective Equipment	2,566,978	Hurricane Sandy was cause of ER48 outage. ERTS outage was because ER T1 tripped out while ER T2 was out of service for maintenance.
					9,184,670	Subtotal
					10,714,478	Annual Total
					86%	Percentage

In 2011, sorting by sustained outages of greater than 100,000 C.O.M. illustrates that just 7 outage events make up almost half of the years sustained interruptions.

2011 Top Contributing Sustained Interruption Events

	ID	Date	Feeder	Cause	C.O.M.	
1	44281	07-Jun-11	73M7	Loss of Supply	499,781	High winds downing Hydro One conductor north of WNH territory.
2	44021	20-Apr-11	33M3	Defective Equipment	168,913	WNH 27.6 kV conductors outside Elmira faulted
3	44257	04-Jun-11	ER48	Tree	198,588	Fallen tree, winds, Beechwood Dr, Waterloo
4	44486	17-Jul-11	9M4	Loss of Supply	130,433	KWH supply. Pole fire.
5	44687	01-Sep-11	33M1	Lightning	105,190	Feeder locked out in storm.
6	44699	03-Sep-11	HS10	Adverse Weather	132,051	High winds, broken pole Northfield Dr at Weber St
7	45180	28-Dec-11	73M7	Loss of Supply	286,234	Hydro One customer had failure in private system causing Hydro One lockout
					1,521,190	Subtotal
					3,311,682	Annual Total
					46%	Percentage

Cause Code Observations

To supplement Sustained Interruption numbers by Cause Code, each outage is logged with an X and Y coordinate to present outages spatially within WNH's serving territory. The Observations below are made per Cause Code and accompanied by a map excerpt whereby outage locations are depicted as follows:

2010 (blue) 2011 (red) 2012 (yellow) 2013 (green) 2014 (purple)

Code 0 – Unknown

2014 indicates that 28 out of 838 sustained outage events were logged as cause unknown at 1%. Added focus seems to have been effective with regard to cause coding. However, some outages were logged with a cause of blown fuse (Defective Equipment) when the cause was unknown. This habit is misleading and the Control Room will continue to solidify logging accuracy.

2013 shows that 37 events of our 810 logged outage events are cause unknown at 5%. Reducing cause unknown events will remain a focus area for our System Operator's.

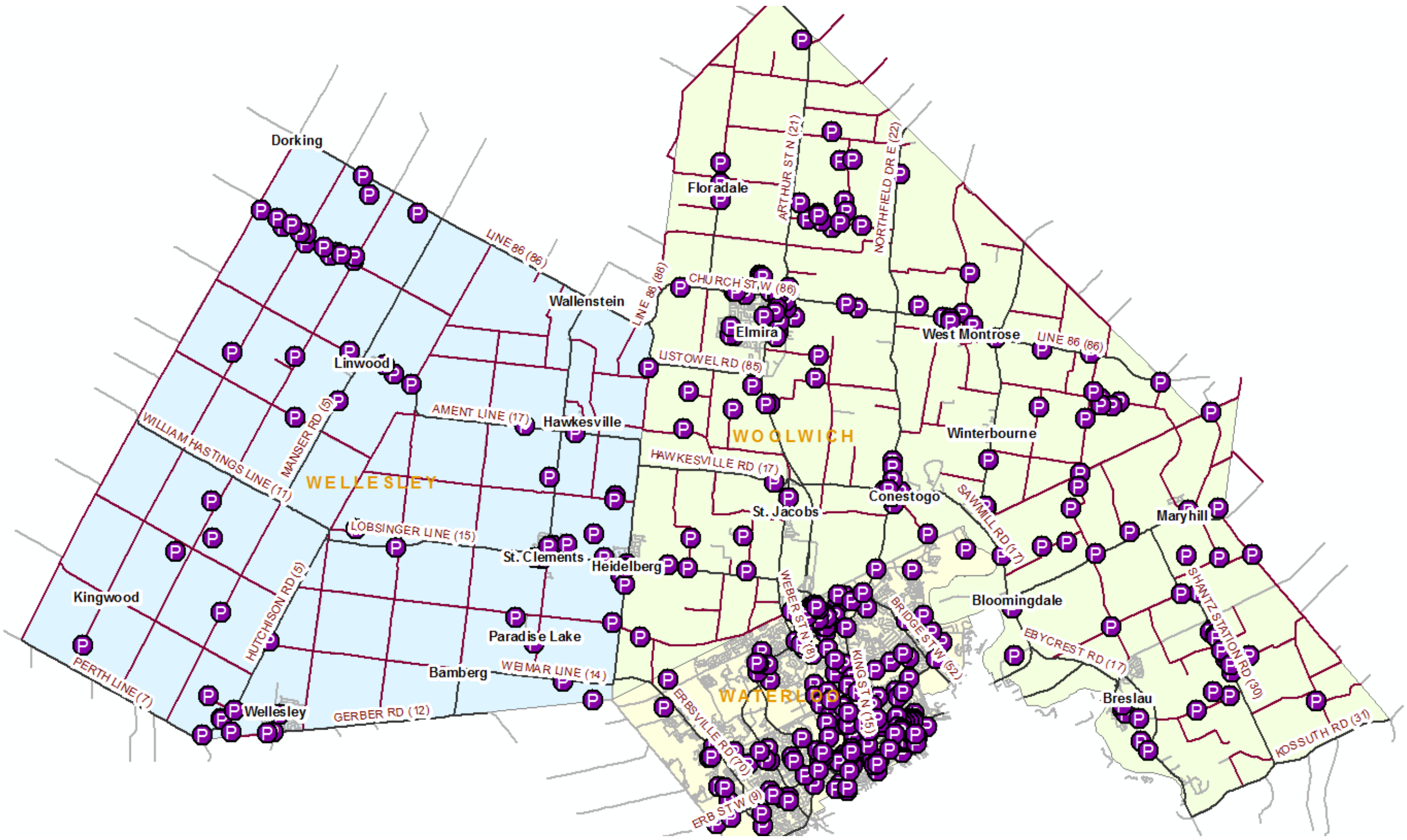
Continued improvement of root cause analysis by Powerline Maintainer's and System Operator's has reduced our unknown sustained outage events from 10% in 2010 (63 events).

Code 1 – Scheduled Outages

The number of scheduled outages remains consistent over five years making up on average, 13.5% of our sustained C.O.M.

For clarity, only 2014 scheduled outages are represented below. Obvious clusters align with capital upgrades where individual transformer outages were captured once energized by the new circuit.

Additionally, WNH was aggressive with feeder patrol work in 2014 where over 60 transformer locations were identified as needing animal guarding. This is a proactive approach to system hardening but a short outage is required to complete the installation of the animal guarding equipment.



Code 2 – Loss of Supply

44kV - 73M7

2011 786,015 C.O.M. 2012 88,219 C.O.M. 2013 2,665,103 C.O.M. 2014 13,622 C.O.M.

230kV - D6V

2011 0 C.O.M. 2012 5,368,709 C.O.M. 2013 6,450,270 C.O.M. 2014 0 C.O.M.

115kV - D10H

2011 0 C.O.M. 2012 0 C.O.M. 2013 2,794,557 C.O.M. 2014 24,645 C.O.M.

In 2014, the most impact was from losing supply from 27.6kV third party embedded supply points.

We lost the Kitchener Wilmot Hydro (KWH) 27.6kV supply to the Wellesley DS26 substation on 3 separate occasions totaling 177,841 C.O.M. Since these 3 events, WNH has installed remote switching via two EVR's (Electronic Vacuum Recloser's) to minimize impact of future KWH loss of supply.

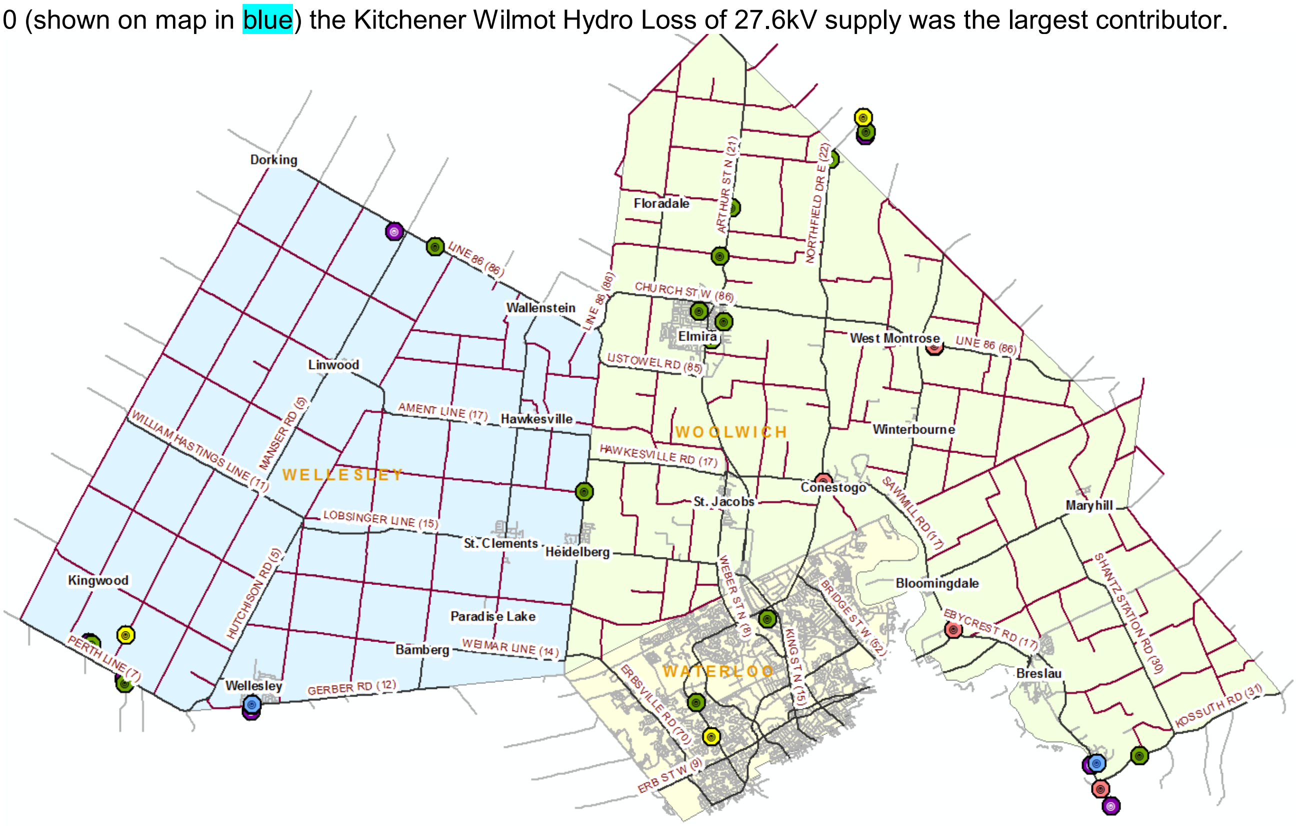
WNH lost the Hydro One 33M2 27.6kV supply to Floradale DS 28 and Wallenstein DS27 on December 15, 2014. This contributed 138,777 C.O.M. A Hydro One conductor broke along Highway 86 outside Wallenstein. It was a clean conductor break and the cause was logged unknown for Hydro One.

We lost the Cambridge North Dumfries 27.6kV supply to the Breslau area on two separate occasions totaling 13,058 C.O.M.

In 2013 and 2012, Hydro One Loss of 115kV and 230kV Supply was most impactful to WNH system performance.

In 2011 the Hydro One Loss of 44kV supply was the largest contributor.

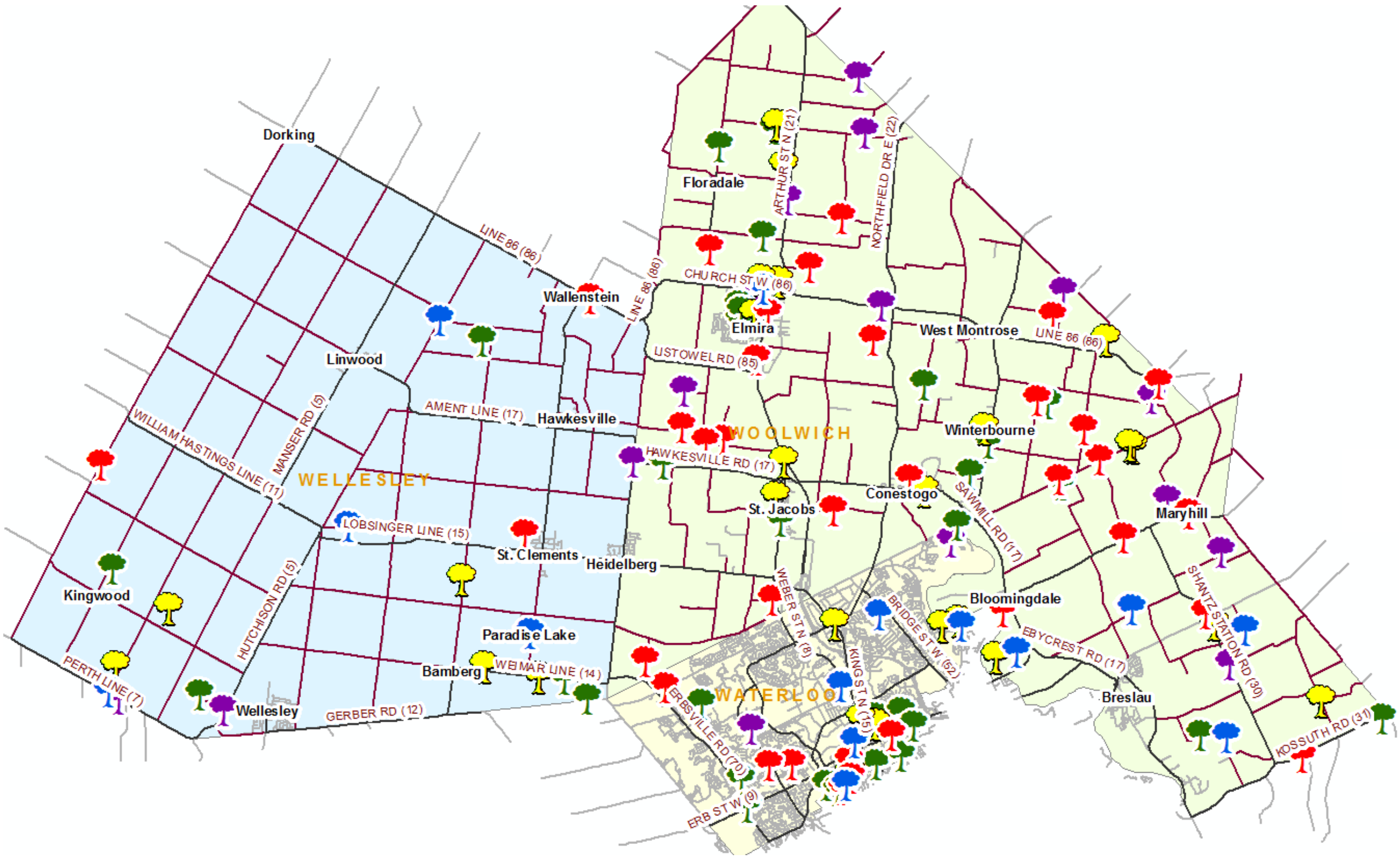
In 2010 (shown on map in blue) the Kitchener Wilmot Hydro Loss of 27.6kV supply was the largest contributor.



Code 3 – Tree Contacts

In reviewing 2014 Tree Contact Outages, 17 tree related outages were logged. No obvious clusters are depicted.

Note that for four years, Tree Contact outages have contributed less than 6% per year to WNH annual C.O.M.

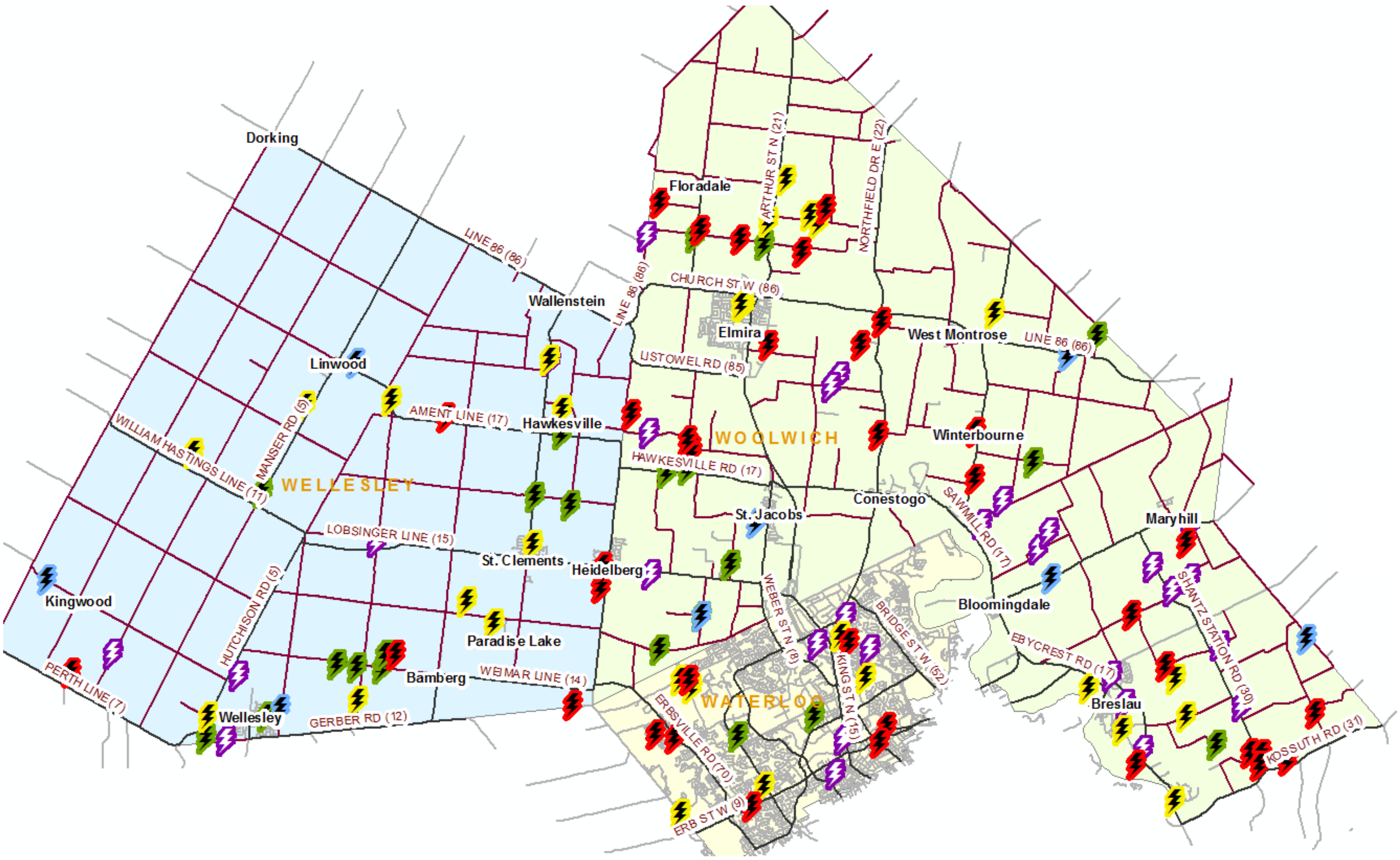


Code 4 – Lightning Contacts

In 2014, 30 sustained interruption events were logged and are shown below in magenta. There may be some pattern to the lightning strike locations with predominance in the township of Woolwich.

WNH installed 20 EVR's in 2014 which will assist in line protection and minimize impact of lightning strikes and other faults

In 2013, 23 Lightning Contact related sustained interruptions were logged. This showed downward trend from 2012 at 29 events and 2011 at 37 events.



Code 5 – Defective Equipment

2014 shows a rise in outages logged as Defective Equipment with 126 events contributing 1,247,211 C.O.M.

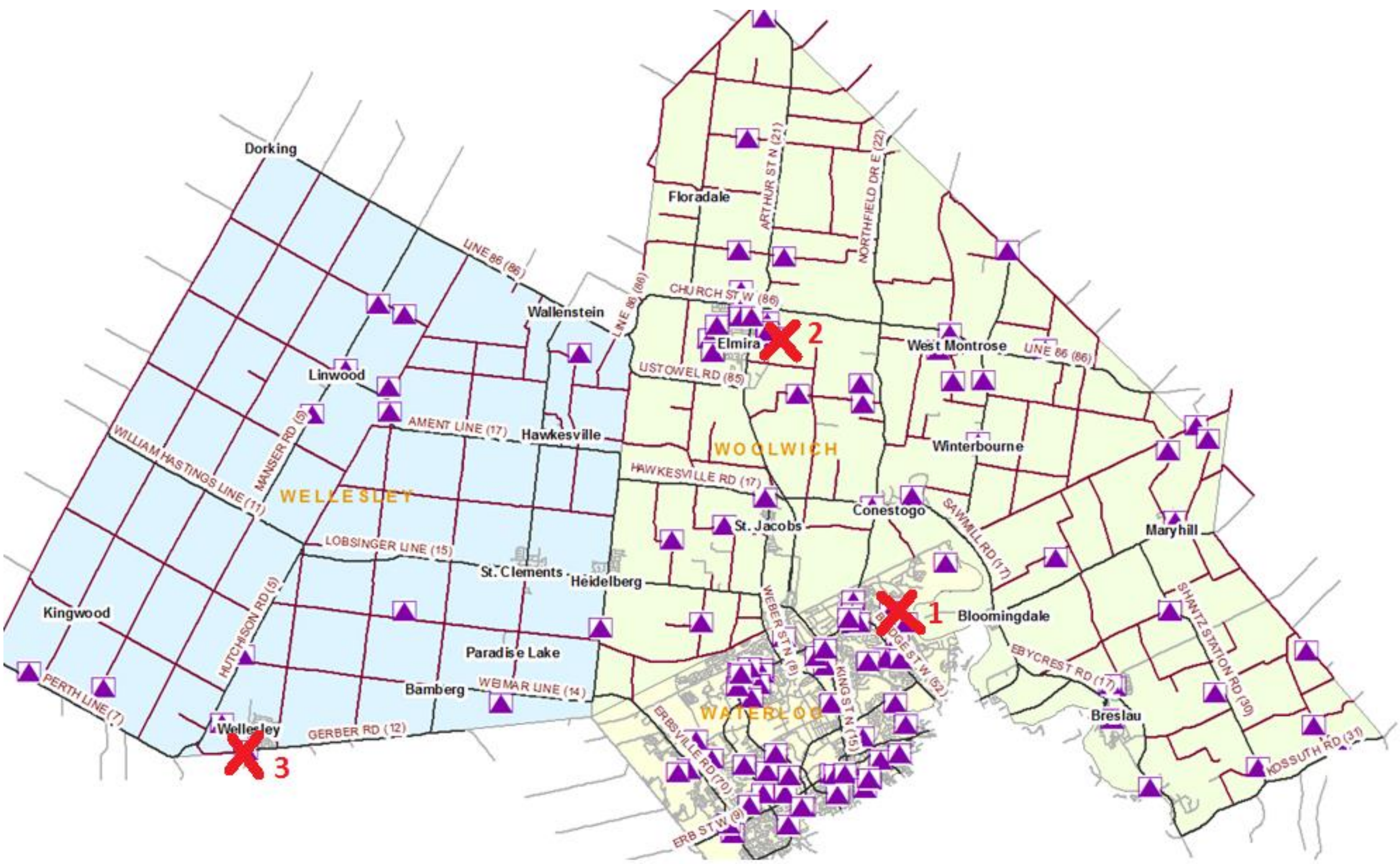
The three largest sustained interruptions in 2014 were due to Defective Equipment whereby these three events contributed 880,116 C.O.M or 28% of the annual C.O.M. Refer to the red 'X''s' on the image below and the associated details.

There were less Defective Equipment outages in 2013 than in previous years at 83 events and 331,364 C.O.M..

Each year breaks down as follows:
2014 .. 126 Total … 30 Blown Fuses … 28 Transformers
2013 … 83 Total … 21 Blown Fuses … 15 Transformers
2012 … 95 Total … 19 Blown Fuses … 17 Transformers
2011 … 85 Total … 20 Blown Fuses … 16 Transformers
2010 … 92 Total … 19 Blown Fuses … 28 Transformers

Going forward, the Control Room will work to drill deeper in to the root cause for Blown Fuse events and log accordingly.

Previous years Defective Equipment locations are toggled off to reduce clutter on the map.



1. On April 10, 2014 a WNH pad mounted dielectric switch failed (gasket of vacuum bottle) causing a feeder to lockout. At outset, 5,948 customers were out of power (a larger than usual customer count because urban feeders were re-arranged to pick up Elmira load due to Hydro One work at the Elmira Transformer Station). WNH sectionalized and restored power to the first block of 1,499 customers within 26 minutes. The restoration was completed in seven steps with the last section of 131 customer's being out of power for 227 minutes. This outage contributed 369,558 C.O.M.

2. On July 02, 2014 an Elmira TS feeder, 33M3, tripped off. A customer owned primary fault was the cause and logged as Defective Equipment. 1,204 customers were out of power for 61 minutes and 2,324 customers were out of power for 84 minutes. This Service Call totaled 268,576 C.O.M. The customer whose equipment caused the outage has since repaired their equipment as requested by WNH.

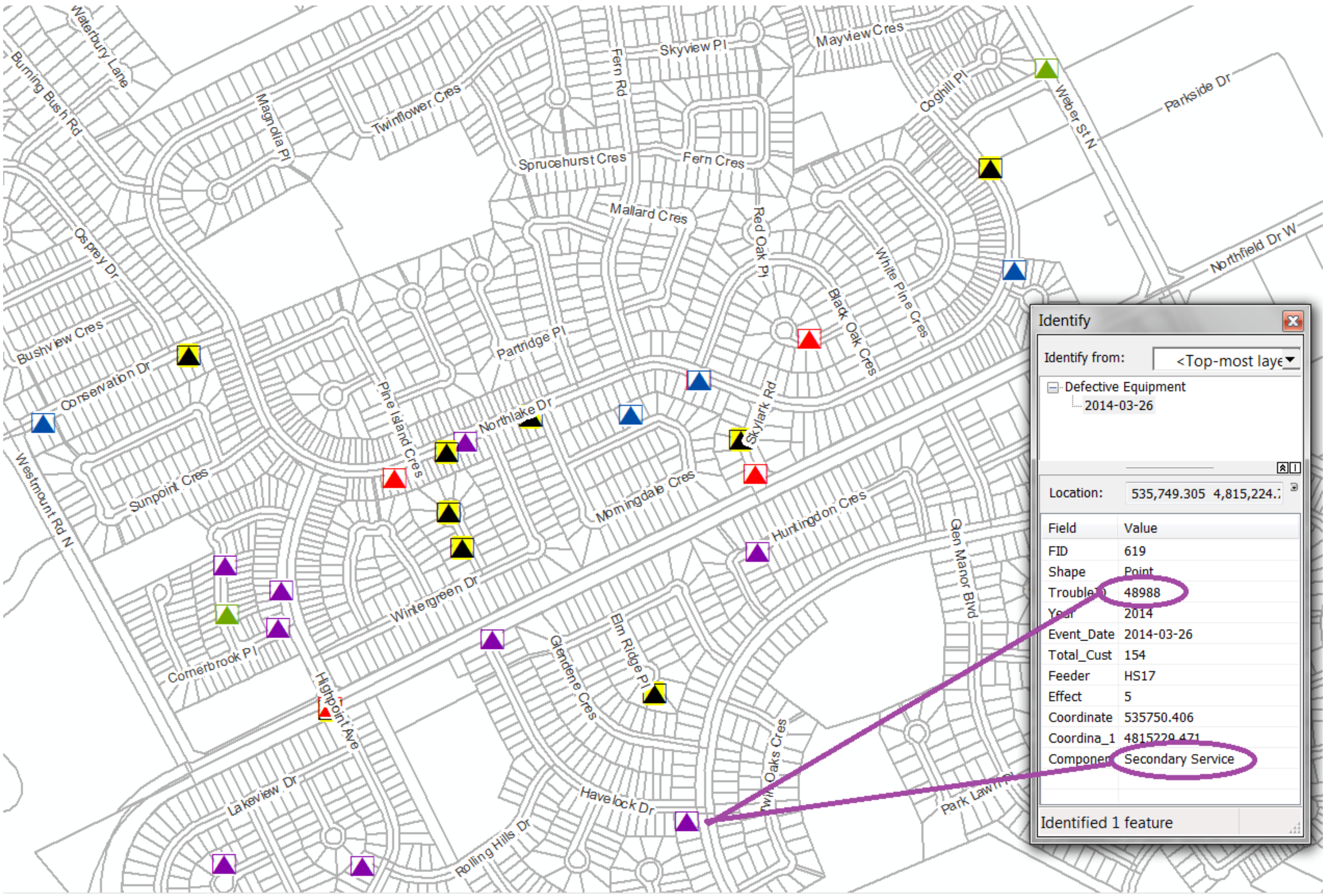
3. On December 18, 2014 WNH Control Room received extreme low voltage alarms for Wellesley DS affecting R26-2 and R26-3 8kV feeders. A field patrol verified a blown station arrestor and fuse, WNH System Operator de-energized both feeders. A post incident investigation identified a hair line crack in a 27.6kV arrestor installed at the DS26 Station. This outage contributed 241,982 C.O.M. affecting 705 customers for up to 6 hours.

2014 continued to depict a trend of failing devices in the southwest quadrant of Lakeshore North subdivision and the northwest quadrant of Lakeshore subdivision.

As shown below, all outage locations are imported in to a GIS map with attributes populated to allow Engineering Technologists to drill in to the related Service Call(s).

Events in 2013 fall within this same area. Detailed subsets of information can be made available for assessment. The grouping of these logged outages may assist with the staging of the underground hydro infrastructure rebuild in this area.

In 2012, a clustering trend of Defective Equipment showed in the Lakeshore North Subdivision area of Waterloo.



Code 6 – Adverse Weather

In contrast to 2013, 2014 presented an extreme decrease in the number of logged weather events, contributing 155,150 C.O.M. or 5% of the annual C.O.M.

The largest adverse weather caused outage in 2014 was on November 24, 2014 where high winds hit the region, gusting up to 102 km/hr. HS23 tripped out three times affecting 2,380 customers and totaling 64,260 C.O.M. A factor in this outage was believed to be 13.8 kV circuit spacing at the intersection of Bridge St W and University Ave E in Waterloo. The conductor spacing was improved shortly after the outage event

2013 presented a clear increase in the number of logged weather events.

Two ice storms and a wind storm created major events in 2013 where the storms contributed 24,960,714 C.O.M. or 85% of the annual C.O.M.

April 11	Ice Storm	15,118,646 C.O.M.	multiple feeders
July 19	Wind Storm	2,853,617 C.O.M.	multiple feeders
December 22	Ice Storm	6,988,451 C.O.M.	multiple feeders

When a third party supply source is lost during a storm, for example a Hydro One transmission line source, that portion of the outage is logged as Loss of Supply.

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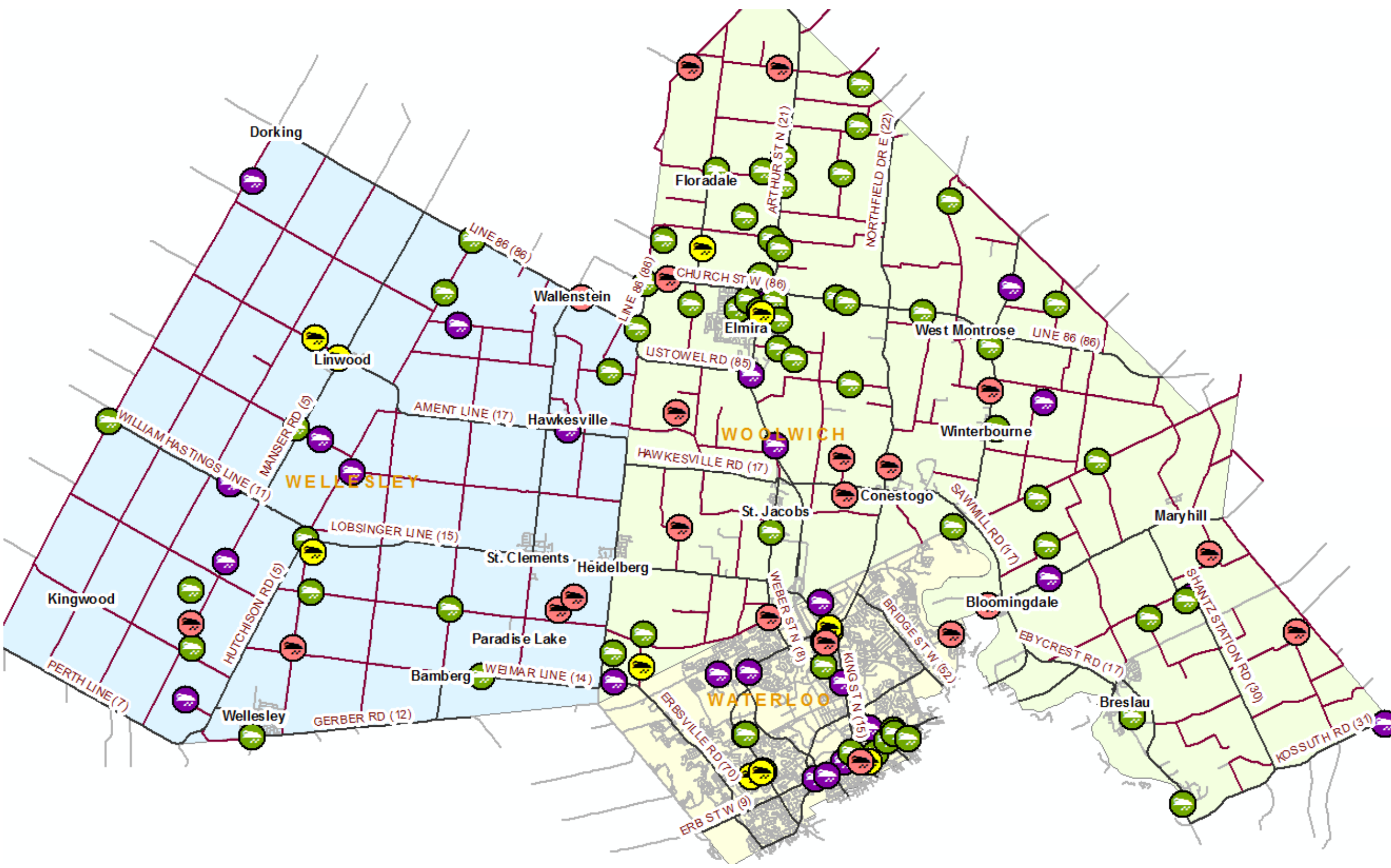


Code 7 – Adverse Environment

In 2014, two sustained interruptions were logged as Adverse Environment and resulted in 1,752 C.O.M.

A barn fire on June 17, 2014 at 1045 Benjamin Road in Waterloo and a house fire on May 18, 2014 at 93 Marshall Street in Waterloo.

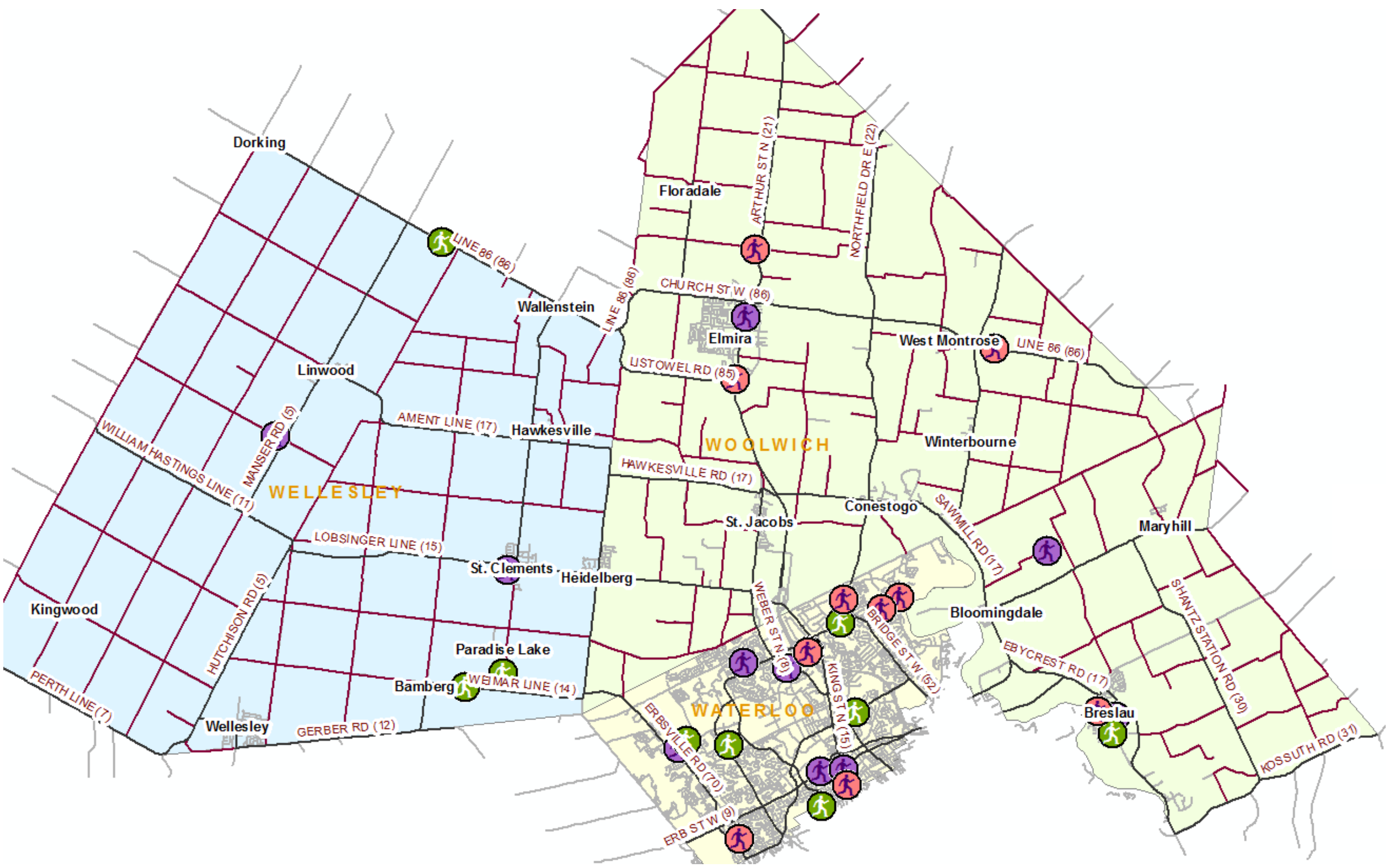
Code 8 – Human Element

2014 Human Element caused outages measures at 14,925 C.O.M. over 11 events.

The largest 2014 Human Element Outage was on June 17, 2014 when a switching error was made. The Control Room authorized load re-routing via a path that was not energized. This increased the overall outage by 6,664 C.O.M.

The incident was reviewed at an Operator's Meeting for the learning opportunity.

2013 Human Element caused outages increased significantly from 2012 to 177,933 C.O.M. over 14 events.



Code 9 – Foreign Interference

In 2014, Foreign Interference events were dominated by:
79 Animal related … 18 Motor Vehicle Accidents … 3 Dig Ins

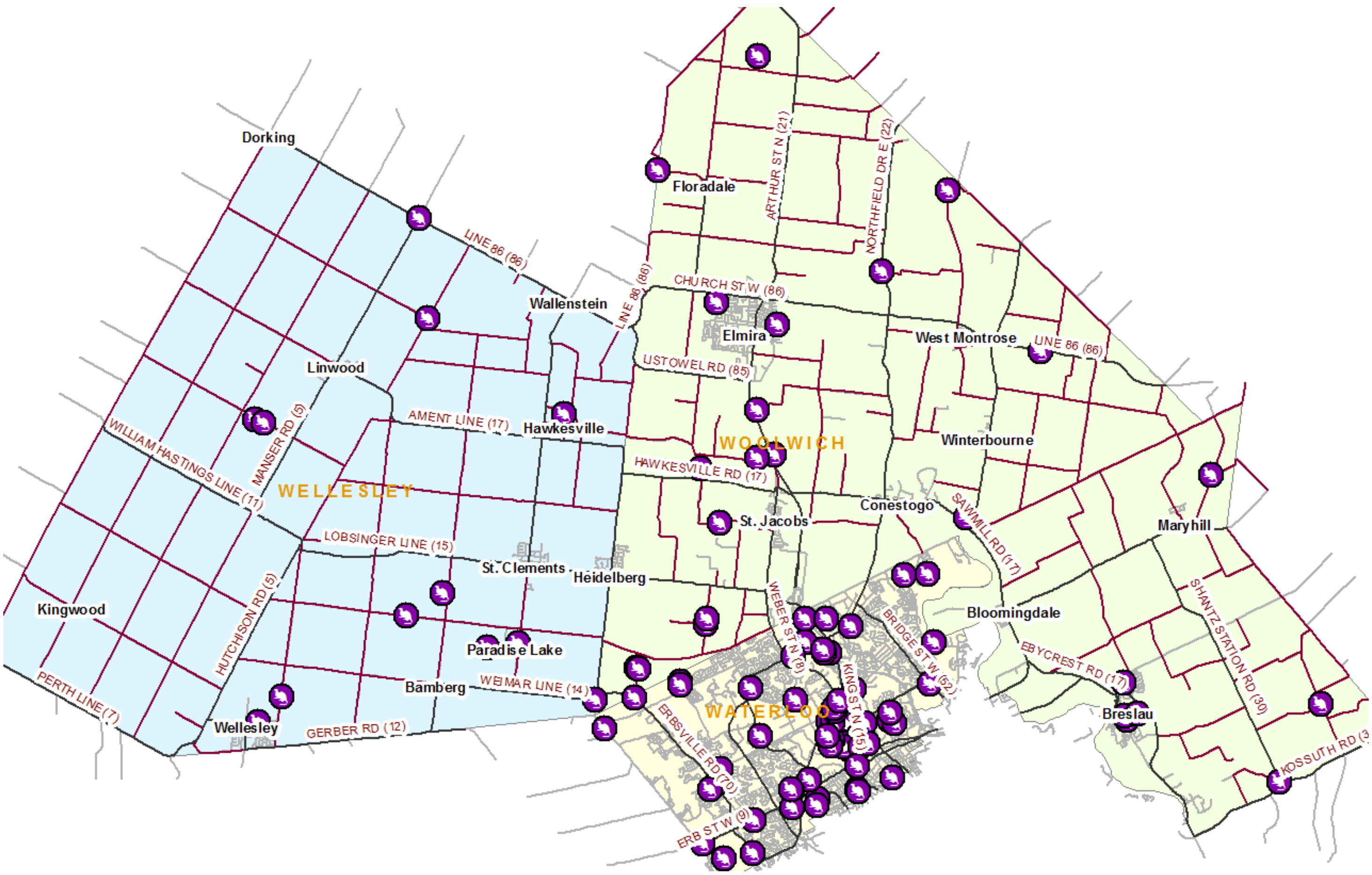
In 2013, plagued by Adverse Weather, the Foreign Interference contribution is 1% of the actual sustained outages and 8% of the normalized sustained outages a shown on page 4.

In 2013 the 89 Foreign Interference events were dominated by:
64 Animal related … 19 Motor Vehicle Accidents … 3 Dig Ins

In 2012 the 99 Foreign Interference events were dominated by:
72 Animal related…23 Motor Vehicle Accidents…3 Dig Ins.

This cross section is typical back to 2010.

Foreign Interference Sustained Interruptions are scattered throughout WNH's territory with no alarming patterns present.



Momentary Interruptions

Historical Comparison based on Count

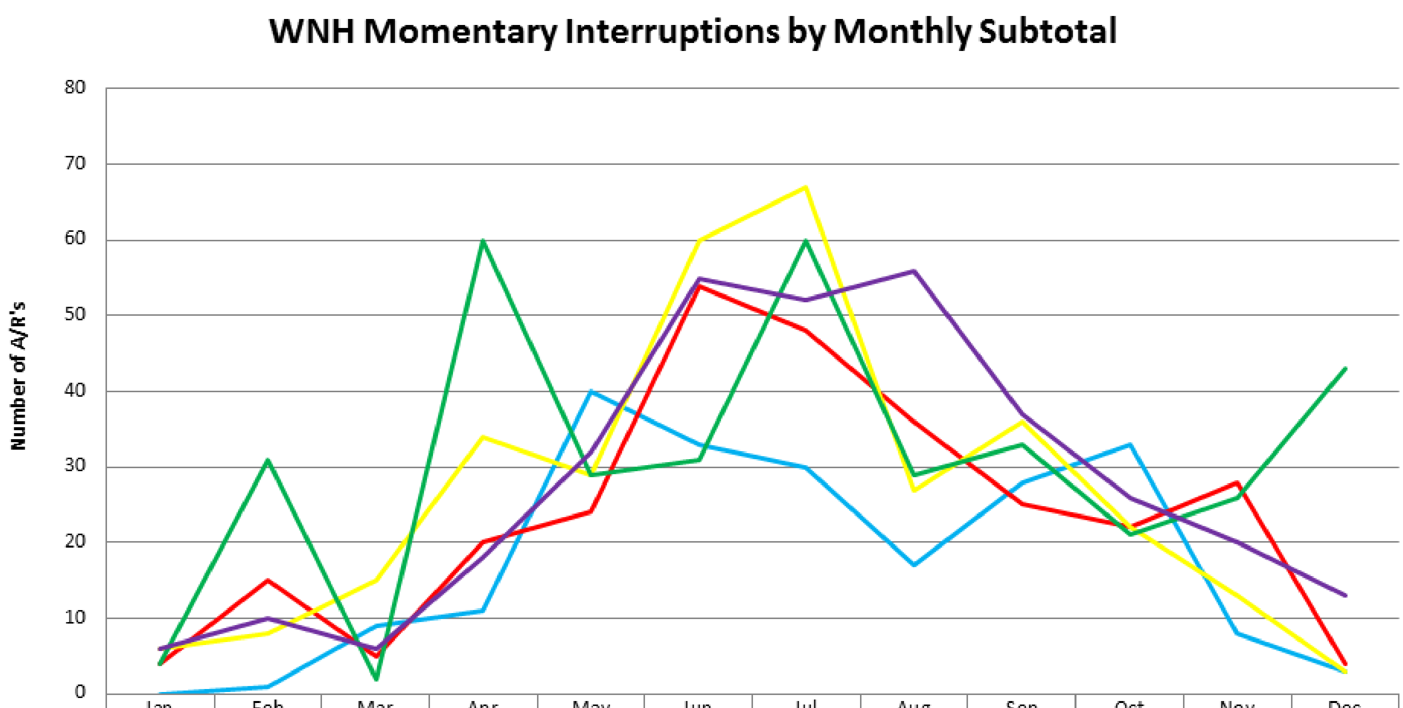
In 2014 a more traditional annual trend of momentary interruptions was logged whereby May through September peaked in the summer months.

However, with the absence of any severe weather related outages in 2014 the annual total is higher than desired. We will continue to focus on system hardening and proactive feeder patrolling to identify deficiencies.

2013 exhibited a clear peak in the number of Auto Recloses in the major event months of April, July and December. In particular April and December are outliers due to the Ice Storm activity. Of the 31 A/R’s in February 2013, 25 of them were due to a winter storm day on February 27, 2013 were high winds and heavy wet snow were the cause. WNH feeder patrols were completed for feeders R26-1 and R26-2 which experienced the most A/R's through the storm’s duration. The need for tree trimming was identified at one location and trimmed, and two blown arrestor's were identified and repaired.

A five year annual history of momentary interruptions is summarized here:

- **2014 = 331**
- 2013 = 369
- 2012 = 320
- 2011 = 285
- 2010 = 213



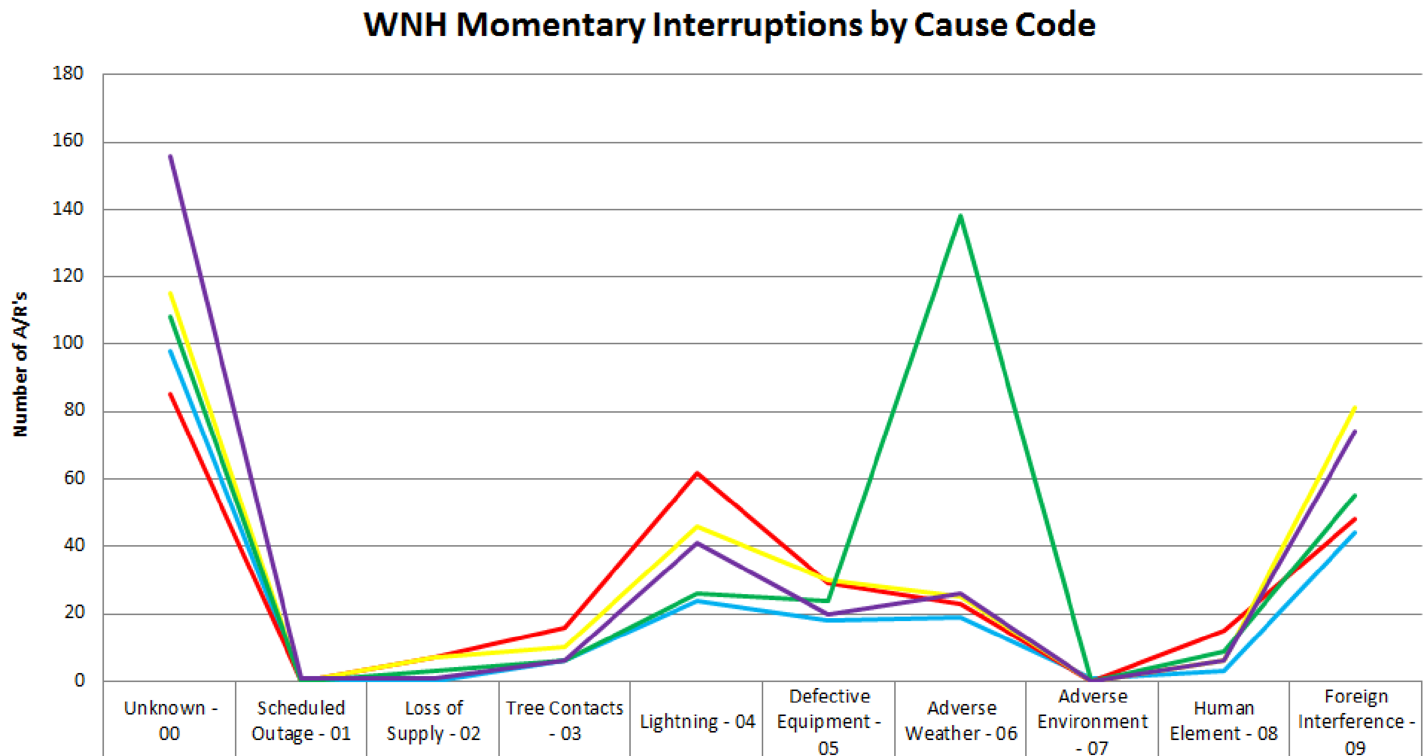
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2010	0	1	9	11	40	33	30	17	28	33	8	3
2011	4	15	5	20	24	54	48	36	25	22	28	4
2012	6	8	15	34	29	60	67	27	36	22	13	3
2013	4	31	2	60	29	31	60	29	33	21	26	43
2014	6	10	6	18	32	55	52	56	37	26	20	13

Historical Comparison based on Cause Code

The outlier for 2014 momentary interruptions is cause unknown where 156 or 47% of the 331 annual momentary interruptions were logged as such.

System faults are often transient and therefore outages that are logged with an unknown cause may be valid. Nonetheless, the WNH Control Room will increase effort to determine root cause analysis and accurate logging thereafter.

Additionally, because cause unknown is the predominant cause over five years, more effort will be extended to leverage Faulted Circuit Indicators to narrow down feeder segments that are problematic or trending poorly.



	Unknown - 00	Scheduled Outage - 01	Loss of Supply - 02	Tree Contacts - 03	Lightning - 04	Defective Equipment - 05	Adverse Weather - 06	Adverse Environment - 07	Human Element - 08	Foreign Interference - 09
2010	98	0	0	6	24	18	19	1	3	44
2011	85	0	7	16	62	29	23	0	15	48
2012	115	0	7	10	46	30	25	0	6	81
2013	108	0	3	6	26	24	138	0	9	55
2014	156	1	1	6	41	20	26	0	6	74

Momentary Interruptions - Top Contributing Feeders

2011			2012			2013			2014		
Feeder	# A/Rs	Comments	Feeder	# A/Rs	Comments	Feeder	# A/Rs	Comments	Feeder	# A/Rs	Comments
ER46	14	3 Unknowns	HS17	20	Northlake	3F63	21	2 Unknowns, 11 weather	3F68	16	2 Unknowns, 11 Foreign Int, 4 Weather
OR-27-3327	14		ER42	15	Cap bank rebuilt	3F68	17	3 Unknowns, 10 weather	ER42	16	8 Unknowns, 8 Foreign Int
R34-1	13		HS22	15	6 Unknowns	R28-1	17	1 Unknown, 16 weather	HS24	14	8 Unknowns, 4 Foreign Int, 1 Def Equip.
HS27	11	10 Unknowns	HS24	13	5 Unknowns, animals	ER42	15	5 Unknowns, 3 weather, 7 Foreign Int	HS29	14	8 Unknowns, 5 Foreign Int, 1 Def Equip
R30-1	11		HS26	13	1 Unknown, 9 one day storm	R30-3	15	5 Unknowns, 2 weather, 2 tree	3F63	13	3 Unknowns, 1 Foreign Int, 7 Weather
3F68	10	2 Unknowns	ER46	12	6 Unknowns, animals, storms	HS23	13	1 Unknown, 4 weather, 3 Foreign Int	ER45	13	3 Unknowns, 9 Foreign Int, 1 Def Equip.
HS25	10		HS27	12	11 Unknowns	R30-1	13	2 Unknowns, 6 weather	HS30	13	8 Unknowns, 3 Foreign Int, 2 Weather
HS23	9		R34-1	12	1 Unknown, Storm, Trees	33M1	12	1 Unknown, 7 weather	R31-3	11	3 Unknowns, 5 Weather, 3 Human Element
HS26	9		3F51	11	8 Unknowns	3F61	12	1 Unknown, 6 weather	HS27	10	4 Unknowns, 2 Foreign Int, 4 Def Equip
HS29	9		3F68	11	large feeder	HS22	12	6 Unknowns, 2 weather, 4 Foreign Int	HS22	9	6 Unkowns, 2 Foreign Int, 1 Weather
	110			134			147			129	

From 2014 Momentary Interruptions

It was identified early in 2014 that feeder HS29 and HS30 were trending poorly.

HS29 was patrolled in July 2014. Tree trimming was completed. Eventually a distribution transformer failed and was replaced. HS29 is expected to perform better in 2015.

HS30 was patrolled in August 2014. 34 locations were identified as needing animal guarding. 5 locations were identified as needing tree trimming.

ER42 persists as a worst performing feeder. The Control Room will propose moving some load off this feeder to adjacent feeder(s), installing EVR's and/or installing additional faulted circuit indicators.

The linear exposure of 3F68 was reduced by moving the tie point from being at the DS26 Wellesley Substation to (the east) on Greewoodhill Road, Wellesley (EVR-27-4886). This reduced the circuit length of 3F68 by approximately 17km, now 92km versus 109km. This reduced the 3F68 customer count from 3,200 customer's to 2,500 customer's.

From 2013 Momentary Interruptions

HS26, ER46 and HS27 are no longer in the top ten worst performing list.

3F68 was targeted as a repeat worst performer. With 109 km of linear exposure, 3F68 will be prioritized for the installation of SCADA controlled EVR's at the midpoint and at multiple tie points to adjacent feeders.

ER42 persists with high quantities of Unknown and Foreign Interference caused momentary interruptions.

HS22 measured again with a high number of Unknown's. This feeder was patrolled in early 2014 and 9 transformer locations were identified as needing animal guarding.

Both ER42 and HS22 had Faulted Circuit Indicators installed at sectionalizing devices in December 2013. We will leverage the use of these tools to identify problem areas.

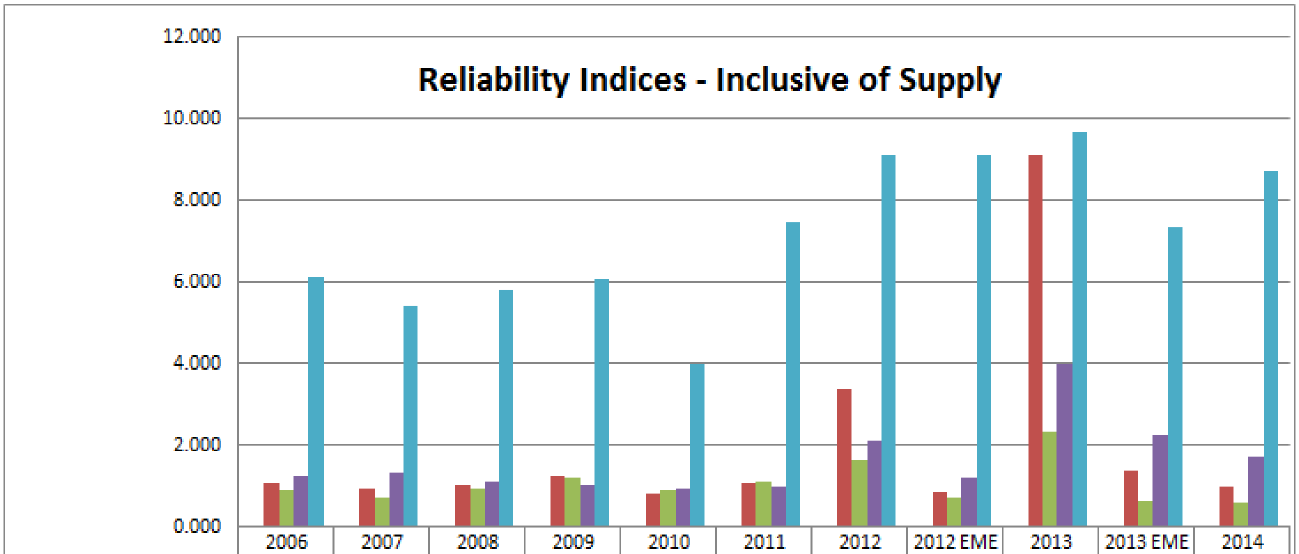
From 2012 Momentary Interruptions

Feeder's HS26, ER46 and HS27 were trending poorly and identified as needing improvement. HS26 at that time was impacting customer Safety Kleen.

HS26 was patrolled and a number of treed locations were trimmed. As well, WNH initiated repair on a customer owned primary connection to WNH system. ER46 and HS27 were patrolled in August 2013 whereby tree trimming occurred and animal guarding was installed in suspect areas.

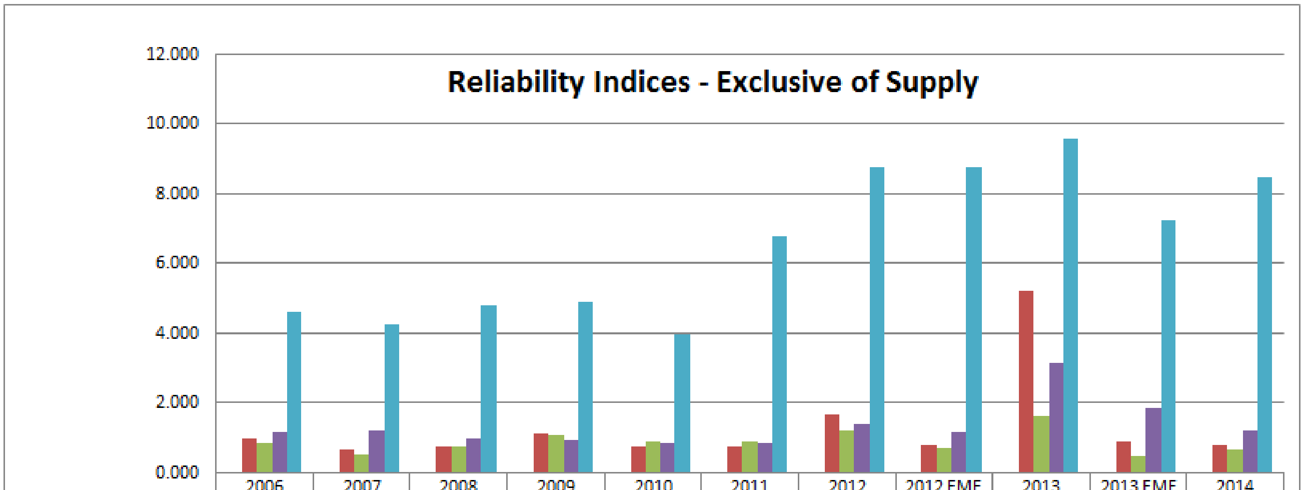
Annual Reliability Indices

Including Loss of Supply



	2006	2007	2008	2009	2010	2011	2012	2012 EME	2013	2013 EME	2014
Inclusive of Supply											
SAIDI	1.05	0.90	1.00	1.22	0.80	1.06	3.37	0.82	9.13	1.36	0.97
CAIDI	0.86	0.69	0.92	1.19	0.87	1.11	1.60	0.69	2.30	0.61	0.56
SAIFI	1.23	1.30	1.09	1.02	0.91	0.96	2.10	1.18	3.97	2.23	1.71
SAARI	6.10	5.40	5.81	6.05	3.99	7.46	9.14	9.14	9.67	7.31	8.73

Excluding Loss of Supply



	2006	2007	2008	2009	2010	2011	2012	2012 EME	2013	2013 EME	2014
Exclusive of Supply											
SAIDI	0.98	0.65	0.75	1.11	0.76	0.75	1.66	0.79	5.19	0.88	0.81
CAIDI	0.85	0.53	0.76	1.08	0.89	0.88	1.19	0.69	1.64	0.47	0.67
SAIFI	1.15	1.23	0.99	0.94	0.85	0.85	1.39	1.16	3.16	1.86	1.21
SAARI	4.60	4.26	4.81	4.89	3.99	6.77	8.75	8.75	9.59	7.24	8.47

SAIDI = System Average Interruption Duration Index (Hours)
CAIDI = Customer Average Interruption Duration Index (Hours)
SAIFI = System Average Interruption Frequency Index (Instances)
SAARI = System Average AutoReclose Index (Instances). Also known as SAIFI MI (Momentary Interruption)

Summary of Recommendations

From 2014 Outage Information

Patrol Feeder ER42 – Review feeder arrangement. Review need for additional FCI's. Review need for EVR's.

Patrol Feeder HS22 – Identify and repair deficiencies. Patrol complete. Repairs pending.

Patrol Feeder HS30 – Identify and repair deficiencies. Patrol complete. Repairs pending.

Patrol Feeder HS29 – Identify and repair deficiencies. Patrol complete. Repairs pending.

Install Outage Management System in Control Room. Pending

Improve SCADA alarming convention including reduction of nuisance alarms for maintenance. Pending.

From 2013 Outage Information

Feeder 3F68 - Sectionalize with EVR's – complete in 2014 Q4

Patrol Feeder ER42 – Repair deficiencies - pending

Patrol Feeder HS22 – Repair deficiencies – field patrol complete - deficiency repairs ongoing.

Identify 2014 Risk, windows of vulnerability with WNH and Hydro One Station Maintenance - ongoing

Identify 2014 next steps for improved or continued storm restoration efforts – ongoing

Identify and budget for Outage Management System considering Work Force Management modules - complete

Improve SCADA alarming convention including reduction of nuisance alarms for maintenance - pending

From 2012 Outage Information

Feeder 3F68 - Sectionalize with EVR's – complete 2014 Q4

Feeder HS27 – Feeder Patrol – clean up any suspect equipment - complete

Feeder ER46 – Feeder Patrol – clean up any suspect equipment - complete

Fault Indicators – Leverage fault indication in areas where Defective Equipment Outages are concentrated - complete

Animal Guarding – Patrol area where foreign interference/Animal is concentrated – complete on HS26

Increase awareness and enforcement of minimizing Operational Risk. For example, the duration of Transformer Station outages. Or the time lapses after job completion to full restoration (distribution system switching) – complete and ongoing

Appendix G: Material Capital Project Summaries

Waterloo North Hydro Inc.

2016 Capital Project Summary Index

2016 Capital Project Summary

GENERAL INFORMATION ON THE PROJECT/ACTIVITY (5.4.5.2.A)

Project Name: Light Rail Transit Relocations

Investment Category: System Access

Project Description: This category represents capital expenditures required to comply with statutory obligations related to the relocation of overhead and underground facilities installed within municipal road allowances to facilitate the new Light Rail Transit system in the Region of Waterloo (Region).

Detailed Listing of Affected Line Sections: The following line sections are covered by this project category:

WNH Project	Sub Project	Project Name	Total
06EN08	16	2016 - LRT - University Ave. Spur- Westmount Rd.	$245,642
06EN08	17	2016 - LRT - Spur - Seagram Dr.	$124,369
06EN08	18	2016 - LRT - King St. - Conestoga Mall	$71,786
06EN08	19	2016 - LRT - 27.6 kV - King St.- Northfield Dr.	$221,444
06EN08	20	2016 - LRT - 13.8 kV - King St.- Northfield Dr.	$221,444
06EN08	21	2016 - LRT - 13.8 kV - King St.- Conestogo Rd.	$195,059
06EN08	23	2016 - LRT - Spur - Weber St.	$129,538
06EN08	24	2016 - LRT - 13.8 kV - Northfield Dr. - Conestogo Rd.	$460,277
06EN08	27	2016 - LRT - Spur - Kumpf Dr.	$222,154
06EN08	29	2016 - LRT - Spur - Quiet Pl.	$202,079
		Total	$ 2,093,792

Capital Investment (5.4.5.2.A.first bullet)

Gross Capital	$2,093,792
Customer Contribution	$899,385
Net Capital	$1,194,407
O&M Costs (if applicable)	$0.00 (not applicable)

Customer Attachments/Load (kVA) (5.4.5.2.A.second bullet): Approximately 25% of the customers in the City of Waterloo are supplied by the affected circuits

Project Timing (5.4.5.2.A.third bullet)

Start Date: January 2, 2016

This is a multi-year project with the above sections going into service in 2016

Expected In-Service Date: December 30, 2016

Expenditure Timing:

Q1:	20%	$ 418,758
Q2:	30%	$ 628,138
Q3:	30%	$ 628,138
Q4:	20%	$ 418,758

Risk and Risk Mitigation (5.4.5.2.A.fourth bullet): The timing of this project is not dictated by WNH. Close coordination is required between the two local municipalities, the LRT general contractor and their subcontractors as well as all other utilities. Regular progress meetings have been taking place since 2014 which helps WNH anticipate project timing and allows to plan this work amongst WNH driven projects.

Comparative Information (5.4.5.2.A.fifth bullet): This is a special one-off project for the Region of Waterloo and has no previous comparator projects.

Total Capital & OM&A Costs Associated with REG Investments (5.4.5.2.A.sixth bullet): Not Applicable

Leave to Construct Approval (5.4.5.2.A.seventh bullet): Not Applicable

EVALUATION CRITERIA AND INFORMATION REQUIREMENTS (5.4.5.2.B)

Evaluation Criteria and information requirements (5.4.5.2.B)

Efficiency, Customer Value, Reliability (5.4.5.2.B.1)

Main Driver (5.4.5.2.B.1.a)	These projects are mandatory. Scope and timelines are dictated by the Region and must closely coordinate with a number of stakeholders.
Related Objectives / Performance Targets	WNH Strategic Imperative 3 as identified in Exhibit 1
Source and Nature of the Information Used to Justify the Investment	Request from the Region of Waterloo as the local road authority under the authority of the Public Service Works on Highways Act, R.S.O. 1990, CHAPTER P.49
Secondary Driver (5.4.5.2.B.1.a)	Approximately 20% of the work involves assets that are near end of life.
Related Objectives / Performance Targets	WNH Strategic Imperatives 1 & 2 as identified in Exhibit 1
Source and Nature of the Information Used to Justify the Investment	Field inspections and asset condition data.
Investment Priority (5.4.5.2.B.1.b)	The relocation of electrical distribution infrastructure is integral to the timing and success of the LRT project. These projects are mandatory and become top priority when requested by the municipality.

Analysis of the Project and Project Alternatives (5.4.5.2.B.1.c)

Effect on system operation efficiency and cost effectiveness	A project of this size and nature will have temporary impacts on the distribution system by constraining circuit configurations during construction. There are no expected long term impacts.
Net benefits accruing to customers	Not Applicable
Impact on reliability performance (including on the frequency and duration of outages)	Not Applicable

Project Alternatives

The relocation of distribution assets is mandatory and is based on the proposed road design. WNH provides input to the road authority (or their agents) on the most economical alternatives for distribution asset relocation, but ultimately the road authority must make the final determination based on the impact to the road design and other road allowance users. Hence, WNH is not in control of project outcomes or alternatives selected.

Safety (5.4.5.2.B.2)

The location of WNH's electrical distribution is being relocated away from overhead LRT power lines to respect the need for safe clearances.

Cyber-security, Privacy (5.4.5.2.B.3)

Not Applicable

Co-ordination, Interoperability (5.4.5.2.B.4)

Co-ordination with utilities, regional planning and/or links with 3rd party providers and/or industry (5.4.5.2.B.4.a)

Coordination with the Region, their agents, contractors, subcontractors and other utilities is on-going throughout the year, which helps with respect to road relocation project coordination. WNH works closely with parties involved providing input on project alternatives in order to minimize costs.

Enabling of future technological functionality or addressing of future operational requirements (5.4.5.2.B.4.b)

During construction of new distribution assets, WNH ensures that there is enough structural capacity to provide for future needs such as additional circuits, third party attachment space, and Distribution Automation.

Economic Development (5.4.5.2.B.5)

Waterloo North Hydro's investment in this project supports the development of rapid transit within the Region of Waterloo and supplements the investments made by provincial and region government in this project. Rapid transit will move people, limit urban sprawl, protect farmland and shape our community. Over the next 20 years, the Province of Ontario expects 200,000 new residents to move to the Region of Waterloo.
Rapid transit will help manage this growth and safeguard our countryside by preventing urban sprawl and promoting intensification in existing urban areas. This will help protect the region's precious agricultural lands, natural beauty, heritage and cultural characteristics that make this community unique.

Environmental Benefits (5.4.5.2.B.6)

Not Applicable

Category-specific requirements - System Access (5.4.5.2.C.a.)

SYSTEM ACCESS SPECIFIC REQUIREMENTS (5.4.5.2.C.a)

Factors Affecting Project Timing/Priority (5.4.5.2.C.a. first bullet)

The timing of individual projects is based on scheduling provided by the road authority or their agents. WNH has been and will continue to work closely with all stakeholders via regular progress meetings that have started in 2014 to ensure sufficient notice is provided to WNH and work is completed in a timeframe required by the road authority.

Factors Relating to Customer Preference or 3rd Party Input (5.4.5.2.C.a. second bullet)

WNH works closely with the road authority and their agents to ensure the relocation of distribution assets is acceptable. All local utilities (communication companies, gas, water, sewer, etc.) work together to minimize costs and disruption, both in design and construction.

Factors Affecting Final Project Costs (5.4.5.2.C.a. third bullet)

Factors affecting the cost of road relocation projects include the length of relocation required, unexpected subsurface conditions and level of traffic management needed during construction. Over and above these typical factors, the LRT project may have additional coordination requirements with a multitude of contractors at multiple locations simultaneously, which may require several mobilizations to the same work site and/or work to be completed outside normal business hours.

Controllable Cost Minimization (5.4.5.2.C.a. fourth bullet)

Costs are minimized through effective coordinated design and construction scheduling or work. Where applicable, WNH takes advantage of LRT contractors to save costs on civil work.

WNH also negotiated cost recovery terms above and beyond the stipulated formula in the Public Service Works on Highways Act (PSWHA) , R.S.O. 1990, CHAPTER P.49. WNH is expected to recover approximately 60% of the over all costs for the entire project as compared to approximately 30% under PSWHA.

Other Planning Objectives Met (5.4.5.2.C.a. fifth bullet)

Other planning objectives being considered during this road relocation include higher poles in some locations to address new framing standards and future circuits. Also the installation of additional ductwork for future underground circuits while the roadways are being excavated.

Technically Feasible Project Options (5.4.5.2.C.a. sixth bullet)

Feasible options have been and continue to be discussed with the Region of Waterloo, consultants and other stakeholders as the LRT project develops. First and foremost, opportunities to avoid relocations were identified. Secondly, where relocations must occur due to conflicts, WNH has worked with stakeholders to minimize the extent and cost of relocations.

Summary of Options Analysis (5.4.5.2.C.a. seventh bullet)

Due to the nature of the LRT projects (high volume of work over a very short period of time, in tight coordination with a multitude of stakeholders), the available technical options are substantially limited.

Results of the 'Final Economic Evaluation (5.4.5.2.C.a. eighth bullet)

The Economic Evaluation is not applicable. WNH negotiated cost recovery terms above and beyond the stipulated formula in the Public Service Works on Highways Act (PSWHA) , R.S.O. 1990, CHAPTER P.49. WNH is expected to recover approximately 60% of the over all costs for the entire project as compared to approximately 30% under PSWHA.

Nature and Magnitude of System Impacts, Costs and Cost Recovery (5.4.5.2.C.a. ninth bullet)

A project of this size and nature will have temporary impacts on the distribution system by constraining circuit configurations during construction. There are no expected long term impacts.

WNH has negotiated cost recovery terms above and beyond the stipulated formula in the Public Service Works on Highways Act (PSWHA) , R.S.O. 1990, CHAPTER P.49. Cost recovery varies with the nature of specific relocation work and can vary between 25% and 100%. WNH is expected to recover approximately 60% of the over all costs for the entire project as compared to approximately 30% under PSWHA. In 2016 WNH is expected to recover approximately 43 % of the planned work.

2016 Capital Project Summary

GENERAL INFORMATION ON THE PROJECT/ACTIVITY (5.4.5.2.A)

Project Name Road Relocations

Investment Category System Access

Project Description This category represents capital expenditures required to comply with statutory obligations related to the relocation of overhead and underground facilities installed within municipal or provincial road allowances. Based on a legislated cost sharing formula, road authority contributes 50% of labour and labour saving devices. Where the road authority directs WNH to replace aged overhead plant with underground, the road authority funds the cost differential between overhead and underground systems.

Detailed Listing of Affected Line Sections The following line sections are covered by this project category:

WNH Project	Sub Project	Project Name	Total
06EN05	1	Bridgeport Rd/Caroline St, King St to Erb St	$237,956
06EN05	7	University Ave, Keats Way to Erb St	$18,118
06EN05	8	Westmount Rd, John St to Erb St	$96,997
06EN05	17	Sawmill Rd, River St to Snyder's Flat's Rd, Bloomingdale	$90,228
06EN05	25	Hutchinson Rd - Through Crosshill	$179,643
06EN08	22	Erb St. - HONI to Costco	$286,095
		Total	$ 909,037

Capital Investment (5.4.5.2.A.first bullet)

Gross Capital	$909,037
Customer Contribution	$181,285
Net Capital	$727,752
O&M Costs (if applicable)	$0.00 (not applicable)

Customer Attachments/Load (kVA) (5.4.5.2.A.second bullet)

Customer Attachments (#): 359
Customer Load (peak KVA) 4,501

Project Timing (5.4.5.2.A.third bullet)

Start Date January 2, 2016

Expected In-Service Date December 30, 2016

Expenditure Timing:

Q1:	20%	$ 181,807
Q2:	30%	$ 272,711
Q3:	30%	$ 272,711
Q4:	20%	$ 181,807

Risk and Risk Mitigation (5.4.5.2.A.fourth bullet) The timing of this project is dictated by the road authority and not dictated by WNH. Close coordination is required between the local, regional, and provincial authorities. Regular progress meetings take place which helps WNH anticipate project timing and allows planning of this work amongst WNH driven projects.

Comparative Information (5.4.5.2.A.fifth bullet)

Comparable investments in previous years are as follows:

2011:	$481,210
2012:	$165,369
2013:	$2,052,912
2014:	$801,705
2015:	$2,913,167

Total Capital & OM&A Costs Associated with REG Investments (5.4.5.2.A.sixth bullet) Not Applicable

Leave to Construct Approval (5.4.5.2.A.seventh bullet) Not Applicable

Evaluation Criteria and information requirements (5.4.5.2.B)

EVALUATION CRITERIA AND INFORMATION REQUIREMENTS (5.4.5.2.B)

Efficiency, Customer Value, Reliability (5.4.5.2.B.1)

Main Driver (5.4.5.2.B.1.a)	These projects are mandatory. Scope and timelines are dictated by the road authority.
Related Objectives / Performance Targets	WNH Strategic Imperative 3 as identified in Exhibit 1
Source and Nature of the Information Used to Justify the Investment	Request from the road authority under the Public Service Works on Highways Act, R.S.O. 1990, CHAPTER P.49
Secondary Driver (5.4.5.2.B.1.a)	Not Applicable
Related Objectives / Performance Targets	Not Applicable
Source and Nature of the Information Used to Justify the Investment	Not Applicable
Investment Priority (5.4.5.2.B.1.b)	These projects are mandatory and become top priority when requested by the road authority.

Analysis of the Project and Project Alternatives (5.4.5.2.B.1.c)

Effect on system operation efficiency and cost effectiveness	Not Applicable
Net benefits accruing to customers	Not Applicable
Impact on reliability performance (including on the frequency and duration of outages)	Not Applicable

Project Alternatives

The relocation of distribution assets is mandatory and is based on the proposed road design. WNH provides input to the road authority (or their agents) on the most economical alternatives for distribution asset relocation, but ultimately the road authority must make the final determination based on the impact to the road design and other road allowance users. Hence, WNH is not in control of project outcomes or alternatives selected.

Safety (5.4.5.2.B.2)

The intention of these types of projects are not to address safety concerns, although at times end of life assets are replaced which may involve elimination of safety hazards.

Cyber-security, Privacy (5.4.5.2.B.3)

Not Applicable

Co-ordination, Interoperability (5.4.5.2.B.4)

Co-ordination with utilities, regional planning and/or links with 3rd party providers and/or industry (5.4.5.2.B.4.a)

Coordination with the road authorities, their agents, contractors, subcontractors and other utilities is on-going throughout the year, which helps with respect to road relocation project coordination. WNH works closely with parties involved providing input on project alternatives in order to minimize costs.

Enabling of future technological functionality or addressing of future operational requirements (5.4.5.2.B.4.b)

During construction of new distribution assets, WNH ensures that there is enough structural capacity to provide for future needs such as additional circuits, third party attachment space, and Distribution Automation.

Economic Development (5.4.5.2.B.5)

Waterloo North Hydro's investment in this project supports the development goals set by the local municipalities and is critical to the success of the communities we serve.

Environmental Benefits (5.4.5.2.B.6)

Not Applicable

Category-specific requirements - System Access (5.4.5.2.C.a.)

SYSTEM ACCESS SPECIFIC REQUIREMENTS (5.4.5.2.C.a)

Factors Affecting Project Timing/Priority (5.4.5.2.C.a. first bullet)

The timing of individual projects is based on scheduling provided by the road authority or their agents. WNH works closely with all stakeholders via regular progress meetings to ensure sufficient notice is provided to WNH and work is completed in a timeframe required by the road authority.

Factors Relating to Customer Preference or 3rd Party Input (5.4.5.2.C.a. second bullet)

WNH works closely with the road authority and their agents to ensure the relocation of distribution assets is acceptable. All local utilities (communication companies, gas, water, sewer, etc.) work together to minimize costs and disruption, both in design and construction.

Factors Affecting Final Project Costs (5.4.5.2.C.a. third bullet)

Factors affecting the cost of road relocation projects include the length of relocation required, unexpected subsurface conditions and level of traffic management needed during construction, which are not known until the road authority completes their design. Cost sharing for these projects is as per the stipulated formula in the Public Service Works on Highways Act (PSWHA) , R.S.O. 1990, CHAPTER P.49, except where change of infrastructure is requested from overhead to underground. Under those circumstances, WNH recovers the cost according to the terms defined in our Conditions of Service.

Controllable Cost Minimization (5.4.5.2.C.a. fourth bullet)

Costs are minimized through effective coordinated design and construction scheduling or work. Cost sharing for these projects is as per the stipulated formula in the Public Service Works on Highways Act (PSWHA) , R.S.O. 1990, CHAPTER P.49, except where change of infrastructure is requested from overhead to underground. Under those circumstances, WNH recovers the cost according to the terms defined in our Conditions of Service.

Other Planning Objectives Met (5.4.5.2.C.a. fifth bullet)

Other planning objectives being considered during this road relocation include higher poles in some locations to address new framing standards and future circuits. WNH may also be able to change the schedule of a renewal project to align with the road authority’s work to maximize these benefits. Also, the installation of additional ductwork for future underground circuits while the roadways are being excavated.

Technically Feasible Project Options (5.4.5.2.C.a. sixth bullet)

Feasible options are discussed with the road authority, their consultants and other stakeholders as the project develops. First and foremost, opportunities to avoid relocations are identified. Secondly, where relocations must occur due to conflicts, WNH works with stakeholders to minimize the extent and cost of relocations.

Summary of Options Analysis (5.4.5.2.C.a. seventh bullet)

Alternatives are considered, however, the analysis is completed on a project by project basis after the project is initiated by the road authority.

Results of the 'Final Economic Evaluation' (5.4.5.2.C.a. eighth bullet)

Not Applicable.

Nature and Magnitude of System Impacts, Costs and Cost Recovery (5.4.5.2.C.a. ninth bullet)

Typically, road relocation projects have minimal impact on the system. Costs for like-for-like relocations are recovered from road authorities according to the stipulated formula in the Public Service Works on Highways Act (PSWHA), R.S.O. 1990, CHAPTER P.49.

Capital contributions toward the cost of all customer demand projects and overhead to underground relocation projects are collected in accordance with the DSC and the provisions of WNH's Conditions of Service.

GENERAL INFORMATION ON THE PROJECT/ACTIVITY (5.4.5.2.A)

2016 Capital Project Summary

Project Name Customer Connections

Investment Category System Access

Project Description This category represents capital expenditures on the overhead and underground primary and secondary systems necessary to rehabilitate and/or expand infrastructure to service new customers or maintain existing customers.

Detailed Listing of Affected Line Sections The following individual projects are covered by this project category:

WNH Project	Sub Project	Project Name	Total
06EN04	4	Third Party Attachments	$14,084
06EN07	1	New Overhead Service Connections/Upgrades	$727,131
06EN11	1	New UG Service Connections/Upgrades	$1,429,245
11DG01	1	FIT Distributed Generator Connections	$46,516
11DG01	3	MicroFIT Distributed Generator Connections	$40,788
		Total	$ 2,257,764

Capital Investment (5.4.5.2.A.first bullet)

Gross Capital $2,257,764

Customer Contribution $854,362

Net Capital $1,403,402

O&M Costs (if applicable) $0.00 (not applicable)

Customer Attachments/Load (kVA) (5.4.5.2.A.second bullet)

Customer Attachments (#): various - driven by demand
Customer Load (peak KVA) various - driven by demand

Project Timing (5.4.5.2.A.third bullet)

Start Date January 2, 2016

Expected In-Service Date December 30, 2016

Expenditure Timing:

Q1:	25%	$	564,441
Q2:	25%	$	564,441
Q3:	25%	$	564,441
Q4:	25%	$	564,441

Risk and Risk Mitigation (5.4.5.2.A.fourth bullet) This work is very routine for WNH and is covered by well established processes both from design and construction perspectives which mitigates issues around timing related risk. As customer connections are very important to WNH, timelines are strictly monitored and enforced to ensure obligations set forth in the DSC are met and that customer satisfaction is maintained.

In WNH's service territory, many developers turned to brownfield re-development, especially in the neighbourhoods close to the two local universities as well as the Uptown core. Most of this re-development takes the form of a replacement of a handful of single family homes with high rise residential apartment units, which require significantly different electrical servicing (three phase) than single family dwellings (single phase). For these neighbourhoods, during the redevelopment period, the electrical system is severed in many places or configured out of normal mode, which leads to increased number of outages when connecting new customers or prolonged unplanned outages. To help mitigate this, WNH requires installation or provision for loops so that the system segregation is minimized, and with it outage requirements for connecting new development.

Comparative Information (5.4.5.2.A.fifth bullet)

Comparable investments in previous years are as follows:

2011:	$2,316,512
2012:	$2,382,786
2013:	$2,236,601
2014:	$2,372,048
2015:	$2,242,481

Total Capital & OM&A Costs Associated with REG Investments (5.4.5.2.A.sixth bullet) This project category includes connection of renewable energy resources. As can be seen from the table above, WNH is not experiencing a high volume of these types of projects. WNH's system is well prepared to accept this level of new generation connection requests and no system investments are expected to be required at this time.

The REG related costs indicated above (projects 11DG01) are related strictly to connection costs, which are fully recovered from the customer.

Leave to Construct Approval (5.4.5.2.A.seventh bullet) Not Applicable

Evaluation Criteria and information requirements (5.4.5.2.B)

EVALUATION CRITERIA AND INFORMATION REQUIREMENTS (5.4.5.2.B)

Efficiency, Customer Value, Reliability (5.4.5.2.B.1)

Main Driver (5.4.5.2.B.1.a)	These projects are mandatory. Scope and timelines are based on requirements put forth by customers and/or obligations set forth for connecting customers in the DSC.
Related Objectives / Performance Targets	WNH Strategic Imperative 3 as identified in Exhibit 1
Source and Nature of the Information Used to Justify the Investment	Request for service and obligations set forth in the DSC.
Secondary Driver (5.4.5.2.B.1.a)	Not Applicable
Related Objectives / Performance Targets	Not Applicable
Source and Nature of the Information Used to Justify the Investment	Not Applicable
Investment Priority (5.4.5.2.B.1.b)	Upgrading existing or installing new services are top priority. Planning and design of these projects is handled through engineering and is scheduled with crews when required by customers.

Analysis of the Project and Project Alternatives (5.4.5.2.B.1.c)

Effect on system operation efficiency and cost effectiveness	Not Applicable
Net benefits accruing to customers	Not Applicable
Impact on reliability performance (including on the frequency and duration of outages)	Not Applicable

Project Alternatives

Customer connection projects are driven by customer requests and the specific requirements of the customer. Design and methodology for such projects are standardized through WNH policies and practices and in line with WNH Conditions of Service. Alternatives are limited as servicing options are standardized, but if alternatives exist, they are normally the choice of the customer. For example, the decision between an overhead or underground service is that of the customer, unless municipality places development conditions requiring underground servicing.

Safety (5.4.5.2.B.2)

These projects are not intended to address any existing safety concerns. With respect to allowing communication companies to attach additional or larger cables to overhead poles, make ready activities, such as installation of additional guying, takes place to ensure no new safety concerns are created because of the new attachments.

Cyber-security, Privacy (5.4.5.2.B.3)

Not Applicable

Co-ordination, Interoperability (5.4.5.2.B.4)

Co-ordination with utilities, regional planning and/or links with 3rd party providers and/or industry (5.4.5.2.B.4.a)

WNH meets regularly with the area Utility Coordinating Council comprised of municipal and third party stakeholders. WNH exchanges project details with other stakeholders for mutual benefit. In some cases, communication companies have chosen to defer their projects by a year or two in order to take advantage of lesser make-ready costs when attaching to pole lines compliant with today's safety standards.

WNH also works very closely with the local municipalities to understand the municipal zoning and/or site plan requirements and their impact on WNH's standardized servicing options. WNH has developed a process through the City of Waterloo to communicate servicing requirements to developers in the very early design stages of site plan development, which ultimately leads to shortened review and approval processes at the City level as well as a smoother service connection process for developer.

Enabling of future technological functionality or addressing of future operational requirements (5.4.5.2.B.4.b)

Not Applicable

Economic Development (5.4.5.2.B.5)

Waterloo North Hydro's investment in this project supports the economic development goals of the local municipalities and is critical to the success of the municipalities we serve. New residents provide a base to attract larger economic development opportunities for the community.

Environmental Benefits (5.4.5.2.B.6)

Not Applicable

Category-specific requirements - System Access (5.4.5.2.C.a.)

SYSTEM ACCESS SPECIFIC REQUIREMENTS (5.4.5.2.C.a)

Factors Affecting Project Timing/Priority (5.4.5.2.C.a. first bullet)

The timing of individual projects is based on what is required by the customer. As explained above, this work is top priority.

Factors Relating to Customer Preference or 3rd Party Input (5.4.5.2.C.a. second bullet)

These projects are initiated by customers and are designed to meet the needs of the customer requirements.

Factors Affecting Final Project Costs (5.4.5.2.C.a. third bullet)

Main factors that affect final costs are size of service, type of service (overhead, underground), type of transformer required (overhead, padmounted, vault room), distance between demarcation point of WNH existing main distribution system and subsurface conditions. Final costs of individual projects cannot be determined until the specific requirements of the proposed work is shared with WNH. Charges to the customer are based on fixed and variable costs that are updated annually.

Controllable Cost Minimization (5.4.5.2.C.a. fourth bullet)

The design and connection of services is standardized and therefore costs are controlled through well established processes, the use of standard material, and the efficiencies established through WNH's experience in connecting such projects.

Other Planning Objectives Met (5.4.5.2.C.a. fifth bullet)

As described above, WNH ensures through planning and connection design requirements that electrical system segregation will be eliminated once all redevelopment of a particular street or neighbourhood is complete.

Technically Feasible Project Options (5.4.5.2.C.a. sixth bullet)

Customers have options with respect to servicing, however, feasible options must be reviewed on a project by project basis, which cannot start until each project is initiated.

Summary of Options Analysis (5.4.5.2.C.a. seventh bullet)

Alternatives are considered, however, the analysis is completed on a project by project basis after the project is initiated. As the expenditure is based on forecasted amounts, this section is not relevant until a project is started or scheduled. When these projects are initiated, they are prioritized based on DSC requirements and, with all things equal, on a queue basis, first in, first out as described in section 4.2.3.1 of the DSP.

Results of the Final Economic Evaluation (5.4.5.2.C.a. eighth bullet)

Not Applicable.

Nature and Magnitude of System Impacts, Costs and Cost Recovery (5.4.5.2.C.a. ninth bullet)

As described above, redevelopment in certain areas of WNH's service territory causes separation and segregation of the existing single phase distribution system while a three phase distribution system is being established. As sometimes it is not possible to provide a standard arrangement for the three phase distribution system until the entire street develops, supply security may be compromised in these neighbourhoods. This leads to system impacts such as increased frequency of planned outages to connect new development as well as increased risk of prolonged outages in case of unexpected failures. These system impacts are managed and minimized as much as possible through continual updates of the local system arrangement based on knowledge of the location and timing of the next new development connection.

GENERAL INFORMATION ON THE PROJECT/ACTIVITY (5.4.5.2.A)

2016 Capital Project Summary

Project Name Expansions (Subdivisions)

Investment Category System Access

Project Description This project category represents the capital work required to build and connect new subdivisions driven by developer demand. The expenditure represents all costs to expand WNH's main distribution system within the public right of way as well as electrical systems on private property up to the demarcation point (meter base).

Detailed Listing of Affected Line Sections The following individual projects are covered by this project category:

WNH Project	Sub Project	Project Name	Total
06EN10	16	Subdivisions - 200 lots	$593,795
		Total	$ 593,795

Capital Investment
(5.4.5.2.A.first bullet)

Gross Capital $593,795

Customer Contribution $316,126

Net Capital $277,669

O&M Costs (if applicable) $0.00 (not applicable)

Customer Attachments/Load (kVA)
(5.4.5.2.A.second bullet)

Customer Attachments (#): Information not available until time of work
Customer Load (peak KVA) Information not available until time of work

Project Timing
(5.4.5.2.A.third bullet)

Start Date January 2, 2016

Expected In-Service Date December 30, 2016

Expenditure Timing:

Q1:	10%	$ 59,380
Q2:	30%	$ 178,139
Q3:	30%	$ 178,139
Q4:	30%	$ 178,139

Risk and Risk Mitigation (5.4.5.2.A.fourth bullet) These projects are driven by developer demand and become top priority for WNH in compliance with obligations set forth in the DSC. A process for connecting new subdivisions is in place (originally developed when WNH was connecting 1500 lots per year), which aids in planning and coordinating the demand and helps mitigate risk around timing. The local municipalities strive to contain urban sprawl (and focus on re-development of existing neighbourhoods) which resulted in a drop in new subdivisions to approximately 200 lots per year. WNH can accommodate this level of expansions, even if it was all requested at the same time. To mitigate risks associated with material delivery, which sometimes can be as high as 6 months, inventory for underground rebuilds can be swapped for new subdivisions if necessary.

Comparative Information
(5.4.5.2.A.fifth bullet)

Comparable investments in previous years are as follows:

2011:	$1,009,825
2012:	$1,458,126
2013:	$833,390
2014:	$737,710
2015:	$386,520

Total Capital & OM&A Costs Associated with REG Investments (5.4.5.2.A.sixth bullet) Not Applicable

Leave to Construct Approval (5.4.5.2.A.seventh bullet) Not Applicable

Evaluation Criteria and information requirements (5.4.5.2.B)

EVALUATION CRITERIA AND INFORMATION REQUIREMENTS (5.4.5.2.B)

Efficiency, Customer Value, Reliability (5.4.5.2.B.1)

Main Driver (5.4.5.2.B.1.a)	These projects are mandatory. Scope and timelines are based on requirements put forth by customers and/or obligations set forth for connecting customers in the DSC.
Related Objectives / Performance Targets	WNH Strategic Imperative 3 as identified in Exhibit 1
Source and Nature of the Information Used to Justify the Investment	Request for service and obligations set forth in the DSC.
Secondary Driver (5.4.5.2.B.1.a)	Not Applicable
Related Objectives / Performance Targets	Not Applicable
Source and Nature of the Information Used to Justify the Investment	Not Applicable
Investment Priority (5.4.5.2.B.1.b)	These projects are mandatory and become top priority when brought forth to WNH. Scope and timelines are based on requirements put forth by customers and/or obligations set forth for connecting customers in the DSC.

Analysis of the Project and Project Alternatives (5.4.5.2.B.1.c)

Effect on system operation efficiency and cost effectiveness	Not Applicable
Net benefits accruing to customers	Not Applicable
Impact on reliability performance (including on the frequency and duration of outages)	Not Applicable

Project Alternatives

Subdivision projects are driven by developer requests. Design and methodology for such projects are standardized through WNH's policies and practices, although differs from project to project based on developer specific requirements. Alternatives cannot be considered until individual projects are brought forth.

Safety (5.4.5.2.B.2)

These projects are not intended to address any existing safety concerns.

Cyber-security, Privacy (5.4.5.2.B.3)

Not Applicable

Co-ordination, Interoperability (5.4.5.2.B.4)

Co-ordination with utilities, regional planning and/or links with 3rd party providers and/or industry (5.4.5.2.B.4.a)

New subdivision development is a very standardized process, both at WNH as well as local municipalities and other utilities. For new subdivisions, WNH plant has designated standard locations within the municipal right of ways, as do the other utilities. Through this standardization, coordination and joint use trenching opportunities are maximized. Differences in project requirements requested by developers are addressed with municipalities and other utilities via meetings, drawing exchange, and the Utilities Coordinating Council. WNH meets regularly with the area Utility Coordinating Council comprised of municipal and third party stakeholders. WNH exchanges project details with other stakeholders for mutual benefit and resolutions of any infrastructure conflicts that might arise.

Enabling of future technological functionality or addressing of future operational requirements (5.4.5.2.B.4.b)

Not Applicable

Economic Development (5.4.5.2.B.5)

Waterloo North Hydro's investment in this project supports the economic development goals of the local municipalities and is critical to the success of the municipalities we serve. New residents provide a base to attract larger economic development opportunities for the community.

Environmental Benefits (5.4.5.2.B.6)

Not Applicable

Category-specific requirements - System Access (5.4.5.2.C.a.)

SYSTEM ACCESS SPECIFIC REQUIREMENTS (5.4.5.2.C.a)

Factors Affecting Project Timing/Priority (5.4.5.2.C.a. first bullet)

The timing of individual projects is based on what is required by the developer. As explained above, this work is top priority.

Factors Relating to Customer Preference or 3rd Party Input (5.4.5.2.C.a. second bullet)

These projects are initiated by developers and are designed to meet the needs of the proposed development.

Factors Affecting Final Project Costs (5.4.5.2.C.a. third bullet)

Final costs of each subdivision cannot be determined until the project is brought forth to WNH. The conditions of the land being developed, the number of lots and type of residence being proposed are the largest factors that affect project costs. Cost recovery from the developer is governed by the economic evaluation process as prescribed in the DSC.

Controllable Cost Minimization (5.4.5.2.C.a. fourth bullet)

The design of subdivision projects is standardized and therefore costs are controlled through well established processes, the use of standard material, and the efficiencies established through WNH's experience in connecting such projects. The developer also has the right to contest various parts of the required work as provided for in the DSC.

Other Planning Objectives Met (5.4.5.2.C.a. fifth bullet)

As most new subdivisions are constructed in stages, WNH plans for and requires each developer to make provisions for servicing subsequent stages of development.

Technically Feasible Project Options (5.4.5.2.C.a. sixth bullet)

Feasible options must be reviewed on a project by project basis, which cannot start until each project is initiated.

Summary of Options Analysis (5.4.5.2.C.a. seventh bullet)

Alternatives are considered, however, the analysis is completed on a project by project basis after the project is initiated. As the expenditure is based on forecasted amounts, this section is not relevant until a project is started or scheduled. When these projects are initiated, they are prioritized based on DSC requirements and, with all things equal, on a queue basis, first in, first out as described in section 4.2.3.1 of the DSP.

Results of the Final Economic Evaluation (5.4.5.2.C.a. eighth bullet)

Capital contributions toward these projects are collected and calculated based on the economic evaluation methodology in accordance with the DSC and WNH's Conditions of Service. Detailed results for each project can only be available after the project is initiated, however, due to the high level of standardization of these projects, capital contribution levels for budgetary purposes are estimated based on averages from actual results on pervious projects.

Nature and Magnitude of System Impacts, Costs and Cost Recovery (5.4.5.2.C.a. ninth bullet)

As WNH's system is not constrained, and municipalities are striving to confine urban sprawl resulting in low demand for new subdivisions, these types of projects have very little impact on the system once they are complete. If development of a new subdivision is staged, for the duration of time between connection of the first customer in the first stage and last customer in the last stage, the construction of the main distribution system may not be fully complete, resulting in system segregation and lesser ability to restore power quickly in case of faults. This, however, is mitigated by the fact that the plant is fairly new, and other than manufacturing defects, no outages are expected.

Costs for these projects are fairly predicable based on standardized processes and materials, and are partially recovered through economic evaluations as prescribed in the DSC.

GENERAL INFORMATION ON THE PROJECT/ACTIVITY (5.4.5.2.A)

2016 Capital Project Summary

Project Name Retail Meters

Investment Category System Access

Project Description This project category includes the installation of WNH's metering assets in compliance with Measurement Canada (MC) standards and the Distribution System Code (DSC). The work includes inspection and replacement of defective meters, procurement, testing, and installation of meters for new or upgraded residential and commercial services, and required supporting infrastructure to measure, record and transfer electricity consumption data.

Detailed Listing of Affected Line Sections The following individual projects are covered by this project category:

WNH Project	Sub Project	Project Name	Total
13MT06	1	Residential Meters (Retail)	$210,467
13MT07	1	C&I Meters < 50kW (Retail)	$70,750
13MT07	2	C&I Meters > 50kW (Retail)	$306,402
		Total	$ 587,619

Capital Investment (5.4.5.2.A.first bullet)

Gross Capital $587,619

Customer Contribution $0

Net Capital $587,619

O&M Costs (if applicable) $0.00 (not applicable)

Customer Attachments/Load (kVA) (5.4.5.2.A.second bullet)

Customer Attachments (#): various - driven by demand

Customer Load (peak KVA) Not Applicable

Project Timing (5.4.5.2.A.third bullet)

Start Date January 2, 2016

Expected In-Service Date December 30, 2016

Expenditure Timing:

Q1:	25%	$ 146,905
Q2:	25%	$ 146,905
Q3:	25%	$ 146,905
Q4:	25%	$ 146,905

Risk and Risk Mitigation (5.4.5.2.A.fourth bullet) This work is very routine for WNH and is covered by well established processes both from design and construction perspectives which mitigates issues around timing related risk. For customer driven work, timelines are strictly monitored and enforced to ensure obligations set forth in the DSC are met and that customer satisfaction is maintained.

Comparative Information (5.4.5.2.A.fifth bullet)

Comparable investments in previous years are as follows:

2011:	$384,911
2012:	$600,650
2013:	$804,379
2014:	$359,348
2015:	$608,256

2012 and 2013 included AMI system modifications required to improve communication system performance. 2015 and 2016 investment requirements are increased to comply with Measurement Canada recommendations and increase in large customer metering installations.

Total Capital & OM&A Costs Associated with REG Investments (5.4.5.2.A.sixth bullet) Not Applicable

Leave to Construct Approval (5.4.5.2.A.seventh bullet) Not Applicable

EVALUATION CRITERIA AND INFORMATION REQUIREMENTS (5.4.5.2.B)

Evaluation Criteria and information requirements (5.4.5.2.B)

Efficiency, Customer Value, Reliability (5.4.5.2.B.1)

Main Driver (5.4.5.2.B.1.a)	These projects are mandatory. For new or upgraded services, scope and timelines are based on requirements put forth by customers and/or obligations set forth for connecting customers in the DSC. For existing meters, scope of work and timelines are based on compliance requirements to Measurement Canada requirements.
Related Objectives / Performance Targets	WNH Strategic Imperative 3 as identified in Exhibit 1
Source and Nature of the Information Used to Justify the Investment	Request for service and obligations set forth in the DSC. Mandated requirements set forth in MC requirements.
Secondary Driver (5.4.5.2.B.1.a)	Not Applicable
Related Objectives / Performance Targets	Not Applicable
Source and Nature of the Information Used to Justify the Investment	Not Applicable
Investment Priority (5.4.5.2.B.1.b)	Upgrading existing or installing new services are mandatory because of regulatory compliance, and are therefore top priority. Planning and design of customer driven projects is handled through engineering and is scheduled with crews when required by customers. Activities related to MC compliance are closely coordinated with customers by metering staff.

Analysis of the Project and Project Alternatives (5.4.5.2.B.1.c)

Effect on system operation efficiency and cost effectiveness	Smart metering infrastructure or remote communication enabled interval meters are now the standard installation for WNH, and each facilitate the following: • Eliminating manual meter reading; • Reducing outage time by assisting with locating trouble areas via power outage messages; • Eliminating appointments to read difficult to access meters.
Net benefits accruing to customers	The customer will benefit from having an accurate meter installed at its facility to ensure accurate and timely billing. Making interval metering data available to the customer will facilitate customer awareness of electricity consumption and will aid in managing energy to reduce or shift demand to off-peak periods.
Impact on reliability performance (including on the frequency and duration of outages)	The metering program is expected to help reduce duration of outages on WNH's distribution system by maintaining and improving data collection and communication from smart meters and integrating the data with the utility's Outage Management System (OMS).

Project Alternatives

Metering asset management is governed by Measurement Canada regulations as well as customer requirements for new or upgraded services. These projects are mandatory and do not have alternatives.

Safety (5.4.5.2.B.2)

These projects are not intended to address any existing safety concerns, but are expected to have safety related added benefits. This metering program facilitates the functionally and ability of WNH to identify tampered customer meters. Awareness of metering equipment tampering assists WNH's metering technicians to investigate and address potentially hazardous conditions to mitigate fire hazards and situations involving power theft.

Cyber-security, Privacy (5.4.5.2.B.3)

WNH's Smart Meter and related AMI network have been procured through Sensus. Sensus' system supports a multi-layered security approach including: access control, authorization, authentication and data integrity protocols. It also includes a robust AES-256 based encryption. As part of its continuous improvement model, WNH collaborates with other Ontario Sensus Customers to perform periodic security assessments and identify opportunities for enhanced system hardening.

Co-ordination, Interoperability (5.4.5.2.B.4)

Co-ordination with utilities, regional planning and/or links with 3rd party providers and/or industry (5.4.5.2.B.4.a)

Coordination with utilities and regional planning is not required. WNH coordinates with customers, contractors, and ESA as required by the scope of work involved.

Enabling of future technological functionality or addressing of future operational requirements (5.4.5.2.B.4.b)

A component of this program supports the capital investments required for the ongoing operation, maintenance, and installation of the Smart Metering Infrastructure.

Economic Development (5.4.5.2.B.5)

Not Applicable

Environmental Benefits (5.4.5.2.B.6)

The Smart Meter infrastructure supports the province's conservation culture. Smart metering also provides environmental benefits through reduction of in field visits associated with manual meter reading.

Category-specific requirements - System Access (5.4.5.2.C.a.)

SYSTEM ACCESS SPECIFIC REQUIREMENTS (5.4.5.2.C.a)

Factors Affecting Project Timing/Priority (5.4.5.2.C.a. first bullet)

New and replacement meters are provided on demand to address new load growth and meter failures.

Factors Relating to Customer Preference or 3rd Party Input (5.4.5.2.C.a. second bullet)

Metering for new and upgraded connection projects are customer initiated and are designed to meet customer identified requirements.

Factors Affecting Final Project Costs (5.4.5.2.C.a. third bullet)

Main factors that affect final costs are size of service, type of service (overhead, underground), and metering location (primary, secondary). Final costs of individual projects cannot be determined until the proposed work is requested by customers and/or a failed/defective metering asset is found.

Controllable Cost Minimization (5.4.5.2.C.a. fourth bullet)

The design and connection of services are standardized and, therefore, costs are controlled through well established processes, the use of standard material, and the efficiencies established through WNH's experience in executing such projects.

Other Planning Objectives Met (5.4.5.2.C.a. fifth bullet)

The change-over of revenue meters to smart meters for general service customers will improve operating efficiency, permit control of peak demand and enable hourly pricing for customers as the transition is completed. The conversion period is aligned with the Ontario Energy Board's amendments as set out in EB-2013-0311.

Technically Feasible Project Options (5.4.5.2.C.a. sixth bullet)

WNH operates a Sensus AMI system and procures meters from Sensus as well as other meter manufacturers who have the capability to equip their meters with the Sensus AMI communication module. The decision on the manufacturer of the meter asset for a particular installation is based on customer class/service type and support for specific features required by the customer.

Summary of Options Analysis (5.4.5.2.C.a. seventh bullet)

Metering asset management is governed by in part Measurement Canada regulations as well as customer requirements for new or upgraded services and good utility practices. These projects are mandatory

Results of the Final Economic Evaluation (5.4.5.2.C.a. eighth bullet)

Not Applicable.

Nature and Magnitude of System Impacts, Costs and Cost Recovery (5.4.5.2.C.a. ninth bullet)

Not Applicable.

Waterloo North Hydro Inc.

2016 Capital Project Summary

GENERAL INFORMATION ON THE PROJECT/ACTIVITY (5.4.5.2.A)

Project Name

Overhead Line Renewal

Investment Category

System Renewal

Project Description

This project category is comprised of overhead lines in poor condition and past their typical useful life (TUL). These lines were originally installed between 1950 and mid 1960's. Field inspections have determined that complete replacement of the assets is required due to their age and condition.

The project scope includes design, construction and installation of new taller poles framed to conform to O. Reg. 22/04 compliant standards as well as new wire and equipment. By completely removing the existing lines, WNH plans to improve the level of safety and reliability associated with newer standards and materials. The determination between which line sections could be refurbished and which need a full replacement is based on field inspections, pole testing program, and investigations into power quality issues.

Detailed Listing of Affected Line Sections

The following line sections are covered by this project category:

WNH Project	Sub Project	Project Name	Total
06EN04	19	William Hastings, Manser to Lichty	$262,223
06EN04	40	Norman St - Roslin Ave to Park Ave	$169,688
		Total	$ 431,911

Capital Investment (5.4.5.2.A.first bullet)

Gross Capital $431,911

Customer Contribution $0.00

Net Capital $431,911

O&M Costs (if applicable) $0.00 (not applicable)

Customer Attachments/Load (kVA) (5.4.5.2.A.second bullet)

Customer Attachments (#): 418
Customer Load (peak KVA) 4,556

Project Timing (5.4.5.2.A.third bullet)

Start Date April 2016 - Engineering
July 2016 - Construction

Expected In-Service Date December 2016

Expenditure Timing

Q1:	0%	$0
Q2:	10%	$43,191
Q3:	60%	$259,147
Q4:	30%	$129,573

Risk and Risk Mitigation (5.4.5.2.A.fourth bullet)

Sub project number 40 is located in an established downtown neighbourhood with a substantial population of mature trees. WNH has past experience with similar projects and neighbourhoods and has found that greater public consultation is required to avoid the risk of project delays due to public objections. To help mitigate this risk, the public consultation process was started well in advance and has included open houses, customer input to various design approaches to minimize tree trimming impact and communication plans to keep all customers informed of project details well in advance of construction.

Sub project number 19 is located along a rural road with little to no tree trimming impact and has no significant risk factors associated with its execution.

Comparative Information (5.4.5.2.A.fifth bullet)

Comparable investments in previous years are as follows:

2011:	$1,744,362
2012:	$465,712
2013:	$1,205,957
2014:	$945,198
2015:	$0

The number of line sections and their length under this project differs from year to year, which explains the variability in comparable investments in previous years.

Total Capital & OM&A Costs Associated with REG Investments (5.4.5.2.A.sixth bullet)

Not Applicable

Leave to Construct Approval (5.4.5.2.A.seventh bullet)

Not Applicable

Evaluation Criteria and information requirements (5.4.5.2.B)

EVALUATION CRITERIA AND INFORMATION REQUIREMENTS (5.4.5.2.B)

Efficiency, Customer Value, Reliability (5.4.5.2.B.1)

Main Driver (5.4.5.2.B.1.a)	The main driver for these project is the age and condition of the existing plant. Most of the infrastructure being replaced was originally put in service from 1950's to mid 1960's and has been identified through regular inspection as being in poor condition.
Related Objectives/Performance Targets	WNH Strategic Imperatives 1 & 2 as identified in Exhibit 1
Source and Nature of the Information Used to Justify the Investment	Field inspections and asset condition data.
Secondary Driver (5.4.5.2.B.1.a)	Not Applicable
Related Objectives/Performance Targets	Not Applicable
Source and Nature of the Information Used to Justify the Investment	Not Applicable
Investment Priority (5.4.5.2.B.1.b)	System Access investments are ranked as top priority, since they are required to be compliant with regulations. We want to ensure we can always connect new customers. Under the System Renewal category, WNH identifies pole line sections in poor condition based on field inspections, pole testing program, and investigations into failures or power quality issues. Assets found at risk of imminent failure are prioritized for immediate replacement. To prioritize the replacement of the remaining assets in poor condition, WNH takes into account additional drivers or benefits of completing the project. This typically includes improvements in: safety, reliability, power quality, opportunity for loss reduction (voltage uprating), operational flexibility, accessibility to operate and maintain, ability to address future system growth or restoration needs, and regulatory compliance. The more drivers or benefits that are attributed to a project (other than age and condition), the higher its priority. Investments in System Service and General Plant categories are prioritized in a similar fashion. Analysis of impact on customers and consideration of impact of project deferral are also considered. The compiled list of projects is reviewed and prioritized by Senior WNH Engineering, Operations, IT and Finance staff. Based on the outcome of this process, this project ranks 14 out of 15.

Analysis of the Project and Project Alternatives (5.4.5.2.B.1.c)

Effect on system operation efficiency and cost effectiveness	The renewal of sub project number 19 will ultimately permit the operation of lines at 27.6kV, which will increase flexibility of the system as a whole in outage scenarios and day to day switching. It will also contribute to a small reduction of line loss on the system.
Net benefits accruing to customers	The renewal of this infrastructure will have the following benefits: the aversion of potentially adverse effects on reliability and safety, avoidance of an increase to maintenance costs, ultimately provide for increased flexibility of the system via harmonization of the distribution voltages, a decrease in line losses, and increase in capacity for connection of REG on voltage converted sections.
Impact on reliability performance (including on the frequency and duration of outages)	This project ensures the elimination of safety hazards and that reliability is maintained. Additionally, the line section covered by project number 40 forms part of a feeder which experiences frequent momentary outages. The renewal of sub project 40 is expected to contribute to the improvement in reliability for the customers this line supplies as well as others on the same feeder.

Project Alternatives

All pole line sections under this project have been identified as being at the end of their useful life and in need of replacement. In light of this fact, WNH considered the following alternatives:
a) Do Nothing - this option results in the perpetuation of operational issues, increased risk of safety incidents, and further deterioration resulting in a decrease in reliability, and is therefore not considered appropriate.
b) Refurbish the lines - these line sections are not appropriate candidates for refurbishment as most poles are too short and structurally too weak to comply with today's safety standards as required by O. Reg. 22/04
c) Replace Like for Like - existing poles are too short and structurally too weak to comply with today's safety standards, so true Like-for-Like replacement is not an option. Furthermore, today's safety standards require same class and height of poles for 4kV or 8kV as for higher voltage systems and certain 4kV and 8kV components are no longer available from manufacturers as they are considered obsolete technology. For all these reasons, the Replace Like for Like option is not considered appropriate nor technically feasible.
d) Replace Like for Like with provisions for operation at higher voltages - this option allows for replacement of aged or unsafe equipment, allows for immediate or ultimate conversion to higher operating voltage, ultimately eliminates the need for expensive station upgrades, provides operational flexibility by ultimately harmonizing the system voltage, improves power quality from a voltage performance point of view, and is therefore, the preferred option.

Safety (5.4.5.2.B.2)

The new construction standards make work on pole lines much safer for all workers due to increased separation of high voltage conductors between themselves as well as from low voltage conductors.

Cyber-security, Privacy (5.4.5.2.B.3)

Not Applicable.

Co-ordination, Interoperability (5.4.5.2.B.4)

Co-ordination with utilities, regional planning and/or links with 3rd party providers and/or industry (5.4.5.2.B.4.a)

WNH will meet with the area Utility Coordinating Council and municipal staff (where applicable) as well as third party stakeholders to exchange project details to coordinate construction. Since this is a 2016 project, this coordination will most likely occur in Q4 2015.

Enabling of future technological functionality or addressing of future operational requirements (5.4.5.2.B.4.b)

The new construction standards provide space for future equipment to be installed with less difficulty and for the line to be operated at a higher voltage in the future if such option is not available at the time of construction.

Economic Development (5.4.5.2.B.5)

There will be very limited economic development directly attributable to this project.

Environmental Benefits (5.4.5.2.B.6)

Not Applicable.

SYSTEM RENEWAL SPECIFIC REQUIREMENTS (5.4.5.2.C.b)

Category-specific requirements - System Renewal (5.4.5.2.C.b.)

Relationship between the Characteristics of Targeted Assets and the Consequences of Asset Failure (5.4.5.2.C.b.first bullet)

Asset Performance Targets and Asset Lifecycle Optimization Policies and Practices (5.4.5.2.C.b.first bullet.first dash)

The majority of the poles, conductors and equipment have been found through inspection to be in poor condition and are over 50 years of age and past their TUL (Table 3-24 of the DSP).

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.first bullet.second dash)

The majority of the poles, conductors and equipment are over 50 years of age and generally in poor condition. The poles that are newer lack the required height and structural strength to meet today's safety standards required by O. Reg. 22/04. Hence, these pole lines must be considered in their entirety and under that lens, these assets are, for the most part, considered in poor condition and past their useful life.

Number of Customers in Each Class Potentially Affected (5.4.5.2.C.b.first bullet.third dash)

This project affects 280 residential customers, 125 small commercial customers, and 13 large commercial customers.

Quantitative Customer Impact and Risk (5.4.5.2.C.b.first bullet.fourth dash)

Quantitative customer impact and risk are not currently available.

Qualitative Customer Impact and Risk (5.4.5.2.C.b.first bullet.fifth dash)

The renewal of this section of line will ensure future level of reliability is maintained, eliminate safety issues and allow for increased flexibility of the operation of the grid. All of this will maintain or improve customer satisfaction.

Value of Customer Impact (5.4.5.2.C.b.first bullet.sixth dash)

Customer impact in terms of potential failure is low. These line sections supply a mix of residential and farm services. Although costs of repair of failed assets are high, the problem can be located quickly, and the risk of prolonged outages is low.

Other Factors Affecting Project Timing (5.4.5.2.C.b.second bullet)

This project is not dependent on others. Due to the age and condition of the infrastructure, this project needs to be completed. See Investment Priority section 5.4.5.2.B.1.b above for further details on project ranking.

Consequences for System O&M costs (5.4.5.2.C.b.third bullet)

There will be no immediate material impact to O&M costs for distribution lines. Without these projects taking place, O&M costs are expected to increase over time.

Reliability and Safety Factors (5.4.5.2.C.b.fourth bullet)

Line sections identified under this project, due to their age and condition, typically contribute to increasing the system customer outage minutes or momentary interruptions.

Analysis of Project Benefits and Timing (5.4.5.2.C.b.fifth bullet)

The line sections identified in this project are definitely in poor condition, past their TUL, and need to be completed. There are no risks to execution that have not already been addressed.

Like for Like Renewal Analysis (5.4.5.2.C.b.sixth bullet)

Projects in this category fall as closely as possible to the Like for Like definition given the technical obsolescence of 4kV and 8kV components.

Waterloo North Hydro Inc.

2016 Capital Project Summary

GENERAL INFORMATION ON THE PROJECT/ACTIVITY (5.4.5.2.A)

Project Name Underground Line Renewal

Investment Category System Renewal

Project Description

This project category is comprised of direct buried underground lines, transformers and switches in poor condition and past their typical useful life (TUL). These lines (and associated equipment) were originally installed between late 1970's and mid 1980's and have been failing prematurely. Emergency repairs and field inspections have determined that complete replacement of the assets is required due to their age and condition. The project scope includes design, construction and installation of new high voltage underground cable complete with associated conduit systems as well as replacement of existing below-grade transformers with padmounted style ones, resulting in improved reliability as well as safety. At the time of initial installation, WNH followed a common practice of placing normal overhead transformers in below-grade vaults. Over the years this has proven to have several serious shortcomings, including safety risks for the crews due to the placement of exposed high voltage transformer connections, frequent failures of the transformers due to premature corrosion as well as associated environmental concerns with oil leaks due to rusted transformers. Since most of the cables and equipment in this particular neighbourhood are of the same vintage and since rates of failure are expected to increase, WNH prepared a 5 year plan for replacing the high voltage cables and transformers proactively with the sections listed below scheduled to be completed in 2016.

Detailed Listing of Affected Line Sections

The following line sections are covered by this project category:

WNH Project	Sub Project	Project Name	Total
06EN09	14	2016 Lakeshore North Ph 8	$250,824
06EN09	15	2016 Lakeshore North Ph 9	$558,293
		Total	$ 809,117

Capital Investment
(5.4.5.2.A.first bullet)

Gross Capital	$809,117
Customer Contribution	$0.00
Net Capital	$809,117
O&M Costs (if applicable)	$0.00 (not applicable)

Customer Attachments/Load (kVA)
(5.4.5.2.A.second bullet)

Customer Attachments (#): 2,022
Customer Load (peak KVA) 8,264

Project Timing
(5.4.5.2.A.third bullet)

Start Date: January 2016 - Engineering
April 2016 - Construction

Expected In-Service Date: December 2016

Expenditure Timing

Q1:	10%	$80,912
Q2:	30%	$242,735
Q3:	30%	$242,735
Q4:	30%	$242,735

Risk and Risk Mitigation (5.4.5.2.A.fourth bullet)

Part of the plan for this project is to replace existing below-grade transformers with padmounted ones, which may be opposed by some residents due to aesthetic concerns. WNH plans to address this risk by educating the customers about the serious shortcomings of the existing solution and doing so well in advance of the project in order to have time to address customer's questions. Failures of below-grade transformers have been relatively frequent in this neighbourhood, and a number of them have already been changed to padmounted transformers with support of the local residents once they understood the challenges of below-grade transformers.

Comparative Information
(5.4.5.2.A.fifth bullet)

Comparable investments in previous years are as follows:

2011:	$2,129,653
2012:	$1,456,577
2013:	$1,227,244
2014:	$1,528,386
2015:	$1,021,180

Projects between 2011 and 2014 represent renewals of aged and failing 4kV cable, which are now substantially complete. Investments in 2015 and 2016 consist primarily of 15kV cable replacement in areas where cable failures are starting to be experienced. As these are considered to be early failures for this vintage of cable, the volume of work required is lower than to deal with the 4kV cable in the historical years. Over time, the investments in 15kV cable renewal are expected to increase to deal with more cable reaching the end of its useful life.

Total Capital & OM&A Costs Associated with REG Investments (5.4.5.2.A.sixth bullet) Not Applicable

Leave to Construct Approval (5.4.5.2.A.seventh bullet) Not Applicable

Evaluation Criteria and information requirements (5.4.5.2.B)

EVALUATION CRITERIA AND INFORMATION REQUIREMENTS (5.4.5.2.B)

Efficiency, Customer Value, Reliability (5.4.5.2.B.1)

Main Driver (5.4.5.2.B.1.a)	The main driver for these projects are the age and condition of the existing plant. Most of the infrastructure being replaced was originally put in service from late 1970's to mid 1980's and has been identified through emergency field repairs and regular inspection as being in poor condition.
Related Objectives/Performance Targets	WNH Strategic Imperatives 1 & 2 as identified in Exhibit 1
Source and Nature of the Information Used to Justify the Investment	Field inspection, failure history, asset condition data.
Secondary Driver (5.4.5.2.B.1.a)	Not Applicable
Related Objectives/Performance Targets	Not Applicable
Source and Nature of the Information Used to Justify the Investment	Not Applicable
Investment Priority (5.4.5.2.B.1.b)	System Access investments are ranked as top priority, since they are required to be compliant with regulations. Under the System Renewal category, WNH identifies line sections in poor condition based on field inspections, equipment failures, and investigations into power quality issues. Assets found at risk of imminent failure are prioritized for immediate replacement. To prioritize the replacement of the remaining assets in poor condition, WNH takes into account additional drivers or benefits of completing the project. This typically includes improvements in: safety, reliability, power quality, opportunity for loss reduction (voltage uprating), operational flexibility, accessibility to operate and maintain, ability to address future system growth or restoration needs, and regulatory compliance. The more drivers or benefits are attributed to a project (other than age and condition), the higher its priority. Investments in System Service and General Plant categories are prioritized in a similar fashion. Analysis of impact on customers and consideration of impact of project deferral are also considered. The compiled list of projects is reviewed and prioritized by Senior WNH Engineering, Operations, IT and Finance staff. Based on the outcome of this process, this project ranks 8 out of 15.

Analysis of the Project and Project Alternatives (5.4.5.2.B.1.c)

Effect on system operation efficiency and cost effectiveness	The replacement of below-grade transformers is expected to have a notable positive effect on the efficiency of operations in this neighbourhood for day to day switching as well as during unplanned outage scenarios. This is because WNH must follow extra steps to address safety concerns with exposed high voltage connections in below-grade transformers that are not required for switching padmounted transformers. As the below-grade transformers are often submersed in water, extra time in needed to deal with this concern when connection changes at a transformer are needed, especially in colder months when the water freezes. Renewal of the subdivision at 27.6kV will make more efficient use of capacity available at this voltage, reduce losses, and align with future system needs.
Net benefits accruing to customers	The renewal of this infrastructure will have the following benefits: reduction of the number and duration of outages, improvements in operational efficiency due to removal of extra steps required to deal with safety risks of below-grade transformers, avoidance of an increase to maintenance costs, better utilization of existing infrastructure, a decrease in line losses, and reduced environmental risks due to oil spills from leaky rusty below grade transformers.
Impact on reliability performance (including on the frequency and duration of outages)	The underground infrastructure in the Lakeshore North subdivision has been failing prematurely and customers in this area have been experiencing multiple prolonged outages. Please see the Annual Service Continuity Report for more information (Appendix F of the DSP). The renewal of this infrastructure is expected to have a substantial positive effect on reliability to the customers in this subdivision and will help in ensuring that reliability indices system wide don't fall below current levels.

Project Alternatives

All line sections under this project have been identified as being at the end of their useful life and in need of replacement. In light of this fact, WNH considered the following alternatives:
a) Do Nothing - this option will result in the perpetuation of operational issues, increased risk of safety incidents, environmental concerns due to oil leaks, and further deterioration resulting in decrease in reliability, and is therefore not considered appropriate.
b) Rejuvenate the cable - WNH considered this option and found that it was not a good fit for this neighbourhood because of the advanced deterioration of the cable as well as a large number of splice locations, some under driveways, considerably driving up rejuvenation and restoration costs. Through the analysis of this option, WNH also learned that the initial cable installation consisted of unjacketed cable, which over time resulted in deterioration of the neutral conductors. Other utilities have also experienced premature failure of unjacketed cable, adjusting their Typical Useful Life to just under 25 years (versus 35-40 more common for newer types of cable). In addition, this option would perpetuate operational, safety, environmental, efficiency, and reliability risks associated with below-grade transformers, and for these reasons, was not considered appropriate.
c) Replace Like for Like - because this option would still call for use of below-grade transformers it would result in the perpetuation of operational issues, requirement to address safety concerns through extra safety procedures, risks of premature failure of transformers and associated oil leaks, and suboptimal improvements in reliability. A variation of this option is to install submersible style below-grade transformers. WNH's experience with submersible style below-grade transformers (with most advanced features for minimizing harmful effects of harsh below-grade environments) is that they have been performing below expectations and failing prematurely due to water ingress and road/sidewalk salt corrosion . For all these reasons, the Replace Like for Like option is not considered appropriate.
d) Replace at 13.8kV with padmounted transformers - this option adequately addresses the operational, safety, environmental, and reliability risks, but it does not contribute to better utilization of existing 27.6kV capacity and does not align with long term system plans. It is important to note that for WNH, the costs for renewal of underground infrastructure in residential subdivisions is approximately the same for 27.6kV as for 13.8kV. A number of years ago, WNH surveyed the marketplace and concluded that it was cheaper to standardize on 27.6kV cable and use it in 13.8kV applications than to buy separate quantities of each. Hence, WNH only stocks 28kV class underground cable and associated terminations. Also, a standard size transformer for residential subdivision applications (50kVA) for the 27.6kV system is approximately $50 cheaper than the same size and style transformer for operation at 13.8kV. This is most likely due to production volumes with respect to voltage levels used by other utilities. Hence, this is not the preferred option as it fails to reap the benefits of operation at 27.6kV voltage at no additional cost and it does not align with long term system plans.
e) Replace at 27.6kV with padmounted transformers - this option adequately addresses the operational, safety, environmental, reliability, efficiency, and future system needs and is the preferred solution.

Safety (5.4.5.2.B.2)

Safety is a driver for this project. The elimination of high voltage live front transformer connections removes risk with respect to electrocution in maintenance situations. WNH considers this a very important risk to mitigate as contact with high voltage has the high potential for fatality.

Cyber-security, Privacy (5.4.5.2.B.3)

Not Applicable.

Co-ordination, Interoperability (5.4.5.2.B.4)

Co-ordination with utilities, regional planning and/or links with 3rd party providers and/or industry (5.4.5.2.B.4.a)

WNH will meet with the area Utility Coordinating Council and municipal staff (where applicable) as well as third party stakeholders to exchange project details to coordinate construction. Since this is a 2016 project, this coordination will most likely occur in Q4 2015.

Enabling of future technological functionality or addressing of future operational requirements (5.4.5.2.B.4.b)

This project is in direct support of the WNH long term system plan.

Economic Development (5.4.5.2.B.5)

There will be very limited economic development directly attributable to this project.

Environmental Benefits (5.4.5.2.B.6)

Substantially reduced risk of oil spills due to leaking transformers.

SYSTEM RENEWAL SPECIFIC REQUIREMENTS (5.4.5.2.C.b)

Category-specific requirements - System Renewal (5.4.5.2.C.b.)

Relationship between the Characteristics of Targeted Assets and the Consequences of Asset Failure (5.4.5.2.C.b.first bullet)

Asset Performance Targets and Asset Lifecycle Optimization Policies and Practices (5.4.5.2.C.b.first bullet.first dash)

Assets planned for replacement in this program are deteriorated beyond repair and in some cases contain critical design flaws. These factors pose failure and safety risks to the system, customers, and field crews. Asset replacement is the only viable alternative.

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.first bullet.second dash)

The underground high voltage servicing is well past its useful life and has been repaired numerous times (See Section 5.4.5.2.B.1.c above under Alternative b) for further details regarding premature cable failures experienced). This will continue to drive O&M costs if not addressed.

Number of Customers in Each Class Potentially Affected (5.4.5.2.C.b.first bullet.third dash)

This project affects 1990 residential customers, 29 small commercial customers, and 3 large commercial customers.

Quantitative Customer Impact and Risk (5.4.5.2.C.b.first bullet.fourth dash)

Quantitative customer impact and risk are not currently available.

Qualitative Customer Impact and Risk (5.4.5.2.C.b.first bullet.fifth dash)

The renewal of this section of line will ensure that the number and duration of outages are reduced, future level of reliability is maintained, eliminate safety issues, make efficient use of existing infrastructure, and support future system needs. All of this will maintain or improve customer satisfaction.

Value of Customer Impact (5.4.5.2.C.b.first bullet.sixth dash)

Customer impact in terms of potential failure is high for the affected customers and medium on a system level. Even though this area is predominately residential and loss of economic productivity is not a significant factor, asset failures happen frequently compared to other areas, are very often hard to find, cannot be repaired quickly (require excavation, emergency locates, etc.) and therefore, lead to prolonged outages.

Other Factors Affecting Project Timing (5.4.5.2.C.b.second bullet)

The customers in this area have already been exposed to repeating outages, some of prolonged duration. Hence, the timing of these projects is also affected by the urgency of resolving the existing reliability deficiency. See Investment Priority section 5.4.5.2.B.1.b above for further details on project ranking.

Consequences for System O&M costs (5.4.5.2.C.b.third bullet)

There will be no immediate material impact to O&M costs for distribution lines. Without these projects taking place, O&M costs are expected to rise over time at an increasing rate due to increase of below-grade transformer failures, oil spills, and associated environmental cleanup costs.

Reliability and Safety Factors (5.4.5.2.C.b.fourth bullet)

Line sections identified under this project, due to their age and condition, typically contribute to increasing the system customer outage minutes or momentary interruptions. The improvements in safety and reliability for the customers affected are expected to be significant. The largest contribution of this project to the system wide reliability indices is the avoidance of their further degradation.

Analysis of Project Benefits and Timing (5.4.5.2.C.b.fifth bullet)

The line sections identified in this project are definitely in poor condition, no longer fit for the purpose they were intended to do, and need to be completed. There are no risks to execution that are not already covered by WNH normal customer consultation process for each line section as further explained in the *Customer Engagement and Customer Focus* section of Exhibit 1.

Like for Like Renewal Analysis (5.4.5.2.C.b.sixth bullet)

Not Applicable. Like for Like Renewal was determined not to be appropriate. See Section 5.4.5.2.B.1.c above for further details.

Waterloo North Hydro Inc.

2016 Capital Project Summary

GENERAL INFORMATION ON THE PROJECT/ACTIVITY (5.4.5.2.A)

Project Name
Overhead Line Renewal - Failing Conductor

Investment Category
System Renewal

Project Description
This project category is comprised of overhead lines that pose a safety risk and are in poor condition. These lines have small conductors which have a tendency to become brittle as they age and fail prematurely. Such failures result in significant safety risk to workers and general public such as energization of the earth near the fallen conductor (which could lead to electrocution of any person nearby), fire on the ground as well as at the pole, and falling debris due to fire. These are lines also in need of complete replacement due to their age (mid 1940's to mid 1970's) and condition.

The project scope includes design, construction and installation of new taller poles framed to conform to O. Reg. 22/04 compliant standards as well as new wire and equipment. By completely removing the existing lines, WNH plans to improve the level of safety and reliability associated with newer standards and materials. The determination between which line sections could be refurbished and which need a full replacement is based on field inspections, pole testing program, and investigations into power quality issues.

Detailed Listing of Affected Line Sections
The following line sections are covered by this project category:

WNH Project	Sub Project	Project Name	Total
06EN04	14	#6: Road 116, H20738 to William Hastings Ln	$130,572
06EN04	15	#6: Sawmill Rd, Conestogo - side streets	$330,981
06EN04	24	#6: Church St at Spruce Lane	$98,840
06EN04	31	#6: Buehler Ln - Lavery Rd to Lichty Rd	$578,988
		Total	$ 1,139,381

Capital Investment (5.4.5.2.A.first bullet)

Gross Capital	$1,139,381	
Customer Contribution	$0.00	
Net Capital	$1,139,381	
O&M Costs (if applicable)	$0.00	(not applicable)

Customer Attachments/Load (kVA) (5.4.5.2.A.second bullet)

Customer Attachments (#):	122
Customer Load (peak KVA)	921

Project Timing (5.4.5.2.A.third bullet)

Start Date: January 2016 - Engineering; February 2016 - Construction

Expected In-Service Date: December 2016

Expenditure Timing

Q1:	20%	$227,876
Q2:	30%	$341,814
Q3:	30%	$341,814
Q4:	20%	$227,876

Risk and Risk Mitigation (5.4.5.2.A.fourth bullet)
Sub project numbers 15 and 24 in the above table are located in an established neighbourhood with a substantial population of mature trees. WNH has had experience with similar projects and neighbourhoods and has found that the risk of project delays can be significant if public consultation is not started well in advance. To help mitigate the risk of project delays due to public objection, plans to keep all customers informed of project details well in advance of construction and communicate to customers various design approaches that can be used to minimize tree trimming impact.

Sub project numbers 14 and 31 are located along township roads with little to no tree trimming impact and have no significant risk factors associated with its execution, except that project 14 requires upfront coordination with Hydro One because of a HONI customer connected to this line.

Comparative Information (5.4.5.2.A.fifth bullet)
Comparable investments in previous years are as follows:

2011:	$264,226
2012:	$660,333
2013:	$316,749
2014:	$2,729,388
2015:	$1,239,740

Small conductor lines were typically installed either in urban subdivisions or along lightly loaded rural roads. Line renewal in urban areas, particularly in backlots, is substantially more expensive due to higher densities of customer connections, the requirement to overcome accessibility challenges, and higher restoration costs. 2011-2013 comprised primarily of rural line sections. 2014 comprised primarily of backlot line sections. 2015 comprised of a combination of rural and backlot lines. 2015 is most representative of the projects in 2016, except 2016 has a greater rural component.

Total Capital & OM&A Costs Associated with REG Investments (5.4.5.2.A.sixth bullet)
No Capital or OM&A Costs for REG investments are associated with this project. However, ability to connect more generation is a side benefit of voltage uprating where available.

Leave to Construct Approval (5.4.5.2.A.seventh bullet)
Not Applicable

Evaluation Criteria and information requirements (5.4.5.2.B)

EVALUATION CRITERIA AND INFORMATION REQUIREMENTS (5.4.5.2.B)

Efficiency, Customer Value, Reliability (5.4.5.2.B.1)

Main Driver (5.4.5.2.B.1.a)

The main driver for these project is the increased safety risk due to premature conductor failure.

Related Objectives/Performance Targets

WNH Strategic Imperative 2 as identified in Exhibit 1

Source and Nature of the Information Used to Justify the Investment

Field inspections, asset condition data, and WNH prior experience with conductors falling to the ground (consistent with experience of other LDCs in Ontario).

Secondary Driver (5.4.5.2.B.1.a)

The secondary driver for these projects is the age and condition of the existing plant. Most of the infrastructure being replaced was originally put in service from mid 1940's to mid 1970's and has been identified through regular inspection as being in poor condition. The combination of the primary and secondary drivers adds a level of urgency to this specific category of projects.

Related Objectives/Performance Targets

WNH Strategic Imperatives 1 and 2 as identified in Exhibit 1

Source and Nature of the Information Used to Justify the Investment

Field inspections and asset condition data.

Investment Priority (5.4.5.2.B.1.b)

System Access investments are ranked as top priority, since they are required to be compliant with regulations.

Under the System Renewal category, WNH identifies pole line sections in poor condition based on field inspections, pole testing program, and investigations into failures and power quality issues. Assets found at risk of imminent failure are prioritized for immediate replacement. To prioritize the replacement of the remaining assets in poor condition, WNH takes into account additional drivers or benefits of completing the project. This typically includes improvements in: safety, reliability, power quality, opportunity for loss reduction (voltage uprating), operational flexibility, accessibility to operate and maintain, ability to address future system growth or restoration needs, and regulatory compliance. The more drivers or benefits are attributed to a project (other than age and condition), the higher its priority.

Investments in System Service and General Plant categories are prioritized in a similar fashion. Analysis of impact on customers and consideration of impact of project deferral are also considered. The compiled list of projects is reviewed and prioritized by Senior WNH Engineering, Operations, IT and Finance staff. Based on the outcome of this process, this project ranks 3 out of 15.

Analysis of the Project and Project Alternatives (5.4.5.2.B.1.c)

Effect on system operation efficiency and cost effectiveness

The installation of larger conductors allows WNH better control of the voltage regulation on these lines, and hence, improves the power quality to all customers supplied by these lines through better voltage performance at each customer connection point. In addition, where higher operating voltages are available (sub project numbers 15, 24, and 31), the line renewal is planned to be done at the higher operating voltage (13.kV or 27.6kV as appropriate), which increases flexibility of the system as a whole in outage scenarios and day to day switching and contributes to a small reduction of line loss on the system.

Net benefits accruing to customers

The renewal of this infrastructure will have the following benefits: increased level of safety to general public and workers, reduced number and duration of outages, avoidance of an increase to maintenance costs, increased flexibility of the system via harmonization of the distribution voltages, decrease in line losses, and increase in capacity for connection of REG on voltage uprated sections.

Impact on reliability performance (including on the frequency and duration of outages)

The completion of this project is expected to have a significant positive effect on reliability to the customers connected to these line sections as well as downstream of these line sections. While the local improvements in reliability are expected to be significant, system wide, these projects are not expected to have a significant impact on reliability. This is because most of the line sections covered under this project are in low customer density areas.

Project Alternatives

All pole line sections under this project have been identified as posing a safety risk to workers and general public, being at the end of their useful life, and in need of replacement. In light of this fact, WNH considered the following alternatives:
a) Do Nothing - this option results in an increased risk of serious safety incidents and further deterioration in reliability. Given the severity of the safety risks to general public, the Do Nothing option could be considered negligent, and for all these reasons, is not considered appropriate.
b) Refurbish the lines - these line sections are not appropriate candidates for refurbishment as most poles are too short and structurally too weak to comply with today's safety standards as required by O. Reg. 22/04
c) Replace Like for Like - because the existing small conductors have been proven to fail prematurely causing significant safety concerns, and because the poles used to support smaller conductors are not of sufficient structural strength to support larger conductors nor meet today's increased safety standards, this option is not considered appropriate.
d) Replace all existing lines with provisions for immediate or future upgrade to higher operating voltages - this option allows for replacement of deteriorated or unsafe equipment, allows for immediate or ultimate uprating to higher operating voltage, ultimately eliminates the need for expensive station upgrades, provides operational flexibility by ultimately harmonizing the system voltage, improves power quality from a voltage performance point of view, and is therefore, the preferred option.

Safety (5.4.5.2.B.2)

These projects also involve replacement of small conductors which are prone to failure as they age due to their brittleness and present a hazard to the public and all workers. The failure can result in hazards such as energization of the earth near the fallen conductor potentially causing electrocution of any person nearby, fire on the ground as well as at the pole, and falling debris due to fire.

Presently hazards associated with undersized conductors for WNH workers are managed by appropriate safety policies and procedures. In addition, the new construction standards make work on pole lines much safer for all workers due to increased separation of high voltage conductors between themselves as well as from low voltage conductors. Hazards associated with failing conductors for general public can only be managed by replacement of these assets.

Cyber-security, Privacy (5.4.5.2.B.3)

Not Applicable.

Co-ordination, Interoperability (5.4.5.2.B.4)

Co-ordination with utilities, regional planning and/or links with 3rd party providers and/or industry (5.4.5.2.B.4.a)

WNH will meet with the area Utility Coordinating Council and municipal staff (where applicable) and third party stakeholders to exchange project details to coordinate construction. Since this is a 2016 project this coordination will most likely occur in Q4 2015.

Enabling of future technological functionality or addressing of future operational requirements (5.4.5.2.B.4.b)

The new construction standards provide space for future equipment to be installed with less difficulty and for the line to be operated at a higher voltage in the future if such is not available at the time of construction.

Economic Development (5.4.5.2.B.5)

There will be very limited economic development directly attributable to this project.

Environmental Benefits (5.4.5.2.B.6)

Albeit small, these projects may have a positive environmental benefit due to reduction in power generation requirements, and hence greenhouse gases, as follows:
a) reduction in losses due to use of larger conductor and due to voltage upgrade (where possible at the time of construction), and
b) increased capacity for green generation due to voltage upgrade.

Category-specific requirements - System Renewal (5.4.5.2.C.b.)

SYSTEM RENEWAL SPECIFIC REQUIREMENTS (5.4.5.2.C.b)

Relationship between the Characteristics of Targeted Assets and the Consequences of Asset Failure (5.4.5.2.C.b.first bullet)

Asset Performance Targets and Asset Lifecycle Optimization Policies and Practices (5.4.5.2.C.b.first bullet.first dash)

The majority of the poles, conductors and equipment have been found through inspection to be in poor condition and pose a safety hazard, and therefore, are considered no longer fit for the purpose they were intended to do. The conductor used on these line sections is small, which makes it more susceptible for corrosion and brittleness to cause failure compared to larger size conductors of the same vintage.

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.first bullet.second dash)

All of the pole lines identified under this project category have conductors at risk of imminent failure. The majority of the poles and equipment are generally in very poor condition due to their vintage, and those in better condition lack the required height and structural strength to meet today's safety standards required by O. Reg. 22/04. Hence, these pole lines must be considered in their entirety and under that lens, these assets are, for the most part, considered in poor condition and past their useful life.

Number of Customers in Each Class Potentially Affected (5.4.5.2.C.b.first bullet.third dash)

This project affects 86 residential customers, 36 small commercial customers, and no large commercial customers.

Quantitative Customer Impact and Risk (5.4.5.2.C.b.first bullet.fourth dash)

Quantitative customer impact and risk are not currently available.

Qualitative Customer Impact and Risk (5.4.5.2.C.b.first bullet.fifth dash)

The renewal of this section of line will ensure future level of reliability is maintained, eliminate safety issues and allow for increased flexibility of the operation of the grid. All of this will maintain or improve customer satisfaction.

Value of Customer Impact (5.4.5.2.C.b.first bullet.sixth dash)

Customer impact in terms of potential failure is high, mostly due to the severity of safety risks associated with conductor failure. Given the history of failures for lines in this project category, the probability of failure is high compared to other line sections. Although costs of repair of failed assets are high, the problem can be located quickly, and the risk of prolonged outages is lower.

Other Factors Affecting Project Timing (5.4.5.2.C.b.second bullet)

This project is not dependent on others. Due to the age and condition of the infrastructure, this project needs to be completed. See Investment Priority section 5.4.5.2.B.1.b above for further details on project ranking.

Consequences for System O&M costs (5.4.5.2.C.b.third bullet)

System wide, there will be no immediate material impact to O&M costs for distribution lines. At a local line section level, accelerated failure incidents of these conductors are expected if these projects were not to proceed, resulting in increasing O&M costs for maintenance of these line sections. The renewal of these aged lines combined with ultimate voltage harmonization will help reduce equipment failure, eliminate safety hazards, reduce line losses, and correct substandard conditions prevalent with this vintage of assets, all of which will help reduce future O&M costs. The elimination of the 4kV and the 8kV systems also as a whole will result in increased operational flexibility, increased reliability through greater redundancy, reduced inventory levels and carrying costs, all of which will help reduce O&M costs. Eventually, System O&M resources that were dedicated to the small conductor failure issues on these lines will be available for other O&M tasks at WNH.

Reliability and Safety Factors (5.4.5.2.C.b.fourth bullet)

Projects in this category all share the common safety concerns associated with premature conductor failure for workers and general public as well as the resulting increase in frequency of outages.

Analysis of Project Benefits and Timing (5.4.5.2.C.b.fifth bullet)

The line sections identified in this project are definitely in poor condition, at the end of their useful life, and need to be completed. There are no risks to execution that are not already covered by WNH normal customer consultation process for each line section as further explained in the *Customer Engagement and Customer Focus* section of Exhibit 1.

Like for Like Renewal Analysis (5.4.5.2.C.b.sixth bullet)

Not Applicable. Like for Like Renewal was determined not to be appropriate. See Section 5.4.5.2.B.1.c above for further details.

Waterloo North Hydro Inc.

2016 Capital Project Summary

GENERAL INFORMATION ON THE PROJECT/ACTIVITY (5.4.5.2.A)

Project Name Overhead Line Renewal (8kV)

Investment Category System Renewal

Project Description This project category is comprised of overhead lines in poor condition and past their typical useful life (TUL). These are lines that, because of their age (late 1940's to mid 1960's) are operating at 8.32kV, some with small conductors that have shown a tendency to become brittle and fail. Field inspections have determined that complete replacement of the assets is required. As part of the renewal project, WNH will take the opportunity to gain efficiencies uprate the operating voltage to 27.6kV, which will support removal from service of stations identified in the DSP.

The project scope includes design, construction and installation of new taller poles framed to conform to O. Reg. 22/04 compliant standards as well as new wire and equipment. By completely removing the existing lines, WNH plans to improve the level of safety and reliability associated with newer standards and materials. The determination between which line sections could be refurbished and which need a full replacement is based on field inspections, pole testing program, and investigations into power quality issues.

Detailed Listing of Affected Line Sections The following line sections are covered by this project category:

WNH Project	Sub Project	Project Name	Total
06EN04	10	Deborah Glaister Ln - Chalmers Forest to Rd 116	**$295,897**
06EN04	20	Woolwich/Guelph Townline - Victoria St to Chilligo Rd	**$199,335**
06EN04	21	Nafziger Rd - Gerber Rd to Queen's Bush Rd	**$268,740**
06EN04	22	Chilligo Rd - Kossuth Rd to Woolwich/Guelph Townline	**$692,257**
06EN04	23	Scotch Line, New Jerusalem Rd to Arthur St	**$385,294**
		Total	**$ 1,841,523**

Capital Investment (5.4.5.2.A.first bullet)

Gross Capital	$1,841,523
Customer Contribution	$0.00
Net Capital	$1,841,523
O&M Costs (if applicable)	$0.00 (not applicable)

Customer Attachments/Load (kVA) (5.4.5.2.A.second bullet)

Customer Attachments (#): 245
Customer Load (peak KVA) 1,200

Project Timing (5.4.5.2.A.third bullet)

Start Date: January 2016 - Engineering; February 2016 - Construction

Expected In-Service Date: December 2016

Expenditure Timing

Q1:	20%	$368,305
Q2:	30%	$552,457
Q3:	30%	$552,457
Q4:	20%	$368,305

Risk and Risk Mitigation (5.4.5.2.A.fourth bullet) Most of the above mentioned overhead line sections are located along township roads with little to no tree trimming impact and have no significant risk factors associated with their execution.

Comparative Information (5.4.5.2.A.fifth bullet) Comparable investments in previous years are as follows:

2011:	$2,006,420
2012:	$2,665,999
2013:	$1,213,787
2014:	$1,829,531
2015:	$1,622,886
Average:	**$1,867,725**

The number of line sections and their length under this project differs from year to year, which explains the variability in comparable investments in previous years. The 2016 investment amount is in line with the historical average for this project.

Total Capital & OM&A Costs Associated with REG Investments (5.4.5.2.A.sixth bullet) No Capital or OM&A Costs for REG investments are associated with this project. However, ability to connect more generation is a side benefit of voltage uprating.

Leave to Construct Approval (5.4.5.2.A.seventh bullet) Not Applicable

Evaluation Criteria and information requirements (5.4.5.2.B)

EVALUATION CRITERIA AND INFORMATION REQUIREMENTS (5.4.5.2.B)

Efficiency, Customer Value, Reliability (5.4.5.2.B.1)

Main Driver (5.4.5.2.B.1.a)

The main driver for these projects are the age and condition of the existing plant. Most of the infrastructure being replaced was originally put in service from late 1940's to mid 1960's and has been identified through regular inspection as being in poor condition.

Related Objectives/Performance Targets

WNH Strategic Imperatives 1 & 2 as identified in Exhibit 1

Source and Nature of the Information Used to Justify the Investment

Field inspections and asset condition data for line assets.

Secondary Driver (5.4.5.2.B.1.a)

The secondary driver for these projects are retirement of distribution transformer stations in need of otherwise expensive upgrades. Over time, uprating the operating voltage during renewal projects from 8.32kV to 27.6kV eliminates the need to operate, maintain, and upgrade stations required for providing electrical connectivity between the 27.6kV and the 8.32kV systems. Sub project numbers 20, 21, and 22 contribute directly to WNH's ability to retire DS34 (which is in poor condition) by the end of 2016.

While capacity is not a driving factor for any projects under this DSP, uprating of 8.32kV distribution system to higher more efficient operating voltages also has the side benefits of slightly lower line losses as well as ability to accept more load and/or generation customers.

Related Objectives/Performance Targets

WNH Strategic Imperatives 1 & 2 (for station assets) as well as 5 & 6 as identified in Exhibit 1

Source and Nature of the Information Used to Justify the Investment

Field inspections and asset condition data for station assets.

Investment Priority (5.4.5.2.B.1.b)

System Access investments are ranked as top priority, since they are required to be compliant with regulations.

Under the System Renewal category, WNH identifies pole line sections in poor condition based on field inspections, pole testing program, and investigations into failures and power quality issues. Assets found at risk of imminent failure are prioritized for immediate replacement. To prioritize the replacement of the remaining assets in poor condition, WNH takes into account additional drivers or benefits of completing the project. This typically includes improvements in: safety, reliability, power quality, opportunity for loss reduction (voltage uprating), operational flexibility, accessibility to operate and maintain, ability to address future system growth or restoration needs, and regulatory compliance. The more drivers or benefits are attributed to a project (other than age and condition), the higher its priority.

Investments in System Service and General Plant categories are prioritized in a similar fashion. Analysis of impact on customers and consideration of impact of project deferral are also considered. The compiled list of projects is reviewed and prioritized by Senior WNH Engineering, Operations, IT and Finance staff. Based on the outcome of this process, this project ranks 11 out of 15.

Analysis of the Project and Project Alternatives (5.4.5.2.B.1.c)

Effect on system operation efficiency and cost effectiveness

The renewal on this project will permit the operation of lines at 27.6kV, which directly supports pending distribution station retirement, helps avoid expensive station upgrades, increases flexibility of the system as a whole in outage scenarios and day to day switching, contributes to a small reduction of line loss on the system, and provides for future system needs.

Net benefits accruing to customers

The renewal of this infrastructure will have the following benefits: the removal of risk of prolonged outages associated with failures of distribution transformer station assets as well as line sections in poor condition, reduction of stray voltage issues, improvements in safety, avoidance of an increase to maintenance costs, increased flexibility of the system via harmonization of the distribution voltage to 27.6kV, a decrease in line losses, increase in capacity for connection of REG on voltage uprated sections, and provides for future system needs.

Impact on reliability performance (including on the frequency and duration of outages)

The completion of this project is expected to have a positive effect on reliability over time for the following reasons:
a) voltage harmonization allowing greater flexibility in responding to distribution system events
b) improved power quality (stray voltage issue reduction, specifically on sub project numbers 10 and 23)
c) reduced risk of prolonged outages associated with aged station equipment needing replacement

Project Alternatives

All pole line sections under this project have been identified as being at the end of their useful life and in need of replacement. In light of this fact, WNH considered the following alternatives:
a) Do Nothing - this option results in the perpetuation of operational issues and higher line losses, increased risk of safety incidents, further deterioration resulting in a decrease in reliability. This option would immediately trigger the need for expensive distribution station upgrades and fail to take the opportunity to address future system needs. For all these reasons, the Do Nothing option is not considered appropriate.
b) Refurbish the lines - these line sections are not appropriate candidates for refurbishment as most poles are too short and structurally too weak to comply with today's safety standards as required by O. Reg. 22/04
c) Replace Like for Like - existing poles are too short and structurally too weak to comply with today's safety standards, so true Like-for-Like replacement is not an option. Furthermore, today's safety standards require same class and height of poles for 8.32kV as for 27.6kV systems and certain 8.32kV components are no longer available from manufacturers as they are considered obsolete technology, effectively causing the pole lines to be built to 28kV standards. As typical size transformers for rural applications (25kVA) are approximately $30 cheaper for 27.6kV versus 8.32kV application, overall construction cost of a 8.32kV line is approximately the same as for a 27.6kV line. In addition, renewing the line at 8.32kV would also immediately trigger the need for expensive distribution station refurbishment. For all these reasons, the Replace Like for Like option is not considered appropriate nor technically feasible.
d) Replace all existing lines with new 27.6kV lines - this option allows for replacement of aged equipment, eliminates the need for expensive distribution station upgrades, provides operational flexibility by harmonizing the system voltage, and provides for future system needs.

Safety (5.4.5.2.B.2)

These projects also involve replacement of small conductors which are prone to failure due to brittleness, and presents a hazard to the public and all workers. The failure can result in hazards such as energization of the earth near the fallen conductor potentially electrocuting any person nearby, fire on the ground as well as at the pole, and falling debris due to fire.

Presently hazards associated with undersized conductors for WNH workers are managed by appropriate safety policies and procedures. The new construction standards make work on pole lines much safer for all workers due to increased separation of high voltage conductors between themselves as well as from low voltage conductors.

Cyber-security, Privacy (5.4.5.2.B.3)

Not Applicable.

Co-ordination, Interoperability (5.4.5.2.B.4)

Co-ordination with utilities, regional planning and/or links with 3rd party providers and/or industry (5.4.5.2.B.4.a)

WNH will meet with the area Utility Coordinating Council and municipal staff (where applicable) and third party stakeholders to exchange project details to coordinate construction. Since this is a 2016 project this coordination will most likely occur in Q4 2015.

Enabling of future technological functionality or addressing of future operational requirements (5.4.5.2.B.4.b)

The new construction standards provide space for future equipment to be installed with less difficulty.

Economic Development (5.4.5.2.B.5)

There will be very limited economic development directly attributable to this project, although the 27.6kV lines will provide more capacity than available today for future development.

Environmental Benefits (5.4.5.2.B.6)

Albeit small, these projects may have a positive environmental benefit due to reduction in power generation requirements, and hence greenhouse gases, as follows:
a) reduction in losses due to voltage upgrade
b) increased capacity for green generation due to voltage upgrade
c) provision for sharing transformer station capacity with neighbouring utilities.

Category-specific requirements - System Renewal (5.4.5.2.C.b.)

SYSTEM RENEWAL SPECIFIC REQUIREMENTS (5.4.5.2.C.b)

Relationship between the Characteristics of Targeted Assets and the Consequences of Asset Failure (5.4.5.2.C.b.first bullet)

Asset Performance Targets and Asset Lifecycle Optimization Policies and Practices (5.4.5.2.C.b.first bullet.first dash)

The majority of the poles, conductors and equipment have been found through inspection to be in poor condition, most assets are 60 years of age and past their TUL (Table 3-24 of the DSP).

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.first bullet.second dash)

The majority of the poles, conductors and equipment are generally in very poor condition, which is expected as most of the poles are over 60 years of age. The poles that are newer are typically over 50 years of age and lack the required height and structural strength to meet today's safety standards required by O. Reg. 22/04. Hence, these pole lines must be considered in their entirety and under that lens, these assets are, for the most part, considered in poor condition and past their useful life.

Number of Customers in Each Class Potentially Affected (5.4.5.2.C.b.first bullet.third dash)

This project affects 176 residential customers, 67 small commercial customers, and 2 large commercial customers.

Quantitative Customer Impact and Risk (5.4.5.2.C.b.first bullet.fourth dash)

Quantitative customer impact and risk are not currently available.

Qualitative Customer Impact and Risk (5.4.5.2.C.b.first bullet.fifth dash)

The renewal of this section of line will ensure future level of reliability is maintained, eliminate safety issues and allow for increased flexibility of the operation of the grid. All of this will maintain or improve customer satisfaction.

Value of Customer Impact (5.4.5.2.C.b.first bullet.sixth dash)

Customer impact in terms of potential failure is low. These line sections supply a mix of residential and farm services. Although costs of repair of failed assets are high, the problem can be located quickly, and the risk of prolonged outages is very low.

Other Factors Affecting Project Timing (5.4.5.2.C.b.second bullet)

Any delays in executing these projects would delay decommissioning DS34 by the end of 2016, which is in poor condition and already past its TUL (Table 3-19 of the DSP) , significantly increasing the risk of prolonged outages due to major component failure at the station as well as increase the risk of new stray voltage issues being experienced by the customers connected to or through these lines. Due to the age and condition of the infrastructure, this project needs to be completed. See Investment Priority section 5.4.5.2.B.1.b above for further details on project ranking.

Consequences for System O&M costs (5.4.5.2.C.b.third bullet)

This project supports the retirement of the next DS station and the elimination of its respective O&M costs (approximately $17,000 per station annually). There will be no immediate material impact to O&M costs for distribution lines. The renewal of the 8kV system as a whole will help reduce equipment failure, eliminate safety hazards, and correct substandard conditions prevalent with this vintage of assets, all of which will help reduce future O&M costs. The elimination of the 8kV system also as a whole will result in increased operational flexibility, increased reliability through greater redundancy and options for the resupply of customers formerly in the 8kV area from 27.6kV sources, reduced line losses, reduced inventory levels and carrying costs, all of which will help reduce O&M costs. Eventually, System O&M resources that were dedicated to the 8kV issues on these lines will be available for other O&M tasks at WNH.

Reliability and Safety Factors (5.4.5.2.C.b.fourth bullet)

There will be no immediate material impact on reliability, however, the 8kV renewal as a whole will help reduce interruptions related to failed equipment. The elimination of safety hazards were considered to be important factors of the project.

Analysis of Project Benefits and Timing (5.4.5.2.C.b.fifth bullet)

The line sections identified in this project are definitely in poor condition, past their TUL, need to be completed and there are no significant risks to their execution.

Like for Like Renewal Analysis (5.4.5.2.C.b.sixth bullet)

Not Applicable. Like for Like Renewal was determined not to be appropriate. See Section 5.4.5.2.B.1.c above for further details.

2016 Capital Project Summary

GENERAL INFORMATION ON THE PROJECT/ACTIVITY (5.4.5.2.A)

Project Name Overhead Line Renewal (4kV)

Investment Category System Renewal

Project Description

This project category is comprised of overhead lines in poor condition and past their typical useful life (TUL). These are lines that, because of their age (early 1950's to early 1970's) are operating at 4.16 kV, some with small conductors that have shown a tendency to become brittle and fail. In addition, the two 13.8kV circuits that supply power to the 4kV stations have been among WNH's worst performing feeders (ER42, HS27) over the last 5 years. Field inspections have determined that complete replacement of the assets is required. As part of the renewal project, WNH will take the opportunity to gain efficiencies and uprate the operating voltage and conductor size (13.8 kV and 556 kcmil AL).

The project scope includes design, construction and installation of new taller poles framed to conform to O. Reg. 22/04 compliant standards as well as new wire and equipment. By completely removing the existing lines, WNH plans to improve the level of safety and reliability associated with newer standards and materials. The determination between which line sections could be refurbished and which need a full replacement has been based on field inspections, pole testing program, and investigations into power quality issues.

Detailed Listing of Affected Line Sections

The following line sections are covered by this project category:

WNH Project	Sub Project	Project Name	Total
06EN04	25	City 4kV - Erb St - Weber St to Dover St	$52,604
06EN04	26	City 4kV - John St - King St to Moore Ave	$184,736
06EN04	27	City 4kV - Allen St - Railway to Weber and side streets	$264,024
06EN04	28	City 4kV - Mary St - Allen St to Union St	$103,427
06EN04	29	City 4kV - Union St - King St to Weber St	$431,717
06EN04	30	City 4kV - Weber St - Allen St to Hartwood Ave	$271,184
06EN04	32	City 4kV - William St & Willow St - Regina St to Allen St	$210,022
06EN04	38	Uptown 4kV - Alexandra Ave - Roslin Ave to Caroline St	$141,709
06EN04	39	Uptown 4kV - Euclid St - Erb St to William St	$141,709
06EN04	41	Uptown 4kV - single phase side streets	$103,756
		Total	$ 1,904,888

Capital Investment (5.4.5.2.A.first bullet)

Gross Capital	$1,904,888
Customer Contribution	$0.00
Net Capital	$1,904,888
O&M Costs (if applicable)	$0.00 (not applicable)

Customer Attachments/Load (kVA) (5.4.5.2.A.second bullet)

Customer Attachments (#): 1,075
Customer Load (peak KVA) 5,084

Project Timing (5.4.5.2.A.third bullet)

Start Date: January 2016 - Engineering
February 2016 - Construction

Expected In-Service Date: December 2016

Expenditure Timing

Q1:	20%	$380,978
Q2:	30%	$571,466
Q3:	30%	$571,466
Q4:	20%	$380,978

Risk and Risk Mitigation (5.4.5.2.A.fourth bullet)

Most of the above mentioned overhead line sections are located in an established downtown neighbourhood with a substantial population of mature trees. WNH has past experience with similar projects and neighbourhoods and has found that greater public consultation is required to avoid the risk of project delays due to public objections. To help mitigate this risk, the public consultation process was started well in advance and has included open houses, customer input to various design approaches to minimize tree trimming impact and communication plans to keep all customers informed of project details well in advance of construction.

Comparative Information (5.4.5.2.A.fifth bullet)

Comparable investments in previous years are as follows:

2011:	$1,903,795
2012:	$2,225,135
2013:	$1,346,130
2014:	$1,095,305
2015:	$885,015

Line sections rebuilt in 2011 through to 2013 are more representative of the line sections scheduled for renewal in 2016 (in urban settings with higher number of multi-circuit lines). The average investment in those years is just over $1,825,000 per year and very similar to the investment requirements in 2016 for this project.

Total Capital & OM&A Costs Associated with REG Investments (5.4.5.2.A.sixth bullet)

No Capital or OM&A Costs for REG investments are associated with this project. However, ability to connect more generation is a side benefit of voltage uprating.

Leave to Construct Approval (5.4.5.2.A.seventh bullet)

Not Applicable

EVALUATION CRITERIA AND INFORMATION REQUIREMENTS (5.4.5.2.B)

Evaluation Criteria and information requirements (5.4.5.2.B)

Efficiency, Customer Value, Reliability (5.4.5.2.B.1)

Main Driver (5.4.5.2.B.1.a)	The main driver for these project is the age and condition of the existing plant. Most of the infrastructure being replaced was originally put in service from early 1950's to early 1970's and has been identified through regular inspection as being in poor condition.
Related Objectives/Performance Targets	WNH Strategic Imperatives 1 & 2 as identified in Exhibit 1
Source and Nature of the Information Used to Justify the Investment	Field inspections and asset condition data for line assets.
Secondary Driver (5.4.5.2.B.1.a)	The secondary driver for these projects are retirement of municipal transformer stations in need of otherwise expensive upgrades. Over time, uprating the operating voltage during renewal projects from 4kV to 13.8kV eliminates the need to operate, maintain, and upgrade municipal transformer stations required for providing electrical connectivity between the 13.8kV and the 4kV systems. This project directly contributes to WNH's ability to retire MS1 and MS 5 (which are in fair to poor condition and at elevated risk of failure) by the end of 2016. While capacity is not a driving factor for any projects under this DSP, uprating of 4kV distribution system to higher more efficient operating voltages also has the side benefits of slightly lower line losses as well as ability to accept more load and/or generation customers. Some of the uprated circuits planned for operation at 13.8kV will aid in transferring load between transmission points of supply, which aligns directly with methodologies used in regional planning where recovery from certain failure contingencies on the transmission system can be mitigated at the distribution level. These capabilities are counted upon and factored into needs assessments performed at the regional planning level.
Related Objectives/Performance Targets	WNH Strategic Imperatives 5, 6, & 9 as identified in Exhibit 1
Source and Nature of the Information Used to Justify the Investment	Field inspections and asset condition data for station assets.
Investment Priority (5.4.5.2.B.1.b)	System Access investments are ranked as top priority, since they are required to be compliant with regulations. Under the System Renewal category, WNH identifies pole line sections in poor condition based on field inspections, pole testing program, and investigations into failures and power quality issues. Assets found at risk of imminent failure are prioritized for immediate replacement. To prioritize the replacement of the remaining assets in poor condition, WNH takes into account additional drivers or benefits of completing the project. This typically includes improvements in: safety, reliability, power quality, opportunity for loss reduction (voltage uprating), operational flexibility, accessibility to operate and maintain, ability to address future system growth or restoration needs, and regulatory compliance. The more drivers or benefits are attributed to a project (other than age and condition), the higher its priority. Investments in System Service and General Plant categories are prioritized in a similar fashion. Analysis of impact on customers and consideration of impact of project deferral are also considered. The compiled list of projects is reviewed and prioritized by Senior WNH Engineering, Operations, IT and Finance staff. Based on the outcome of this process, this project ranks 9 out of 15.

Analysis of the Project and Project Alternatives (5.4.5.2.B.1.c)

Effect on system operation efficiency and cost effectiveness	The renewal on this project will permit the operation of lines at 13.8kV, which increases flexibility of the system as a whole in outage scenarios and day to day switching. It will also contribute to a small reduction of line loss on the system. In addition, the two 13.8kV circuits that supply power to the 4kV stations have been among WNH worst performing feeders (ER42, HS27) over the last 5 years. Replacement of pole lines that currently carry both, a 13.8kV and a 4kV circuit will also improve reliability to all other customers elsewhere on those particular 13.8kV circuits.
Net benefits accruing to customers	The renewal of this infrastructure will have the following benefits: the removal of risk of prolonged outages associated with failures of transformer station assets as well as line sections in poor condition, improvements in safety, avoidance of an increase to maintenance costs, increased flexibility of the system via harmonization of the distribution voltage to 13.8kV, a decrease in line losses, increase in capacity for connection of REG on voltage converted sections, and significant improvement in ability to restore power during major loss of supply events.
Impact on reliability performance (including on the frequency and duration of outages)	The completion of this project is expected to have a positive effect on reliability over time for the following reasons: a) voltage harmonization allowing greater flexibility in responding to distribution system events b) improved tie capabilities to restore power to more customers during major loss of supply events c) replacing aging infrastructure on two of WNH's worst performing feeders

Project Alternatives

All pole line sections under this project have been identified as being at the end of their useful life and in need of replacement. In light of this fact, WNH considered the following alternatives:
a) Do Nothing - this option results in the perpetuation of operational issues and higher line losses, increased risk of safety incidents, further deterioration resulting in a decrease in reliability. This option would trigger the need for expensive station upgrades, as well as the addition of new lines in areas where they presently don't exist to satisfy the operating need for more tie lines between transmission points of supply. For all these reasons, the Do Nothing option is not considered appropriate.
b) Refurbish the lines - these line sections are not appropriate candidates for refurbishment as most poles are too short and structurally too weak to comply with today's safety standards as required by O. Reg. 22/04
c) Replace Like for Like - existing poles are too short and structurally too weak to comply with today's safety standards, so true Like-for-Like replacement is not an option. Furthermore, today's safety standards require same class and height of poles for 4kV and 13.8kV systems and certain 4kV components are no longer available from manufacturers as they are considered obsolete technology, effectively causing the pole lines to be built to 15kV standards. In addition, this option would not address the operational need for more tie lines between transmission points of supply (which would cause negative tree trimming impact to a neighbourhood with established mature trees) and would immediately trigger the need for expensive station refurbishment at MS1. For all these reasons, the Replace Like for Like option is not considered appropriate nor technically feasible.
d) Replace all existing lines with new 13.8kV lines - this option allows for replacement of aged equipment, eliminates the need for expensive station upgrades, provides operational flexibility by harmonizing the system voltage, and allows for new tie lines to be implemented in the least obtrusive way to the neighbourhoods.

Safety (5.4.5.2.B.2)

Upon completion of these projects, safety risks associated with old construction methods such as under slung transformers and small conductors that have a tendency to become brittle and break will be eliminated.

Under slung transformers do not meet current safety standard since they result in installation of high voltage components in the low voltage space on the pole. This potential hazard impacts hydro workers and communication company workers.

These projects also involve replacement of small conductors which are prone to failure due to brittleness and presents a hazard to the public and all workers. The failure can result in hazards such as energization of the earth near the fallen conductor potentially causing electrocution of any person nearby, fire on the ground as well as at the pole, and falling debris due to fire.

Presently hazards associated with under slung transformers and undersized conductors for WNH workers are managed by appropriate safety policies and procedures. The new construction standards make work on pole lines much safer for all workers due to increased separation of high voltage conductors between themselves as well as from low voltage conductors and communication company equipment.

Cyber-security, Privacy (5.4.5.2.B.3)

Not Applicable.

Co-ordination, Interoperability (5.4.5.2.B.4)

Co-ordination with utilities, regional planning and/or links with 3rd party providers and/or industry (5.4.5.2.B.4.a)

WNH has been meeting with the area Utility Coordinating Council, municipal staff, and third party stakeholders to exchange project details to coordinate construction since 2014 as part of the Area Plan Development for this neighbourhood and will continue the coordination efforts until project completion.

Some of the new circuits will aid in transferring load between transmission points of supply which aligns directly with methodologies used in regional planning where recovery from certain failure contingencies on the transmission system can be mitigated at the distribution level. These capabilities are counted upon and factored into needs assessments performed at the regional planning level.

Enabling of future technological functionality or addressing of future operational requirements (5.4.5.2.B.4.b)

The new construction standards provide space for future equipment to be installed with less difficulty.

Economic Development (5.4.5.2.B.5)

These projects are renewals of existing lines within fully developed parts of WNH's service area. There will be very limited economic development directly attributable to this project, although the 13.8kV lines will provide more capacity than available today if future in-fill development projects required it.

Environmental Benefits (5.4.5.2.B.6)

Albeit small, these projects may have a positive environmental benefit due to reduction in power generation requirements, and hence greenhouse gases, as follows:
a) reduction in losses due to voltage upgrade
b) increased capacity for green generation due to voltage upgrade
c) resolution of transmission system failures at the distribution level.

SYSTEM RENEWAL SPECIFIC REQUIREMENTS (5.4.5.2.C.b)

Category-specific requirements - System Renewal (5.4.5.2.C.b.)

Relationship between the Characteristics of Targeted Assets and the Consequences of Asset Failure (5.4.5.2.C.b.first bullet)

Asset Performance Targets and Asset Lifecycle Optimization Policies and Practices (5.4.5.2.C.b.first bullet.first dash)

The majority of the poles, conductors and equipment have been found through inspection to be in poor condition and are over 45 years of age and past their TUL (Table 3-24 of the DSP).

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.first bullet.second dash)

The majority of the poles, conductors and equipment are generally in poor condition, which is expected as the areas identified under this project are found in the oldest parts of the City of Waterloo. Most of the pole lines were installed between early 1950's and early 19070's. The poles that are newer lack the required height and structural strength to meet today's safety standards required by O. Reg. 22/04. Hence, these pole lines must be considered in their entirety and under that lens, these assets are, for the most part, considered in poor condition and past their useful life.

Number of Customers in Each Class Potentially Affected (5.4.5.2.C.b.first bullet.third dash)

This project affects 972 residential customers, 112 small commercial customers, and 11 large commercial customers.

Quantitative Customer Impact and Risk (5.4.5.2.C.b.first bullet.fourth dash)

Quantitative customer impact and risk are not currently available.

Qualitative Customer Impact and Risk (5.4.5.2.C.b.first bullet.fifth dash)

The renewal of these sections of line will ensure future level of reliability is maintained, eliminate safety issues and allow for increased flexibility of the operation of the grid. All of this will maintain or improve customer satisfaction.

Value of Customer Impact (5.4.5.2.C.b.first bullet.sixth dash)

Customer impact in terms of potential failure is medium. These line sections supply a mix of residential and small and large commercial customers including schools, retail locations, and business offices. Although costs of repair of failed assets are high, the problem can be located quickly, and the risk of prolonged outages are low.

Other Factors Affecting Project Timing (5.4.5.2.C.b.second bullet)

Any delays in executing these projects would delay decommissioning MS1 and MS5 by the end of 2016, which are in fair to poor condition (Table 3-19 of the DSP) , significantly increasing the risk of prolonged outages due to major component failure at the station for the customers connected to or through these lines. Due to the age and condition of the infrastructure, this project needs to be completed. See Investment Priority section 5.4.5.2.B.1.b above for further details on project ranking.

The Region of Waterloo has undertaken a major project of installing a Light Rail Transit system, which is planned to run through the heart of the City of Waterloo where most of the lines that form this project are located. Some brownfield re-development has already begun in anticipation of the LRT installation and this is expected to ramp up after the LRT system becomes operational (scheduled for 2017). Renewal of these deteriorated lines and uprating of voltage to 13.8kV prior to 2017 has the added benefit of accommodating in-fill development and doing so in an organized manner as not to cause unnecessary delays in connections of new customers, should they materialize.

Consequences for System O&M costs (5.4.5.2.C.b.third bullet)

This project supports the retirement of 2 municipal substations and the elimination of their respective O&M costs (approximately $17,000 per station annually). There will be no immediate material impact to O&M costs for distribution lines. The renewal of the 4kV system as a whole will help reduce equipment failure, eliminate safety hazards, and correct substandard conditions prevalent with this vintage of assets, all of which will help reduce future O&M costs. The elimination of the 4kV system also as a whole will result in increased operational flexibility, increased reliability through greater redundancy and options for the resupply of customers formerly in the 4kV area from neighbouring 13.8kV stations, reduced line losses, reduced inventory levels and carrying costs, all of which will help reduce O&M costs. Eventually, System O&M resources that were dedicated to the 4kV issues on these lines will be available for other O&M tasks at WNH.

Reliability and Safety Factors (5.4.5.2.C.b.fourth bullet)

The two 13.8kV feeders which are routed through the neighbourhood affected by this rebuild and supply power to the two remaining 4kV stations have been amongst the feeders experiencing most momentary interruptions (approximately 25 interruptions per year for both feeders). This number is expected to be significantly reduced once all above identified line sections are rebuilt.

Analysis of Project Benefits and Timing (5.4.5.2.C.b.fifth bullet)

The line sections identified in this project are definitely in poor condition and need to be completed. There are no risks to execution that have not already been addressed.

Like for Like Renewal Analysis (5.4.5.2.C.b.sixth bullet)

Not Applicable. Like for Like Renewal was determined not to be appropriate. See Section 5.4.5.2.B.1.c above for further details.

2016 Capital Project Summary

GENERAL INFORMATION ON THE PROJECT/ACTIVITY (5.4.5.2.A)

Project Name Overhead Line Refurbishment (4kV)

Investment Category System Renewal

Project Description

This project category is a companion project to the Overhead Line Renewal (4kV) project. It consists of line sections in good condition constructed between mid 1980's to mid 1990's and well within their typical useful life, which presently operate at 4kV and would provide system benefits if they were uprated to operate at 13.8kV.

The work required to complete this project varies with age of plant. Most of the line sections from the 1990's already use uprated switches and insulators as well as transformers capable of operation at 13.8kV voltage, and therefore, the scope of work for those lines consists of minimal reconfiguration changes. The line sections from mid 1980's may require replacement of small hardware and some equipment. All original major pole line components such as poles and wire will remain in service.

This project together with its companion 4kV Overhead Line Renewal project will enable WNH to complete its 20+ year voltage conversion program in the City of Waterloo and support decommissioning of the remaining two 4kV municipal stations (MS1 and MS5) by the end of 2016, which are near or past the end of their useful life and in need of substantial upgrades.

Detailed Listing of Affected Line Sections

The following line sections are covered by this project category:

WNH Project	Sub Project	Project Name	Total
06EN04	7	4kV OH Conversions	$205,390
06EN04	33	City 4kV Reinsulate - Allen St - Railway to King St & side streets	$60,513
06EN04	34	City 4kV Reinsulate - Bridgeport Rd - Weber St to Ellis St	$64,132
06EN04	35	City 4kV Reinsulate - Herbert St - William St to Union St	$43,659
06EN04	36	City 4kV Reinsulate - Moore Ave - Allen St to Union St	$28,324
06EN04	42	Uptown 4kV Reinsulate - William St - Roslin Ave to Caroline St	$82,935
		Total	$ 484,953

Capital Investment (5.4.5.2.A.first bullet)

Gross Capital	$484,953
Customer Contribution	$0.00
Net Capital	$484,953
O&M Costs (if applicable)	$0.00 (not applicable)

Customer Attachments/Load (kVA) (5.4.5.2.A.second bullet)

Customer Attachments (#): 627
Customer Load (peak KVA) 1807

Project Timing (5.4.5.2.A.third bullet)

Start Date: January 2016 - Engineering; February 2016 - Construction

Expected In-Service Date: December 2016

Expenditure Timing

Q1:	20%	$96,991
Q2:	30%	$145,486
Q3:	30%	$145,486
Q4:	20%	$96,991

Risk and Risk Mitigation (5.4.5.2.A.fourth bullet) There are no significant risks associated with execution of this project.

Comparative Information (5.4.5.2.A.fifth bullet)

Comparable investments in previous years are as follows:

2011:	$0
2012:	$0
2013:	$0
2014:	$99,682
2015:	$107,017

4kV refurbishment projects are infrequent in the historical years because WNH's practice is to uprate assets at time of renewal, so most 4kV related projects are full renewal projects. WNH has been doing this for over 20 years, which resulted in remnant sections of the distribution system still operating at the outdated 4kV voltage. Uprating the remaining remnant 4kV lines is the lower cost option to enable the immediate replacement of station assets in poor condition at MS1 and MS5, and hence, all remnant lines have been scheduled for completion in 2016.

Total Capital & OM&A Costs Associated with REG Investments (5.4.5.2.A.sixth bullet) No Capital or OM&A Costs for REG investments are associated with this project. However, ability to connect more generation is a side benefit of voltage uprating.

Leave to Construct Approval (5.4.5.2.A.seventh bullet) Not Applicable

Evaluation Criteria and information requirements (5.4.5.2.B)

EVALUATION CRITERIA AND INFORMATION REQUIREMENTS (5.4.5.2.B)

Efficiency, Customer Value, Reliability (5.4.5.2.B.1)

Main Driver (5.4.5.2.B.1.a)

The main driver for this project is its support of the retirement of the last 2 municipal sub stations in the City (MS1 and MS5) by the end of 2016. MS1 and MS5 station components are in poor condition and at elevated risk of failure (transformers at MS1 and breakers at MS5).

Related Objectives/Performance Targets

WNH Strategic Imperative 1 as identified in Exhibit 1

Source and Nature of the Information Used to Justify the Investment

Field inspections and asset condition data for station assets.

Secondary Driver (5.4.5.2.B.1.a)

The secondary driver for this project is increased efficiency and operational flexibility resulting from harmonizing operating voltages within the City of Waterloo core area to 13.8kV.

Some of the uprated circuits will aid in transferring load between transmission points of supply which aligns directly with methodologies used in regional planning where recovery from certain failure contingencies on the transmission system can be mitigated at the distribution level. These capabilities are counted upon and factored into needs assessments performed at the regional planning level.

Related Objectives/Performance Targets

WNH Strategic Imperatives 5, 6, & 9 as identified in Exhibit 1

Source and Nature of the Information Used to Justify the Investment

WNH Strategic Imperatives of Productivity and Cost reduction as well as Organizational Effectiveness.

Investment Priority (5.4.5.2.B.1.b)

System Access investments are ranked as top priority, since they are required to be compliant with regulations.

Under the System Renewal category, WNH identifies assets in poor condition or requiring modifications based on field inspections, testing programs, and investigations into failures and power quality issues. Assets found at risk of imminent failure are prioritized for immediate implementation. To prioritize the replacement or refurbishment of the remaining assets, WNH takes into account additional drivers or benefits of completing the project. This typically includes improvements in: safety, reliability, power quality, opportunity for loss reduction (voltage uprating), operational flexibility, accessibility to operate and maintain, ability to address future system growth or restoration needs, and regulatory compliance. The more drivers or benefits are attributed to a project (other than age and condition), the higher its priority. This project is an efficient alternative to immediate replacement of station assets found near or past the end of their useful life.

Investments in System Service and General Plant categories are prioritized in a similar fashion. Analysis of impact on customers and consideration of impact of project deferral are also considered. The compiled list of projects is reviewed and prioritized by Senior WNH Engineering, Operations, IT and Finance staff. Based on the outcome of this process, this project ranks 10 out of 15.

Analysis of the Project and Project Alternatives (5.4.5.2.B.1.c)

Effect on system operation efficiency and cost effectiveness

The completion of this project will support the removal from service, 2 municipal sub stations with a total of 3 station transformers, reduce associated operating and maintenance costs, and avoid the need for expensive station asset replacement. It will also permit the operation of lines at 13.8kV, which increases flexibility of the system as a whole in outage scenarios and day to day switching and contributes to a small reduction of line loss on the system.

Net benefits accruing to customers

The renewal of this infrastructure will have the following benefits: the removal of risk of prolonged outages associated with failures of transformer station assets, improvements in safety, avoidance of an increase to maintenance costs, increased flexibility of the system via harmonization of the distribution voltage to 13.8kV, a decrease in line losses, increase in capacity for connection of REG, and significant improvement in ability to restore power during major loss of supply events.

Impact on reliability performance (including on the frequency and duration of outages)

The completion of this project is expected to have a positive effect on reliability over time for the following reasons:
a) voltage harmonization allowing greater flexibility in responding to distribution system events
b) improved tie capabilities to restore power to more customers during major loss of supply events
c) life extension for equipment installed on existing pole lines

Project Alternatives

All pole line sections under this project have been identified as being in relatively good condition and not yet at the end of their useful life. In light of this fact, WNH considered the following alternatives:
a) Do Nothing - this option results in the perpetuation of operational issues and higher line losses, inability to connect larger load or generation customers, system segmentation resulting in inability to fully restore customers during major transmission events. This option would immediately trigger the need for expensive station upgrades (transformer upgrade at MS1 at approximately $720,000 and breaker upgrade at MS5 at approximately $100,000), as well as addition of new lines in areas where they presently don't exist to satisfy the operating need for more tie lines between transmission points of supply (approximately $105,000) . For all these reasons, the Do Nothing option is not considered appropriate.
b) Refurbish the lines - these line sections are appropriate candidates for uprating as most poles are tall enough and structurally strong enough to comply with today's safety standards as required by O. Reg. 22/04. It provides operational flexibility by harmonizing the system voltage, eliminates the need for expensive station upgrades, and allows for new tie lines to be implemented in the least obtrusive way to the neighbourhoods, and is therefore, the preferred solution.
c) Replace Like for Like - for new construction, today's safety standards require same class and height of poles for 4kV and 13.8kV systems. Furthermore, certain 4kV components are no longer available from manufacturers as they are considered obsolete technology, hence the pole lines would have to be build to 15kV standards. In addition, this option would not address the operational need for more tie lines between transmission points of supply and would also trigger the need for expensive station refurbishment. For all these reasons, the Replace Like for Like option is not considered appropriate nor technically feasible.
d) Replace all existing lines with new 13.8kV lines - this option allows for replacement of aged equipment, eliminates the need for expensive station upgrades, provides operational flexibility by harmonizing the system voltage, and allows for new tie lines to be implemented in the least obtrusive way to the neighbourhoods. However, it requires replacement of assets still in good condition. In presence of an acceptable and less costly alternative, this option is not preferred.

Safety (5.4.5.2.B.2)

Even though these projects are not meant to address safety concerns, there will be some improvement in safety due to use of newer materials with more safety related features (example, transformers with current limiting fuses).

Cyber-security, Privacy (5.4.5.2.B.3)

Not Applicable.

Co-ordination, Interoperability (5.4.5.2.B.4)

Co-ordination with utilities, regional planning and/or links with 3rd party providers and/or industry (5.4.5.2.B.4.a)

Not Applicable. This project involves reconfiguration of equipment and hardware on existing pole lines, and as such, is not impactive to other utilities, regional planning, 3rd parties and/or industry.

Enabling of future technological functionality or addressing of future operational requirements (5.4.5.2.B.4.b)

Not Applicable.

Economic Development (5.4.5.2.B.5)

These projects are renewals of existing lines within fully developed parts of WNH's service area. There will be very limited economic development directly attributable to this project, although the 13.8kV lines will provide more capacity than available today if future in-fill development projects required it.

Environmental Benefits (5.4.5.2.B.6)

Albeit small, these projects may have a positive environmental benefit due to reduction in power generation requirements, and hence greenhouse gases, as follows:
a) reduction in losses due to voltage upgrade
b) increased capacity for green generation due to voltage upgrade
c) resolution of transmission system failures at the distribution level.

SYSTEM RENEWAL SPECIFIC REQUIREMENTS (5.4.5.2.C.b)

Category-specific requirements - System Renewal (5.4.5.2.C.b.)

Relationship between the Characteristics of Targeted Assets and the Consequences of Asset Failure (5.4.5.2.C.b.first bullet)

Asset Performance Targets and Asset Lifecycle Optimization Policies and Practices (5.4.5.2.C.b.first bullet.first dash)

The majority of the poles and conductors in these pole lines are in good condition and have 35-45% remaining life based on age. As reinsulation projects typically cost approximately 25% compared to renewal, it is economical to proceed with this asset investment. If, by the time WNH proceeds to detailed design and construction, it will be evident that the poles are deteriorating faster than anticipated, the affected line sections will undergo a full renewal rather than uprating, based on actual asset condition.

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.first bullet.second dash)

The majority of assets are in good condition, do not require replacement, and will be reused. This is expected as a majority of assets are approximately 20 years old. As some assets approach 30 years of age, those will undergo a closer examination to ensure that there are no signs of premature deterioration.

Number of Customers in Each Class Potentially Affected (5.4.5.2.C.b.first bullet.third dash)

This project affects 596 residential customers, 27 small commercial customers, and 4 large commercial customers.

Quantitative Customer Impact and Risk (5.4.5.2.C.b.first bullet.fourth dash)

Quantitative customer impact and risk are not currently available.

Qualitative Customer Impact and Risk (5.4.5.2.C.b.first bullet.fifth dash)

The renewal of this section of line will ensure future level of reliability is maintained, allow for increased flexibility of the operation of the grid, and avoid unnecessary costs associated with refurbishing stations or installing additional tie lines. All of this will maintain or improve customer satisfaction.

Value of Customer Impact (5.4.5.2.C.b.first bullet.sixth dash)

Customer impact in terms of potential failure is medium. These line sections supply a mix of residential and small commercial customers including schools, retail locations, and business offices. Although costs of repair of failed assets are high, the problem can be located quickly, and the risk of prolonged outages is low.

Other Factors Affecting Project Timing (5.4.5.2.C.b.second bullet)

Any delays in executing these projects would delay decommissioning MS1 and MS5 by the end of 2016, which are in fair to poor condition (Table 3-19 of the DSP) , significantly increasing the risk of prolonged outages due to major component failure at the station for the customers connected to or through these lines. Due to the age and condition of the stations infrastructure, this project needs to be completed. See Investment Priority section 5.4.5.2.B.1.b above for further details on project ranking.

The Region of Waterloo has undertaken a major project of installing a Light Rail Transit system, which is planned to run through the heart of the City of Waterloo where most of the lines that form this project are located. Some brownfield re-development has already begun in anticipation of the LRT installation and this is expected to ramp up after the LRT system becomes operational (scheduled for 2017). Renewal of these deteriorated lines and uprating of voltage to 13.8kV prior to 2017 has the added benefit of accommodating in-fill development and doing so in an organized manner as not to cause unnecessary delays in connections of new customers, should they materialize.

Consequences for System O&M costs (5.4.5.2.C.b.third bullet)

This project supports the retirement of 2 municipal substations and the elimination of their respective O&M costs (approximately $17,000 per station annually). There will be no immediate material impact to O&M costs for distribution lines. The renewal of the 4kV system as a whole will help reduce equipment failure, eliminate safety hazards, and correct substandard conditions prevalent with this vintage of assets, all of which will help reduce future O&M costs. The elimination of the 4kV system also as a whole will result in increased operational flexibility, increased reliability through greater redundancy and options for the resupply of customers formerly in the 4kV area from neighbouring 13.8kV stations, reduced line losses, reduced inventory levels and carrying costs, all of which will help reduce O&M costs. Eventually, system O&M resources that were dedicated to the 4kV issues on these lines will be available for other O&M tasks at WNH.

Reliability and Safety Factors (5.4.5.2.C.b.fourth bullet)

There will be no immediate significant impact on system reliability nor safety, however, completion of these projects will reduce the risk of further deterioration of reliability and safety concerns.

Analysis of Project Benefits and Timing (5.4.5.2.C.b.fifth bullet)

Based on inspection and testing data, the station assets are definitely in poor condition and in need of immediate replacement. This project is a lower cost and more efficient alternative to the required station upgrades and there are no significant risks to its execution.

Like for Like Renewal Analysis (5.4.5.2.C.b.sixth bullet)

Not Applicable. Like for Like Renewal was determined not to be appropriate. See Section 5.4.5.2.B.1.c above for further details.

Waterloo North Hydro Inc.

GENERAL INFORMATION ON THE PROJECT/ACTIVITY (5.4.5.2.A)

2016 Capital Project Summary

Project Name	Reactive Renewal
Investment Category	System Renewal
Project Description	Reactive renewal projects represent small unplanned projects over the year that consist of assets that are failed, are about to fail, or present a safety hazard to the public. The commonality in these projects is that they are small (typically 5 poles or less), typically have caused an outage or a safety hazard to the general public, require immediate replacement, and for the most part, are unforeseen. These projects typically arise from trouble calls, storm damage, dig-in damage, accidents, fires, etc. as well as information provided from third parties (ESA, customers, communication companies).
Detailed Listing of Affected Line Sections	The following projects are covered by this project category:

WNH Project	Sub Project	Project Name	Total
06EN04	2	Storm and Equipment Damage	$228,539
		Total	$ 228,539

Capital Investment (5.4.5.2.A.first bullet)

Gross Capital	$228,539
Customer Contribution	$0.00
Net Capital	$228,539
O&M Costs (if applicable)	$0.00 (not applicable)

Customer Attachments/Load (kVA) (5.4.5.2.A.second bullet)

Customer Attachments (#): Information not available until time of work
Customer Load (peak KVA) Information not available until time of work

Project Timing (5.4.5.2.A.third bullet)

Start Date: January 2, 2016

Expected In-Service Date: December 30, 2016

Expenditure Timing

Q1:	25%	$57,135
Q2:	25%	$57,135
Q3:	25%	$57,135
Q4:	25%	$57,135

Risk and Risk Mitigation (5.4.5.2.A.fourth bullet) A risk with this project is the inherent uncertainty. The investment amount is based on historical investment levels.

Comparative Information (5.4.5.2.A.fifth bullet)

Comparable investments in previous years are as follows:

2011:	$167,071
2012:	$158,557
2013:	$778,487
2014:	$461,312
2015:	$190,963

Total Capital & OM&A Costs Associated with REG Investments (5.4.5.2.A.sixth bullet) Not Applicable

Leave to Construct Approval (5.4.5.2.A.seventh bullet) Not Applicable

EVALUATION CRITERIA AND INFORMATION REQUIREMENTS (5.4.5.2.B)

Evaluation Criteria and information requirements (5.4.5.2.B)

Efficiency, Customer Value, Reliability (5.4.5.2.B.1)

Main Driver (5.4.5.2.B.1.a)

The main driver behind the majority of these projects is the requirement to replace failed assets or end of life assets that were not scheduled for replacement, but due to their present condition must be replaced immediately to ensure that safety and reliability are not further compromised.

Related Objectives/Performance Targets

WNH Strategic Imperatives 1 & 2 as identified in Exhibit 1

Source and Nature of the Information Used to Justify the Investment

Asset condition at the time of discovery and consequences of not doing anything provide the justification required.

Secondary Driver (5.4.5.2.B.1.a)

Not Applicable

Related Objectives/Performance Targets

Not Applicable

Source and Nature of the Information Used to Justify the Investment

Not Applicable

Investment Priority (5.4.5.2.B.1.b)

System Access investments are ranked as top priority, since they are required to be compliant with regulations.

Under the System Renewal category, WNH identifies pole line sections in poor condition based on field inspections, pole testing program, and investigations into failures and power quality issues. Assets found at risk of imminent failure are prioritized for immediate replacement. To prioritize the replacement of the remaining assets in poor condition, WNH takes into account additional drivers or benefits of completing the project. This typically includes improvements in: safety, reliability, power quality, opportunity for loss reduction (voltage uprating), operational flexibility, accessibility to operate and maintain, ability to address future system growth or restoration needs, and regulatory compliance. The more drivers or benefits are attributed to a project (other than age and condition), the higher its priority.

Investments in System Service and General Plant categories are prioritized in a similar fashion. Analysis of impact on customers and consideration of impact of project deferral are also considered. The compiled list of projects is reviewed and prioritized by Senior WNH Engineering, Operations, IT and Finance staff. Based on the outcome of this process, this project ranks 2 out of 15.

Analysis of the Project and Project Alternatives (5.4.5.2.B.1.c)

Effect on system operation efficiency and cost effectiveness

Not Applicable

Net benefits accruing to customers

All projects ensure the elimination of safety hazards and that reliability is maintained.

Impact on reliability performance (including on the frequency and duration of outages)

Reliability may be impacted by failed assets involved in these projects. Replacement of failed assets will help improve reliability in the future.

Project Alternatives

Alternatives are rarely considered for these projects as the majority involve like for like replacements (to current safety standards). At times, pole heights will be adjusted to align to future needs and transformer sizing may be increased or decreased based on actual loading information. Both adjustments are made to avoid future costs.

Safety (5.4.5.2.B.2)

The majority of these projects involve assets that have failed or are about to fail, and therefore, the work almost always involves eliminating a current or soon to be safety hazard.

Cyber-security, Privacy (5.4.5.2.B.3)

Not Applicable.

Co-ordination, Interoperability (5.4.5.2.B.4)

Co-ordination with utilities, regional planning and/or links with 3rd party providers and/or industry (5.4.5.2.B.4.a)

Not Applicable.

Enabling of future technological functionality or addressing of future operational requirements (5.4.5.2.B.4.b)

Not Applicable.

Economic Development (5.4.5.2.B.5)

Not Applicable.

Environmental Benefits (5.4.5.2.B.6)

Not Applicable.

Category-specific requirements - System Renewal (5.4.5.2.C.b.)

SYSTEM RENEWAL SPECIFIC REQUIREMENTS (5.4.5.2.C.b)

Relationship between the Characteristics of Targeted Assets and the Consequences of Asset Failure (5.4.5.2.C.b.first bullet)

Asset Performance Targets and Asset Lifecycle Optimization Policies and Practices (5.4.5.2.C.b.first bullet.first dash)

The majority of assets involved with these projects are replaced because they have failed or are close to failure, and therefore, in line with lifecycle optimization policies and practices.

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.first bullet.second dash)

The majority of assets involved with these projects are replaced because they have failed or are close to failure, and therefore, have reached the end of their useful life. The asset condition relative to typical life varies project by project due to the unpredictable nature of the source of failure (storm, automobile impact, premature failure, etc.). For example, if a municipality re-graded an area after pole installation so that soil is above the treatment line of a pole, such pole may fail during a storm only after 20-30 years in service, so much sooner than the typical useful life of the pole asset pool.

Number of Customers in Each Class Potentially Affected (5.4.5.2.C.b.first bullet.third dash)

The number of customers varies project by project.

Quantitative Customer Impact and Risk (5.4.5.2.C.b.first bullet.fourth dash)

Quantitative customer impact varies project by project.

Qualitative Customer Impact and Risk (5.4.5.2.C.b.first bullet.fifth dash)

The renewal of these assets will typically result in outage restoration activities being immediately undertaken, eliminate safety issues, ensure future level of reliability is maintained, and provide room on the pole for future requirements. All of which will maintain or improve customer satisfaction.

Value of Customer Impact (5.4.5.2.C.b.first bullet.sixth dash)

Value of customer impact varies project by project.

Other Factors Affecting Project Timing (5.4.5.2.C.b.second bullet)

Due to the nature of the projects, they are done immediately or scheduled very quickly.

Consequences for System O&M costs (5.4.5.2.C.b.third bullet)

These projects do not materially impact system O&M costs.

Reliability and Safety Factors (5.4.5.2.C.b.fourth bullet)

There will be no material impact on reliability, however, spot replacement of end of life assets as a whole will help reduce interruptions related to failed equipment. The elimination of safety hazards were considered as factors to the importance of the project as described above.

Analysis of Project Benefits and Timing (5.4.5.2.C.b.fifth bullet)

Investments in this category are required immediately and are not subject to prioritization as they are, for the most part, mandatory in order to restore loss of service conditions, eliminate safety hazards to the public, and/or comply with safety regulations.

Like for Like Renewal Analysis (5.4.5.2.C.b.sixth bullet)

The majority of the assets replaced in this category fall as close as possible to like-for-like renewal, adjusted only by requirement to adhere to current safety standards or to provide pole space for future circuits. Given the nature of the small scope of work for these types of projects (typically 5 poles or less), providing pole space for a future circuit is not a significant cost increase to the individual project (approximately 1%).

Waterloo North Hydro Inc.

2016 Capital Project Summary

GENERAL INFORMATION ON THE PROJECT/ACTIVITY (5.4.5.2.A)

Project Name Proactive Renewal

Investment Category System Renewal

Project Description Proactive renewal projects represent small unplanned projects over the year that consist of assets that are found in very poor condition or present a safety hazard. The commonality in these projects is that they are identified through regular inspection and testing programs, require immediate replacement, are small in scope, are at several different locations, and for the most part, are unforeseen. These type of projects typically arise from equipment maintenance, system inspection, testing programs and have not yet caused an outage or a safety hazard to the general public.

Detailed Listing of Affected Line Sections The following projects are covered by this project category:

WNH Project	Sub Project	Project Name	Total
06EN04	6	Pole Testing Program Replacements	$82,645
06OH01	1	Depreciated Pole Replacements	$138,951
06OH01	2	OH Transformer Replacement	$53,608
06OH01	3	Re-Insulating Overhead Lines	$144,214
06OH01	4	Load Break Replacement	$84,708
07OU01	1	Switch Cubicle Replacement	$101,119
07OU01	2	UG Transformer Replacement	$158,187
		Total	$ 763,432

Capital Investment (5.4.5.2.A.first bullet)

Gross Capital	$763,432
Customer Contribution	$0.00
Net Capital	$763,432
O&M Costs (if applicable)	$0.00 (not applicable)

Customer Attachments/Load (kVA) (5.4.5.2.A.second bullet)

Customer Attachments (#): Information not available until time of work
Customer Load (peak KVA) Information not available until time of work

Project Timing (5.4.5.2.A.third bullet)

Start Date January 2, 2016

Expected In-Service Date December 30, 2016

Expenditure Timing

Q1:	25%	$190,858
Q2:	25%	$190,858
Q3:	25%	$190,858
Q4:	25%	$190,858

Risk and Risk Mitigation (5.4.5.2.A.fourth bullet) Not Applicable

Comparative Information (5.4.5.2.A.fifth bullet)

Comparable investments in previous years are as follows:

2011:	$1,300,280
2012:	$1,295,422
2013:	$812,348
2014:	$1,074,191
2015:	$765,779

Historical years 2013 as well as 2015 are representative of this project. This is because in 2012 WNH completed a multi-year proactive replacement project of a specific style of padmounted switchgear which was failing prematurely. In 2014, WNH had to make a substantial investment into re-insulating a critical multi-circuit line alongside a major highway as the salt accumulation degraded the insulators prematurely. WNH owns only a few lines alongside highways, so the 2014 investment level is not expected to be required on an annual basis.

Total Capital & OM&A Costs Associated with REG Investments (5.4.5.2.A.sixth bullet) Not Applicable

Leave to Construct Approval (5.4.5.2.A.seventh bullet) Not Applicable

EVALUATION CRITERIA AND INFORMATION REQUIREMENTS (5.4.5.2.B)

Evaluation Criteria and information requirements (5.4.5.2.B)

Efficiency, Customer Value, Reliability (5.4.5.2.B.1)

Main Driver (5.4.5.2.B.1.a)	The main driver behind the majority of these projects is the requirement to replace end of life assets that were not scheduled for replacement, but due to their present condition must be replaced immediately to ensure that safety and reliability are not compromised.
Related Objectives/Performance Targets	WNH Strategic Imperatives 1 & 2 as identified in Exhibit 1
Source and Nature of the Information Used to Justify the Investment	Asset condition at the time of discovery and consequences of not doing anything provide the justification required.
Secondary Driver (5.4.5.2.B.1.a)	Not Applicable
Related Objectives/Performance Targets	Not Applicable
Source and Nature of the Information Used to Justify the Investment	Not Applicable
Investment Priority (5.4.5.2.B.1.b)	System Access investments are ranked as top priority, since they are required to be compliant with regulations. Under the System Renewal category, WNH identifies pole line sections in poor condition based on field inspections, pole testing program, and investigations into failures and power quality issues. Assets found at risk of imminent failure are prioritized for immediate replacement. To prioritize the replacement of the remaining assets in poor condition, WNH takes into account additional drivers or benefits of completing the project. This typically includes improvements in: safety, reliability, power quality, opportunity for loss reduction (voltage uprating), operational flexibility, accessibility to operate and maintain, ability to address future system growth or restoration needs, and regulatory compliance. The more drivers or benefits are attributed to a project (other than age and condition), the higher its priority. Investments in System Service and General Plant categories are prioritized in a similar fashion. Analysis of impact on customers and consideration of impact of project deferral are also considered. The compiled list of projects is reviewed and prioritized by Senior WNH Engineering, Operations, IT and Finance staff. Based on the outcome of this process, this project ranks 4 out of 15.

Analysis of the Project and Project Alternatives (5.4.5.2.B.1.c)

Effect on system operation efficiency and cost effectiveness	Not Applicable
Net benefits accruing to customers	All projects ensure the elimination of safety hazards and that reliability is maintained.
Impact on reliability performance (including on the frequency and duration of outages)	Reliability may be impacted by failed assets involved in projects. Replacement of failed assets will help improve reliability in the future.

Project Alternatives

Alternatives are often not considered for these projects as the majority involve like for like replacements (to current safety standards). At times, pole heights will be adjusted to align to future needs and transformer sizing may be increased or decreased based on actual loading information. Some load break switches may be replaced with automated switches and in other cases consideration may be given to relocating the equipment at the time of replacement if accessibility is an issue. All adjustments are made to avoid future costs.

Safety (5.4.5.2.B.2)

The majority of these projects involve assets that are about to fail, and therefore, the work almost always involves eliminating a soon to be safety hazard.

Cyber-security, Privacy (5.4.5.2.B.3)

Not Applicable.

Co-ordination, Interoperability (5.4.5.2.B.4)

Co-ordination with utilities, regional planning and/or links with 3rd party providers and/or industry (5.4.5.2.B.4.a)

Not Applicable.

Enabling of future technological functionality or addressing of future operational requirements (5.4.5.2.B.4.b)

Not Applicable.

Economic Development (5.4.5.2.B.5)

Not Applicable.

Environmental Benefits (5.4.5.2.B.6)

Replacing oil containing equipment (ex. rusty transformers) on a proactive basis mitigates negative impacts associated with oil spills.

SYSTEM RENEWAL SPECIFIC REQUIREMENTS (5.4.5.2.C.b)

Category-specific requirements - System Renewal (5.4.5.2.C.b.)

Relationship between the Characteristics of Targeted Assets and the Consequences of Asset Failure (5.4.5.2.C.b.first bullet)

Asset Performance Targets and Asset Lifecycle Optimization Policies and Practices (5.4.5.2.C.b.first bullet.first dash)

The majority of assets involved with these projects are replaced because they are close to failure, and therefore, in line with lifecycle optimization policies and practices.

For assets requiring attention, WNH considers all three options: replacement, refurbishment, and maintenance and chooses the most cost effective option from those technically available for each asset category. This investment category is for assets where replacement is the only or best viable option.

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.first bullet.second dash)

The majority of assets involved with these projects are replaced because they are close to failure, and therefore, have reached the end of their useful life. The asset condition relative to typical life varies project by project. For example, if grading has been done after pole installation so that soil is above the treatment line of a pole, such pole may fail after 20-30 years, so much sooner than the typical useful life of the pole asset pool.

Number of Customers in Each Class Potentially Affected (5.4.5.2.C.b.first bullet.third dash)

The number of customers varies project by project.

Quantitative Customer Impact and Risk (5.4.5.2.C.b.first bullet.fourth dash)

Quantitative customer impact varies project by project.

Qualitative Customer Impact and Risk (5.4.5.2.C.b.first bullet.fifth dash)

The renewal of these assets will ensure future level of reliability is maintained, eliminate safety issues, and provide room on the pole for future requirements. All of which will maintain or improve customer satisfaction.

Value of Customer Impact (5.4.5.2.C.b.first bullet.sixth dash)

Value of customer impact varies project by project.

Other Factors Affecting Project Timing (5.4.5.2.C.b.second bullet)

Because these projects involve assets close to failure, and therefore, close to causing an outage and/or a safety hazard, these projects are done immediately or scheduled very quickly.

Consequences for System O&M costs (5.4.5.2.C.b.third bullet)

These projects do not materially impact system O&M costs.

Reliability and Safety Factors (5.4.5.2.C.b.fourth bullet)

There will be no material impact on reliability, however, spot replacement of end of life assets as a whole will help reduce interruptions related to failed equipment. The elimination of safety hazards were considered as factors to the importance of the project as described above.

Analysis of Project Benefits and Timing (5.4.5.2.C.b.fifth bullet)

Investments in this category are required immediately and are not subject to prioritization as they are, for the most part, mandatory in order to prevent inevitable loss of service and/or remove risk of safety hazards to the public.

Like for Like Renewal Analysis (5.4.5.2.C.b.sixth bullet)

The majority of the assets replaced in this category fall as close as possible to like-for-like renewal, adjusted only by requirement to adhere to current safety standards or to provide pole space for future circuits. Given the nature of the small scope of work for these types of projects (typically individual locations scattered throughout the service territory), providing pole space for a future circuit is not a significant cost increase to the individual project (approximately 1%).

Waterloo North Hydro Inc.

2016 Capital Project Summary

GENERAL INFORMATION ON THE PROJECT/ACTIVITY (5.4.5.2.A)

Project Name Station Breaker Renewal

Investment Category System Renewal

Project Description

This project is for the refurbishment of breakers at Scheifele 'B' Transformer Station (HSB TS), which is WNH's largest station supplying power to approximately half of the City of Waterloo. HSB is a transmission connected DESN transformer station originally constructed by Ontario Hydro on behalf of WNH in mid 1980's. The breakers for the four (4) busses at this station were special ordered to Ontario Hydro standards at the time. The breakers are now past the end of their useful life as they have been experiencing a number of mechanical failures, ready replacement alternatives do not exist due to the customized original design, and replacement parts are not always available.

This is a two year project which commenced in 2015 and is broken down into two stages, with each stage going into service by the end of the fiscal year it is scheduled for. This project capitalizes on the opportunity to refurbish the breakers while Hydro One is undertaking breaker refurbishments with the original manufacturer for the same equipment at HONI owned stations. The project consists of purchasing a handful of brand new retrofit breakers, making switchgear shell modifications to accept the retrofit breakers, and contracting with the original manufacturer to refurbish the majority of the original breakers (which do not require any switchgear shell modifications).

Detailed Listing of Affected Line Sections

The following projects are covered by this project category:

WNH Project	Sub Project	Project Name	Total
06SN04	2	HSB Breaker Refurbishment - 2 Buses, Phase 2 of 2	$193,611
		Total	$ 193,611

Capital Investment
(5.4.5.2.A.first bullet)

Gross Capital	$193,611
Customer Contribution	$0.00
Net Capital	$193,611
O&M Costs (if applicable)	$0.00 (not applicable)

Customer Attachments/Load (kVA)
(5.4.5.2.A.second bullet)

Customer Attachments (#):	19,530
Customer Load (peak KVA)	91,670

Project Timing
(5.4.5.2.A.third bullet)

Start Date April 2016

Expected In-Service Date December 2016

Expenditure Timing

Q1:	0%	$0
Q2:	50%	$96,806
Q3:	0%	$0
Q4:	50%	$96,806

Risk and Risk Mitigation (5.4.5.2.A.fourth bullet)

There are two main risk factors for this project: availability of parts and equipment outage scheduling windows. To combat the first risk, WNH is choosing to do this work at the same time as Hydro One, who has a large number of the same breakers to be refurbished. If critical components of a breaker are deteriorated, the mechanical components that are still in good condition are harvested and used to refurbish other breakers. The breakers which could not be refurbished need to be replaced with new ones, which requires switchgear shell modifications, and hence an extended equipment outage(s). It is important to note that a planned equipment outage does not result in loss of power to the customers as the power is re-routed. It does, however, put a strain on the distribution system from a capacity point of view (now the other components must supply a much higher level of load than under normal conditions), and risks that the system might not have the capacity to supply all customers if a major distribution system component was to fail during the extended equipment outage. For this reason, extended equipment outages are only scheduled during times of low probability that the system will need to operate at peak load (i.e. spring and fall). To combat the second risk, WNH is planning to install the new breakers only on one bus (out of four), which provides more flexibility for outage scheduling windows while at the same time freeing up WNH breakers available for refurbishment and/or harvesting for spare parts.

Comparative Information
(5.4.5.2.A.fifth bullet)

Comparable investments in previous years are as follows:

2011:	$0
2012:	$0
2013:	$0
2014:	$25,382
2015:	$304,477

As described above, this is a two stage project, with stage one planned for completion in 2015. Stage one includes procurement and installation of brand new breakers and switchgear shell modifications required along with refurbishment of the remaining breakers for 2 buses, which accounts for the higher costs for stage 1 of this project. 2014 consisted of minor repairs to 2 breakers with mechanical failures. 2016 will consist of refurbishment of the remaining breakers for the remaining 2 buses.

Total Capital & OM&A Costs Associated with REG Investments (5.4.5.2.A.sixth bullet) Not Applicable

Leave to Construct Approval (5.4.5.2.A.seventh bullet) Not Applicable

Evaluation Criteria and information requirements (5.4.5.2.B)

EVALUATION CRITERIA AND INFORMATION REQUIREMENTS (5.4.5.2.B)

Efficiency, Customer Value, Reliability (5.4.5.2.B.1)

Main Driver (5.4.5.2.B.1.a)

The main driver for these projects are the age and condition of the existing assets and the frequency of failures already experienced leading to high risk and severe consequence of catastrophic failure of the breakers. To date WNH experienced minor mechanical failures of the breakers, which are typically precursors to more severe mechanical failures. If not addressed, these failures progress to catastrophic failures, which result in explosions, fire, consequential damage to adjacent station components, risk to human life and safety, extensive and prolonged outages.

Related Objectives/Performance Targets

WNH Strategic Imperatives 1 & 2 as identified in Exhibit 1

Source and Nature of the Information Used to Justify the Investment

Field inspection, test reports, failure history, asset condition data.

Secondary Driver (5.4.5.2.B.1.a) Not Applicable.

Related Objectives/Performance Targets Not Applicable.

Source and Nature of the Information Used to Justify the Investment Not Applicable.

Investment Priority (5.4.5.2.B.1.b)

System Access investments are ranked as top priority, since they are required to be compliant with regulations.

Under the System Renewal category, WNH identifies assets in poor condition based on field inspections, testing programs, and investigations into failures or power quality issues. Assets found at risk of imminent failure are prioritized for immediate replacement. To prioritize the replacement of the remaining assets in poor condition, WNH takes into account additional drivers or benefits of completing the project. This typically includes improvements in: safety, reliability, power quality, opportunity for loss reduction (voltage uprating), operational flexibility, accessibility to operate and maintain, ability to address future system growth or restoration needs, and regulatory compliance. The more drivers or benefits are attributed to a project (other than age and condition), the higher its priority.

Investments in System Service and General Plant categories are prioritized in a similar fashion. Analysis of impact on customers and consideration of impact of project deferral are also considered. The compiled list of projects is reviewed and prioritized by Senior WNH Engineering, Operations, IT and Finance staff. Based on the outcome of this process, this project ranks 5 out of 15.

Analysis of the Project and Project Alternatives (5.4.5.2.B.1.c)

Effect on system operation efficiency and cost effectiveness

This project will result in breaker renewal being done at approximately 45% of the replacement cost, extension of life of existing assets, and increase in inventory of spare parts for further failure mitigation and/or life extension activities.

Net benefits accruing to customers

The renewal of this infrastructure will have the benefit of reducing the risk of catastrophic failures at this station affecting failed and healthy components, and, therefore, reducing the risk of prolonged outages and rotating blackouts for approximately 35% of all of WNH customers, vast majority of them in the urban area of the City of Waterloo. It also reduces the risk of minor mechanical failures, which reduces the risk of unplanned outages for the particular feeder affected and provides spare breaker available on hand for quicker restoration of power when unexpected mechanical failures of breakers occur.

Impact on reliability performance (including on the frequency and duration of outages)

This project will primarily ensure that current reliability levels are maintained and will remove a significant risk of a notable reduction in reliability indices.

Project Alternatives

The breakers originally installed at HSB TS were modified by the manufacturer to comply with Ontario Hydro specific requirements. These modifications rendered the product unique to the market place. In recent years different manufacturers have developed ready replacements for the unmodified breakers, which unfortunately will not work as a replacement for the modified breakers. In light of this fact, WNH considered the following options:
a) Do Nothing - the breakers have already experienced minor failures. The Do Nothing option carries a significant risk of complete or catastrophic failure and the severe consequences that could follow. This option could be considered as negligent and is not considered appropriate.
b) Refurbish Breakers - as these breakers are functionally obsolete and no new parts are manufactured for them, this option is only feasible if the manufacturer has access to spare parts. It results in extending the life of the breakers and has the advantage that no other modifications to station components (and hence extended equipment outages) are required.
c) Replace Breakers - this option involves installation of brand new breakers as well as modifications to existing switchgear shell and interface systems (and associated extended equipment outages) to field fit the new breakers in. It has the benefit of longer expected life of the breakers compared to the Refurbishment option, but at a significantly higher upfront capital as well as installation costs.
d) Combination of Breaker Refurbishment and Replacement - this is the preferred option as described above in the Project Description and Risk Mitigation sections. It consists of installing replacement breakers on one bus and refurbishment of the remaining breakers (14). This option addresses the renewal needs, minimizes the execution risks, minimizes capital costs, and provides spare parts inventory to minimize outages in case of future failures.

Safety (5.4.5.2.B.2)

This project mitigates significant risks to safety and human life in case of catastrophic failure of the breakers. WNH has experienced one catastrophic breaker failure in the past (in mid 1990's) which could have resulted in severe burns or death if a worker were to be present in the switchgear room at the time of the failure.

Cyber-security, Privacy (5.4.5.2.B.3)

Not Applicable.

Co-ordination, Interoperability (5.4.5.2.B.4)

Co-ordination with utilities, regional planning and/or links with 3rd party providers and/or industry (5.4.5.2.B.4.a)

As this is a transmission connected transformer station, close coordination with IESO and Hydro One is required, which follows an already established outage coordination and approval procedure. As there are no capacity changes implicated by this project, it is not relevant to the regional planning process. Due to the reliance of this solution on spare parts availability, close coordination with the breaker supplier is required.

Enabling of future technological functionality or addressing of future operational requirements (5.4.5.2.B.4.b)

The new breakers contemplated for purchase use vacuum technology rather than SF6 gas insulation as the original breakers do. Vacuum technology is the de facto standard in the industry as well as at all other WNH transmission connected stations. As vacuum breakers have less moving parts, they require less time for maintenance and are subject to less failure modes compared to other breakers.

Economic Development (5.4.5.2.B.5)

There will be very limited economic development directly attributable to this project.

Environmental Benefits (5.4.5.2.B.6)

Not Applicable.

SYSTEM RENEWAL SPECIFIC REQUIREMENTS (5.4.5.2.C.b)

Category-specific requirements - System Renewal (5.4.5.2.C.b.)

Relationship between the Characteristics of Targeted Assets and the Consequences of Asset Failure (5.4.5.2.C.b.first bullet)

Asset Performance Targets and Asset Lifecycle Optimization Policies and Practices (5.4.5.2.C.b.first bullet.first dash)

The breakers are past their useful life and will affect safety and reliability targets if not addressed. They are also functionally obsolete and normally refurbishment would not be an option offered by the manufacturer. However, because of work that the manufacturer is doing for other large utilities, spare parts are expected to be available and life extension of these breakers is a feasible and the preferred option.

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.first bullet.second dash)

The breakers are approximately 30 years old and in poor condition. Many have already experienced minor mechanical failures. This is in line with expectations for equipment of this vintage.

Number of Customers in Each Class Potentially Affected (5.4.5.2.C.b.first bullet.third dash)

This project affects 16898 residential customers, 2351 small commercial customers, and 281 large commercial customers

Quantitative Customer Impact and Risk (5.4.5.2.C.b.first bullet.fourth dash)

Quantitative customer impact and risk are not currently available.

Qualitative Customer Impact and Risk (5.4.5.2.C.b.first bullet.fifth dash)

The renewal of the breakers will ensure future level of reliability is maintained as well as reduce risks of catastrophic failure and its consequences: damage to adjacent equipment, extensive outage area, prolonged outages and/or rotating blackouts. This will maintain or improve customer satisfaction.

Value of Customer Impact (5.4.5.2.C.b.first bullet.sixth dash)

Customer impact in the event of failure is extremely high. HSB TS supplies power to approximately half of the City of Waterloo and these breakers have already been experiencing minor problems. Major problems with the breakers could result in extended outages and very high repair costs as system integrity could be severely compromised.

Other Factors Affecting Project Timing (5.4.5.2.C.b.second bullet)

This project is not dependent on others. Due to the age and condition of the infrastructure, this project needs to be completed. See Investment Priority section 5.4.5.2.B.1.b above for further details on project ranking.

Consequences for System O&M costs (5.4.5.2.C.b.third bullet)

There will be no immediate material impact to O&M costs. Without this project taking place, O&M costs are expected to increase over time.

Reliability and Safety Factors (5.4.5.2.C.b.fourth bullet)

There will be no immediate significant impact on system reliability or safety, however, completion of these projects will significantly reduce the risk of further deterioration of reliability and safety concerns.

Analysis of Project Benefits and Timing (5.4.5.2.C.b.fifth bullet)

The assets identified in this project are definitely in poor condition, past their TUL, and this project needs to be completed. There are no risks to execution that have not already been addressed.

Like for Like Renewal Analysis (5.4.5.2.C.b.sixth bullet)

Projects in this category fall as closely as possible to the Like for Like definition given the technical obsolescence of the breaker and the risk mitigation associated with availability of spare parts.

Waterloo North Hydro Inc.

2016 Capital Project Summary

GENERAL INFORMATION ON THE PROJECT/ACTIVITY (5.4.5.2.A)

Project Name

Contingency Enhancement

Investment Category

System Service

Project Description

This project category represents investments required to make improvements to feeders in existing electrical distribution systems that are currently unable to quickly restore power to affected customers under a contingency situation. This program addresses areas of large load concentration where reliability issues have already been experienced and will reduce the risk of prolonged outages for customers by ensuring that crews and system controllers have full capability to re-route affected customers to nearby feeders. For the most part, the projects consist of rebuilding existing pole lines which are near or at the end of their useful life and in poor condition with ones that carry additional circuits in order to provide required tie and sectionalizing points. The trigger driver of such investments is the constrained ability of the system to provide consistent services, and the project has accordingly been classified as system service, despite having elements of system renewal.

The project scope includes design, construction and installation of new taller poles framed to conform to O. Reg. 22/04 compliant standards as well as new wire and equipment. By completely removing the existing lines and installing additional circuits, WNH plans to improve the level of safety and reliability associated with newer standards, materials, and added system flexibility.

Detailed Listing of Affected Line Sections

The following line sections are covered by this project category:

WNH Project	Sub Project	Project Name	Total
06EN06	10	Huntsberger Rd - Katherine St to Golf Course Rd	$407,011
06EN06	11	Northfield Dr - Weber St to Westmount Rd	$401,821
		Total	$ 808,832

Capital Investment (5.4.5.2.A.first bullet)

Gross Capital $808,832

Customer Contribution $0.00

Net Capital $808,832

O&M Costs (if applicable) $0.00 (not applicable)

Customer Attachments/Load (kVA) (5.4.5.2.A.second bullet)

Customer Attachments (#): 2,734
Customer Load (peak KVA) 13,444

Project Timing (5.4.5.2.A.third bullet)

Start Date January 2016

Expected In-Service Date December 2016

Expenditure Timing

Q1:	20%	$161,766
Q2:	30%	$242,650
Q3:	30%	$242,650
Q4:	20%	$161,766

Risk and Risk Mitigation (5.4.5.2.A.fourth bullet)

Sub project number 11 is located along a regional road with ample space for hydro poles and little to no tree impact, and therefore, has no significant risk factors associated with its execution. Sub project 10 is located on a narrow township road with little to no tree impact and will require upfront coordination with township staff to determine suitable location for the pole line in the right of way.

Comparative Information (5.4.5.2.A.fifth bullet)

Comparable investments in previous years are as follows:
This project has no comparable investments in the historical period in the system service category.

Total Capital & OM&A Costs Associated with REG Investments (5.4.5.2.A.sixth bullet)

No Capital or OM&A Costs for REG investments are associated with this project. However, ability to connect more generation is a side benefit of voltage uprating.

Leave to Construct Approval (5.4.5.2.A.seventh bullet)

Not Applicable

Evaluation Criteria and information requirements (5.4.5.2.B)

EVALUATION CRITERIA AND INFORMATION REQUIREMENTS (5.4.5.2.B)

Efficiency, Customer Value, Reliability (5.4.5.2.B.1)

Main Driver (5.4.5.2.B.1.a)	The main driver for these projects are to improve system performance under contingency situations for areas of large load concentration, such as a distribution station or a large subdivision.
Related Objectives/Performance Targets	WNH Strategic Imperative 1 as identified in Exhibit 1
Source and Nature of the Information Used to Justify the Investment	WNH experienced localized reliability degradation on the 44kV supply (driving factor for sub project number 10) and within the Lakeshore North subdivision (driving factor for sub project number 11). Please see the Annual Service Continuity Report for more information (Appendix F of the DSP).
Secondary Driver (5.4.5.2.B.1.a)	The secondary driver for these projects are the age and condition of the existing plant. Most of the infrastructure being replaced was originally put in service from mid 1950's to early 1970's and has been identified through regular inspection as being in poor condition.
Related Objectives/Performance Targets	WNH Strategic Imperatives 1 & 2 as identified in Exhibit 1
Source and Nature of the Information Used to Justify the Investment	Field inspections and asset condition data.
Investment Priority (5.4.5.2.B.1.b)	System Access investments are ranked as top priority, since they are required to be compliant with regulations. Under the System Service category, WNH identifies service level issues based on post-mortem analysis of large outages, investigations into power quality issues as well as detailed review of the Annual Service Continuity Report and develops a list of solutions. The solutions that can be implemented quickly and/or inexpensively are executed as soon as possible (for example, installation of additional load break switches or reconfiguration of existing circuitry and tap points). Service level issues which can only be solved by improvements in interconnect ability require renewal of existing line sections or construction of new line sections. To decide which line sections should be selected to achieve the goal of improvement in interconnect ability, WNH takes into account additional drivers or benefits of constructing each line section. These typically include selecting line sections that: are at or near the end of their useful life, have safety issues associated with them (for example, failing conductors), provide opportunity for loss reduction (voltage uprating), call for additional circuitry from a long term system plan perspective, have experienced other power quality issues (for example, stray voltage or poor voltage regulation), are in need of relocation (either municipally driven or due to WNH's issues with accessibility), or require replacement for regulatory compliance. The more drivers or benefits are attributed to a solution, the higher priority of rebuilding the line sections forming part of that solution. Investments in System Renewal and General Plant categories are prioritized in a similar fashion. Analysis of impact on customers and consideration of impact of project deferral are also considered. The compiled list of projects is reviewed and prioritized by Senior WNH Engineering, Operations, IT and Finance staff. Based on the outcome of this process, this project ranks 7 out of 15.

Analysis of the Project and Project Alternatives (5.4.5.2.B.1.c)

Effect on system operation efficiency and cost effectiveness	The line sections selected for renewal and contingency enhancement under this project category will increase operational flexibility for day to day switching, expand window of time when outages for maintenance purposes are possible (increasing flexibility in scheduling maintenance work and potentially reducing overtime requirements), solve safety and reliability concerns associated with line sections which required renewal anyway, provide circuits identified in the long term system plan, and support companion underground renewal and voltage uprating projects.
Net benefits accruing to customers	The implementation of these projects will have the following benefits: significantly reducing the risk of lengthy outages, the aversion of potentially adverse effects on and safety and avoidance of an increase to maintenance costs due to renewal of line sections requiring it anyway, decrease in line losses and increase in capacity for connection of REG on voltage uprated sections line sections.
Impact on reliability performance (including on the frequency and duration of outages)	The completion of this project is expected to have a significant positive effect on reliability for the localized areas these projects are meant to address as a result of significantly reducing the risk of prolonged outages for these areas. On a system level, these projects will have some positive effect over time due to: a) improved interconnection capabilities for day to day use a) support for voltage harmonization allowing greater flexibility in responding to distribution system events c) reduction of failure risk associated with aging assets

Project Alternatives

The projects identified under system service category have been initiated as a result of substandard conditions in supply security identified through outages experienced. In the absence of a looped supply to a large customer concentration area, a fault in the trunk portion of the feeder or any upstream equipment forming part of that feeder's supply path exposes the customers to prolonged outages while the fault is corrected. In light of this fact, WNH considered the following alternatives:

a) Do Nothing - this option results in the perpetuation of poor reliability issues for a localized concentration of customers as well as significant (and potentially very public) customer dissatisfaction. Over time, with risk of increased frequency of failures due to aging infrastructure and associated prolonged outages for a large number of customers, the Do Nothing option would result in notable deterioration of reliability indices at a system level. For all these reasons, the Do Nothing option is not considered appropriate.

b) Reconfigure Existing Wires and/or Add More Switching Points - this option is always considered as one of the alternatives for contingency enhancement. It has the characteristics of being quick and relatively inexpensive to implement. In some cases, this option alone is an adequate technical solution, and in those cases it is executed as soon as possible. If additional switching points form the complete or part of the final solution, installing automated switches rather than manually operated ones is always considered as it has positive localized as well as system wide operational benefits.

c) Add new circuits to pole lines build with provisions for additional circuits - in some cases WNH renews existing lines with provisions for future circuits in accordance with our long term system plans. If such pole lines exist between desired interconnection points, this option is executed as soon as possible as it requires very little design time and relatively short construction times.

d) Uprate Existing Lines - this option consists of identifying line sections between desired interconnection points that presently operate at outdated voltages (4kV or 8kV) or utilize a conductor size used for local distribution (typically 3/0 or less) and determining if re-insulating for higher voltage operation and/or upsizing the conductor (to a size appropriate for use on a trunk feeder) would provide an adequate technical solution. Reinsulation or reconductoring projects are very quick to design and relatively quick to construct. These options are only executed if the remaining life of the poles is sufficient to justify off-cycle replacement of insulators or conductors.

e) Renew and Expand Existing Lines - this option consists of renewing line sections between desired interconnection points and installing additional wires. The cost of this option is higher than a straightforward renewal costs due to the required installation of additional wires. This option is primarily considered for line sections that are approaching or at the end of their useful life and the additional circuitry is required as per the long term system plan. If absolutely no other technical solutions exist to address the contingency enhancement requirements, this option may be executed if long term system plans can be adjusted to take advantage of the new circuits..

f) System Expansion - this option consists of building new pole lines where none exist today. This option is only executed if it is required by the long term system plan. If no other technical solution exists to address the contingency issue at hand, this option may be executed if long term system plans can be adjusted to take advantage of the new circuits.

g) Combination of Alternatives b) thru f) - it is very unusual that only one of the above alternatives will provide an adequate and complete technical solution to the supply security issue. Most often, the adequate technical solution requires the use of a combination of the above identified alternatives. It involves identifying various line sections where multiple trigger drivers or benefits can be realized and forming a solution comprised of various steps. This may result in providing a technical solution that is not along the shortest path of desired interconnection points, but is always the one that minimizes overall and future costs, avoids the possibility of renewing pole lines that are not approaching end of life, and minimizes the risk of stranded assets on a long term basis.

For sub project number 11, alternative e) provides a complete technical solution and results in renewal of a line at the end of its useful life. For sub project number 10, alternative g) is utilized. The complete technical solution for sub project 10 is comprised of a line section that falls under alternative d) as well as two line sections that fall under alternative e) and finally a line section that falls under alternative f).   This project results in renewal of lines at the end of their useful life as well as installation of new lines required by WNH long term system plan.

Safety (5.4.5.2.B.2)

Even though these projects are not meant to address safety concerns, renewing pole lines to new construction standards makes work on pole lines much safer for all workers due to increased separation of high voltage conductors as well as the separation from low voltage conductors.

Cyber-security, Privacy (5.4.5.2.B.3)

Not Applicable.

Co-ordination, Interoperability (5.4.5.2.B.4)

Co-ordination with utilities, regional planning and/or links with 3rd party providers and/or industry (5.4.5.2.B.4.a)

WNH will meet with the area Utility Coordinating Council and municipal staff (where applicable) as well as third party stakeholders to exchange project details to coordinate construction. Since this is a 2016 project, this coordination will most likely occur in Q4 2015.

Enabling of future technological functionality or addressing of future operational requirements (5.4.5.2.B.4.b)

The new construction standards provide space for future equipment to be installed with less difficulty.

Economic Development (5.4.5.2.B.5)

There will be very limited economic development directly attributable to this project, although the 27.6kV lines will provide more capacity than available today if future in-fill development projects require it. The improvement in reliability will have the largest economic impact on customers in terms of reduction of productivity loss.

Environmental Benefits (5.4.5.2.B.6)

Albeit small, these projects may have a positive environmental benefit due to reduction in power generation requirements, and hence greenhouse gases, as follows:
a) reduction in losses due to voltage upgrade
b) increased capacity for green generation due to voltage upgrade

SYSTEM SERVICE SPECIFIC REQUIREMENTS (5.4.5.2.C.c)

Category-specific requirements - System Service (5.4.5.2.C.c.)

Assessment of the Benefits of the Project for Customers (5.4.5.2.C.c.first bullet)

Please see answers provided to Section 5.4.5.2.B.1.c above.

Information on Regional Planning (5.4.5.2.C.c.second bullet)

Although not directly related to the Regional Planning process, both of the individual projects identified above support the concept of addressing system service issues with distribution level solutions.

Integration of Advanced Technology (5.4.5.2.C.c.third bullet)

Integration of Advanced Technology is always considered when looking for solutions to system service issues. For projects that consist primarily of renewing existing lines, this level of analysis will be performed at the individual project level during detailed design.

System Benefits to Reliability, Efficiency and Safety (5.4.5.2.C.c.fourth bullet)

Please see answers provided to Section 5.4.5.2.B.1.c above regarding Reliability and Efficiency as well as section 5.4.5.2.B.2 above regarding Safety.

Factors Affecting Implementation Timing/Priority (5.4.5.2.C.c.fifth bullet)

The customers in both localized areas (Lakeshore subdivision and 44kV stations) have already been exposed to repeating outages, some of prolonged duration. Hence, the timing of these projects is driven by the urgency of resolving existing system service and security of supply issues.

Summary of Options Analysis (5.4.5.2.C.c.sixth bullet)

As described in detailed under section 5.4.5.2.B.1.c above, the Do Nothing option is not appropriate given the issue at hand. For sub project number 11, alternative e) provides a complete technical solution and results in renewal of a line at the end of its useful life. For sub project number 10, the complete technical solution is formed by utilizing alternatives d) e) and f) and results in renewal of lines at the end of their useful life as well as installation of new lines required by WNH long term system plan.

Alternative b) alone could not provide an adequate technical solution.
Alternative c) does not exist as a solution to the issue at hand.
Alternative d) does not exist for sub project 11.
Alternative d) forms part of the solution for sub project 10. It is technically possible to utilize this alternative to form the entire solution, however, it would have to be along a different and two and a half times longer path than the proposed solution. Given the obviously substantial extra costs involved, this solution was not considered appropriate.
Alternative e) forms the entire solution for sub project 11 and part of the solution for sub project 10. Similar to Alternative d), Alternative e) could technically form the entire solution for sub project 11 but along a different, much longer path and with the result of stranded assets as extra circuitry along this path would not be required on a long term basis. Given these facts, utilizing Alternative e) alone to address the needs of sub project 11 was not considered appropriate.
Alternative f) forms the remaining part of the solution for sub project 10. It does not exist as a solution for sub project 11.

Waterloo North Hydro Inc.

2016 Capital Project Summary

GENERAL INFORMATION ON THE PROJECT/ACTIVITY (5.4.5.2.A)

Project Name System Enhancement - Distribution Automation

Investment Category System Service

Project Description

WNH covers a relatively large service territory and is amongst the top 5 utilities in terms of coverage area. With only a handful of remotely monitored or controlled devices in our system, most system disturbances result in long outages due to relatively long travel distances, lack of detailed information about the disturbance location, and need to patrol the entire feeder prior to power restoration. The Distribution Automation program aims to improve reliability, system operational efficiency, and safety by installing remotely controlled switches and other smart devices that bring live system information to our Control Room and help our staff locate the disturbance area faster while restoring power to customers connected to the healthy sections of the system through remote control of switching points.

This project category consists of design, installation, and commissioning of remotely controlled reclosers (switches with ability to act like breakers), remotely monitored fault indicators, and remote operating capabilities for select existing underground switchgear. This is a five year program with approximately 20 remotely monitored and controlled devices being deployed each year.

This program was started in 2014 with different aspects of this program being the main drivers each year as follows:
- 2014: automating switching points used under a distribution loss of supply scenario (either HONI or other LDC supply points)
- 2015: feeder segmentation (at city boundary and at large load densities) and automating furthest switching points
- 2016: automating most frequently used manual switching points and a pilot project for automating underground switchgear
- 2017: automating underground switchgear near large load densities and other points used under a transmission loss of supply scenario
- 2018: feeder segmentation and automating underground switchgear near large load densities

This program flow is chosen to work best in conjunction with other WNH projects, such as contingency enhancement projects as well as SCADA upgrades to reap the greatest benefits from the investments made.

Detailed Listing of Individual Projects The following individual projects are covered by this project category:

WNH Project	Sub Project	Project Name	Total
06EN06	13	2016 Recloser Program	$1,035,635
06EN06	14	2016 Fault Indicators	$39,535
06EN06	31	Vistagear SCADA Control Deployment	$81,998
		Total	$ 1,157,168

Capital Investment (5.4.5.2.A.first bullet)

Gross Capital	$1,157,168
Customer Contribution	$0.00
Net Capital	$1,157,168
O&M Costs (if applicable)	$0.00 (not applicable)

Customer Attachments/Load (kVA) (5.4.5.2.A.second bullet)

Customer Attachments (#): System wide
Customer Load (peak KVA) System wide

Project Timing (5.4.5.2.A.third bullet)

Start Date January 2, 2016

Expected In-Service Date December 30, 2016

Expenditure Timing

Q1:	5%	$57,858
Q2:	25%	$289,292
Q3:	50%	$578,584
Q4:	20%	$231,434

Risk and Risk Mitigation (5.4.5.2.A.fourth bullet)

There are two major risk factors to this program: coordination of construction and inadequate communication systems in the long term. In 2014, WNH deployed 22 reclosers on its system and developed a robust approach of coordination and cooperation between Engineering, Control Room, Line Construction crews, and material suppliers. The same process will be followed each year, minimizing risk to timely project completion.

The second major risk is inadequate communication system coverage for parts or the entire WNH service area for bringing live data to WNH's Control Room. The planned communication infrastructure for the Distribution Automation project is via radio frequency devices, and it is expected to work correctly in both WNH's townships as well as in low density residential/commercial areas within the City of Waterloo. The largest risk areas are the UpTown Core and the university neighbourhoods, where redevelopment resulting in high rise buildings may cause the existing radio frequency technology to no longer be adequate in the long term. To address this risk, WNH is pursuing two avenues: staying on top of current radio frequency technology and running two pilot projects as well as negotiating with the Region of Waterloo for fibre connectivity to be provided to these areas as part of the Light Rail Transit project.

Comparative Information (5.4.5.2.A.fifth bullet)

Comparable investments in previous years are as follows:

2011:	$112,753
2012:	$388,276
2013:	$459,796
2014:	$989,430
2015:	$1,181,173

The recloser deployment program in the historical years 2011-2013 targeted replacement of existing oil reclosers at the end of their useful life. Starting in 2014, the program focus changed as described above and is more representative of the investments in this project category.

Total Capital & OM&A Costs Associated with REG Investments (5.4.5.2.A.sixth bullet) Not Applicable

Leave to Construct Approval (5.4.5.2.A.seventh bullet) Not Applicable

Evaluation Criteria and information requirements (5.4.5.2.B)

Efficiency, Customer Value, Reliability (5.4.5.2.B.1)

Main Driver (5.4.5.2.B.1.a) The main driver for these projects are decreasing time required to restore power during an outage.

Related Objectives/Performance Targets WNH Strategic Imperatives 1 & 5 as identified in Exhibit 1

Source and Nature of the Information Used to Justify the Investment Because of WNH's large service area size, time to restore power is long due to long travel times and the time required to patrol feeders. Please see the Annual Service Continuity Report for more information (Appendix F of the DSP). Shortening time required for outage restoration is the top priority for WNH's residential and commercial customers (section 2.2.1.1 of the DSP).

Secondary Driver (5.4.5.2.B.1.a) The secondary driver for these projects are increase in efficiency and safety due to reduced need for manual switching for contingency or day to day operation. This is due to a reduced number of truck rolls to operate a device as well as reduced safety risk exposure associated with manually operating live equipment, especially during major weather events where good access to these devices might be compromised and operation of a switch might result in energizing a faulted section of the distribution system.

Related Objectives/Performance Targets WNH Strategic Imperatives 2, 5 & 6 as identified in Exhibit 1

Source and Nature of the Information Used to Justify the Investment Section 2.1.2 of the DSP

Investment Priority (5.4.5.2.B.1.b) System Access investments are ranked as top priority, since they are required to be compliant with regulations.

Under the System Service category, WNH identifies service level issues based on post-mortem analysis of large outages, investigations into power quality issues as well as detailed review of the Annual Service Continuity Report and develops a list of solutions. The solutions that can be implemented quickly and/or inexpensively are executed as soon as possible (for example, installation of additional load break switches or reconfiguration of existing circuitry and tap points). Service level issues which can only be solved by improvements in interconnect ability require renewal of existing line sections or construction of new line sections. To decide which line sections should be selected to achieve the goal of improvement in interconnect ability, WNH takes into account additional drivers or benefits of constructing each line section. These typically include selecting line sections that: are at or near the end of their useful life, have safety issues associated with them (for example, failing conductors), provide opportunity for loss reduction (voltage uprating), call for additional circuitry from a long term system plan perspective, have experienced other power quality issues (for example, poor voltage regulation), are in need of relocation (either municipally driven or due to WNH's issues with accessibility), or require replacement for regulatory compliance. The more drivers or benefits are attributed to a solution, the higher priority of rebuilding the line sections forming part of that solution.

Investments in System Renewal and General Plant categories are prioritized in a similar fashion. Analysis of impact on customers and consideration of impact of project deferral are also considered. The compiled list of projects is reviewed and prioritized by Senior WNH Engineering, Operations, IT and Finance staff. Based on the outcome of this process, this project ranks 6 out of 15.

Analysis of the Project and Project Alternatives (5.4.5.2.B.1.c)

Effect on system operation efficiency and cost effectiveness

a) Eliminates manual switching allowing WNH to utilize resources for other matters
b) Provides more, better, and faster information to system controllers allowing them to diagnose the issue quicker and use their time more efficiently
c) Reduces patrol time as only faulted sections need to be patrolled versus entire feeder under present conditions

Net benefits accruing to customers

a) Reduces the length of customer outages
b) Increases the number of customers that can be restored quickly during an outage
c) Improved customer communications due to better and faster data availability on system disturbances
d) Limits the number of customers affected by an outage due to feeder segmentation
e) Shortens outage duration for customers on non-automated feeders as the crews can now get to them quicker

Impact on reliability performance (including on the frequency and duration of outages)

a) Enhances reliability through faster load transfers
b) Improved system performance during high impact events, including major storms
c) Sustained outages may be minimized to only momentary outages
d) Reduces the customer impact of momentary and sustained outages due to feeder segmentation

Project Alternatives

The projects identified under system service category have been initiated as a result of substandard conditions in supply security identified through outages experienced. To address the issue, WNH considered the following alternatives:
a) Do Nothing - this option results in the perpetuation of poor reliability issues as well as significant (and potentially very public) customer dissatisfaction. Over time, with risk of increased frequency of failures due to aging infrastructure and associated prolonged outages for a large number of customers, the Do Nothing option would result in notable deterioration of reliability indices at a system level. For all these reasons, the Do Nothing option is not considered appropriate.
b) Reconfigure Existing Wires and/or Add More Switching Points - this option is always considered as one of the alternatives for contingency enhancement. It has the characteristics of being quick and relatively inexpensive to implement. In some cases, this option alone is an adequate technical solution, and in those cases it is executed as soon as possible. If additional switching points form the complete or part of the final solution, installing automated switches rather than manually operated ones is always considered as it has positive localized as well as system wide operational benefits.
c) Add new circuits to pole lines built with provisions for additional circuits - in some cases WNH renews existing lines with provisions for future circuits in accordance with our long term system plans. If such pole lines exist between desired interconnection points, this option is executed as soon as possible as it requires very little design time and relatively short construction times.
d) Uprate Existing Lines - this option consist of identifying line sections between desired interconnection points that presently operate at outdated voltages (4kV or 8kV) or utilize a conductor size used for local distribution (typically 3/0 aluminum or less) and determining if re-insulating for higher voltage operation and/or upsizing the conductor (to a size appropriate for use on a trunk feeder) would provide an adequate technical solution. Reinsulation or reconductoring projects are very quick to design and relatively quick to construct. These options are only executed if the remaining life of the poles is sufficient to justify off-cycle replacement of insulators or conductors.
e) Renew and Expand Existing Lines - this option consists of renewing line sections between desired interconnection points and installing additional wires. The cost of this option is higher than a straightforward renewal cost due to the required installation of additional wires. This option is primarily considered for line sections that are approaching or at the end of their useful life and the additional circuitry is required as per the long term system plan. If absolutely no other technical solutions exist to address the issue at hand, this option may be executed if long term system plans can be adjusted to take advantage of the new circuits..
f) System Expansion - this option consists of building new pole lines where none exist today. This option is only executed if it is required by the long term system plan. If no other technical solution exists to address the issue at hand, this option may be executed if long term system plans can be adjusted to take advantage of the new circuits.
g) Combination of Alternatives b) thru f) - it is very unusual that only one of the above alternatives will provide an adequate and complete technical solution to the supply security issue. Most often, the adequate technical solution requires the use of a combination of the above identified alternatives. It involves identifying various line sections where multiple trigger drivers or benefits can be realized and forming a solution comprised of various steps. This may result in providing a technical solution that is not along the shortest path of desired interconnection points, but is always the one that minimizes overall and future costs, avoids the possibility of renewing pole lines that are not approaching end of life, and minimizes the risk of stranded assets on a long term basis.

The Distribution Automation project is implemented in harmony with the above process by installing remotely controlled switches in areas where need for new switches is identified as well as in areas where new interconnect ability is implemented through renewal and/or expansion of the distribution system. The main focus areas for each year of this project may be reshuffled and reprioritized based on post-mortem analysis of new outages experienced and/or updated recommendations stemming from each year's Annual Service Continuity report.

Safety (5.4.5.2.B.2)

EVALUATION CRITERIA AND INFORMATION REQUIREMENTS (5.4.5.2.B)

Although not primarily meant to address any particular safety issues, the Distribution Automation project has the added benefit of eliminating manual switching which reduces crew exposure to energized equipment and reduces associated safety risks, especially during major weather events where access to switches might not be optimal and operating a switch may cause energization of a faulted section. It also increases safety by faster isolation of faulted conductors where feeder segmentation has been implemented.

Cyber-security, Privacy (5.4.5.2.B.3)

WNH uses a wireless communication system for Distribution Automation. The wireless platform chosen is equipped with comprehensive security framework such as device security including boot security, signed firmware and tamper detection; user security including user access control, authentication and secure device management; network security including device authentication, encryption and firewall.

Co-ordination, Interoperability (5.4.5.2.B.4)

Co-ordination with utilities, regional planning and/or links with 3rd party providers and/or industry (5.4.5.2.B.4.a)

WNH meets regularly with the area Utility Coordinating Council comprised of municipal and third party stakeholders. WNH exchanges project details with other stakeholders for mutual benefit. For the Distribution Automation project, coordination with other parties is fairly minimal from an installation point of view (reclosers get hung up on existing poles, and if poles need to be changed due to condition, they are changed like-for-like). The greatest amount of coordination is with the Region of Waterloo in negotiating fibre connectivity to cover future risk of communication infrastructure inadequacy.

Enabling of future technological functionality or addressing of future operational requirements (5.4.5.2.B.4.b)

This project is integral to enabling future technological functionality and to addressing future operational requirements with respect to installation of Fault Detection, Isolation, and Restoration (FDIR) feature to our SCADA system. There are two main approaches to FDIR in the industry: centralized and localized. Both require intelligent devices and a communication system. In the localized mode, the intelligent devices communicate directly to their peers to determine where the system disturbance might be and how best to restore the power to as many people as possible. This system works very well in locations where feeder routes are fixed and not subject to reconfiguration. In the centralized mode, the intelligent devices communicate to a centralized system (in WNH's case, the FDIR software component of our SCADA system), and the centralized system determines origin of disturbance and follow up actions. As WNH's distribution system is subject to constant change and reconfiguration (either due to brownfield redevelopment and/or installation of new interconnection points), the localized mode is not a good fit for our system. The centralized mode via FDIR SCADA software is the preferred solution, and to work effectively in an automatic (no manual intervention or human delay mode), it requires a critical mass of intelligent electronic devices (such as reclosers and fault indicators) communicating live data to it as well as remote control ability of key switching points in our distribution system. All these requirements are provided under the Distribution Automation project.

Economic Development (5.4.5.2.B.5)

While this project is not meant to contribute significantly to new economic development, it will have a positive effect on the local economy by minimizing production losses associated with sustained and momentary outages.

Environmental Benefits (5.4.5.2.B.6)

Albeit small, these projects will have a positive environmental benefit due to reduced vehicle emissions. This is because travel to operate manual switches is eliminated and area required for patrol is smaller once distribution automation is implemented on a feeder.

SYSTEM SERVICE SPECIFIC REQUIREMENTS (5.4.5.2.C.c)

Category-specific requirements - System Service (5.4.5.2.C.c.)

Assessment of the Benefits of the Project for Customers (5.4.5.2.C.c.first bullet)

Please see answers provided to Section 5.4.5.2.B.1.c above.

Information on Regional Planning (5.4.5.2.C.c.second bullet)

Although not directly related to the Regional Planning process, this program supports the concept of addressing system service issues with distribution level solutions. It will also provide WNH the ability to quickly transfer load from a station supplied by 115kV circuits to stations supplied by 230kV circuits and vice versa. While this may be of benefit to transmission lines locally, as both the 115kV and the 230kV transmission lines belong to the same transmission subsystem, it does not have any impact at the provincial level.

Integration of Advanced Technology (5.4.5.2.C.c.third bullet)

Please see answers provided to Section 5.4.5.2.B.4.b above.

System Benefits to Reliability, Efficiency and Safety (5.4.5.2.C.c.fourth bullet)

Please see answers provided to Section 5.4.5.2.B.1.c above regarding Reliability and Efficiency as well as section 5.4.5.2.B.2 above regarding Safety.

Factors Affecting Implementation Timing/Priority (5.4.5.2.C.c.fifth bullet)

Reduction of time it takes to restore power is our customers' top priority.

Summary of Options Analysis (5.4.5.2.C.c.sixth bullet)

As described in detail under section 5.4.5.2.B.1.c above, the Do Nothing option is not appropriate given the issue at hand. Alternative b) is the easiest, quickest, and cheapest way to resolve distribution system service level issues (where technically feasible), and forms the entire solution to the issue at hand with the modification that all switches installed are automated due to the benefits described in all the sections above.

Waterloo North Hydro Inc.

2016 Capital Project Summary

GENERAL INFORMATION ON THE PROJECT/ACTIVITY (5.4.5.2.A)

Project Name Replacement of Customer Information System Software

Investment Category General Plant

Project Description

In 2016 Waterloo North Hydro (WNH) will transition from the current CIS software to a new product. The current CIS system was purchased in 2000, was based on mature technology at the time of purchase, and today is costly to maintain and difficult to modify. This compromises WNH's ability to efficiently and cost effectively deploy the necessary CIS enhancements as required for new regulatory and public policy initiatives as well as Customer driven new functionality.

The new software will improve Customer support capabilities making it easier to respond to Customer inquiries, faster processing of field based Customer service orders, streamlined and automated billing related routines leading to improved productivity and organizational effectiveness with a measurable annual reduction of $100,000 in software annual maintenance fees.

Capital Investment (5.4.5.2.A.first bullet)

Gross Capital	**$378,363**
Customer Contribution	$0.00
Net Capital	**$378,363**
O&M Costs (if applicable)	**$0.00** (not applicable)

Customer Attachments/Load (kVA) (5.4.5.2.A.second bullet)

Not Applicable
Not Applicable

Project Timing (5.4.5.2.A.third bullet)

Start Date: Mar 1 2014

Expected In-Production Date: June 30 2016

Expenditure Timing

2015	Q1:	5%	$18,918.15
2015	Q2:	20%	$75,672.60
2015	Q3:	25%	$94,590.75
2015	Q4:	25%	$94,590.75
2016	Q1:	10%	$37,836.30
2016	Q2:	10%	$37,836.30
2016	Q3:	5%	$18,918.15
2016	Q4:	0%	$0.00
		100%	$ 378,363

Risk and Risk Mitigation (5.4.5.2.A.fourth bullet) The risks for WNH are as follows:

a) failure to achieve a successful cutover within the time period stated and within the budgeted dollar cost. This risk is being managed through effective Project Management including construction of detailed project implementation schedules, extensive internal resource planning for appropriate allocation of the necessary staff to the project and routine review of the projects' projected budget $ to actual $.

b) failure to select an appropriate solution which adequately addresses the needs of the Ontario based regulatory initiatives & related public policy and to provide appropriate functionality to facilitate easier response to customer inquiries in a more cost effective and efficient manner. These risks have been addressed through an RFI and RFP process which started in 2012 and completed in 2014. WNH has also collaboratively defined CIS requirements with management across selected corporate departments including Billing, Regulatory, Metering, Operations, Finance and IT.

c) failure to select a solution that is based on new technology with a lower total cost of ownership for now and the future. This risk has been addressed through a collaborative and extensive RFI and RFP process which started in 2012 and completed in 2014. This process required vendors to provide full visibility to their current technology platform, future roadmaps, project implementation costs, ongoing service fee structures as well as annual maintenance fees deployed over the past number of years and scheduled increases for future years.

Comparative Information (5.4.5.2.A.fifth bullet) WNH has no recently completed project which is comparable in scope and scale which can be used as a reasonable comparator.

Total Capital & OM&A Costs Associated with REG Investments (5.4.5.2.A.sixth bullet) Not Applicable

Leave to Construct Approval (5.4.5.2.A.seventh bullet) Not Applicable

Evaluation Criteria and information requirements

EVALUATION CRITERIA AND INFORMATION REQUIREMENTS (5.4.5.2.B)

Efficiency, Customer Value, Reliability

Main Driver (5.4.5.2.B.1.a)	The main driver of the new CIS software acquisition and implementation is that the current system is based on an old technology and design that is difficult and costly to maintain in response to changes required for regulatory initiatives, public policy and Customer driven new functionality.
Related Objectives/Performance Targets	Strategic Imperatives 3 & 5 (as identified in Exhibit 1)
Source and Nature of the Information Used to Justify the Investment	WNH's invoices paid over the last number of years reflect a high cost of ownership for annual maintenance and modifications. The software is based on an old technology and design and does not reflect the current needs of current AMI based billing processes. Regulatory initiatives, public policy changes and Customer driven functionality will incur additional expenses to WNH in the form of modifications. The vendor's annual maintenance pricing model increases each year based on accumulated modifications. This is a model that WNH can no longer sustain.
Secondary Driver (5.4.5.2.B.1.a)	The secondary driver of the new CIS software acquisition and implementation is that WNH seeks to improve Customer service levels as well as internal productivity and organizational effectiveness through better software features and functionality.
Related Objectives/Performance Targets	Strategic Imperatives 3, 5 & 6 (as identified in Exhibit 1)
Source and Nature of the Information Used to Justify the Investment	On a daily basis, WNH experiences difficulties in finding specific Customer information quickly and easily in response to Customer inquiries. Furthermore WNH experiences lost productivity with respect to various billing related functions, rate administration, collections processing and regulatory reporting requirements.
Investment Priority (5.4.5.2.B.1.b)	System Access investments are ranked as top priority, since they are required to be compliant with regulations. Under the General Plant category, WNH identifies underperforming assets or processes based on feedback received from customers, staff, tracking of performance, operating and maintenance costs. WNH also identifies opportunities for improvement in its ability to meet the WNH Strategic Imperatives and compiles a complete list of projects for this category. To prioritize the execution of these projects, WNH takes into account additional drivers or benefits of completing the project. This typically includes improvements in: worker safety, ability to continue to provide services to customers, opportunity for cost reduction, increase in productivity, operating efficiency, ability to operate and maintain, ability to adapt to future needs, and regulatory compliance. The more drivers or benefits are attributed to a project (other than asset age and condition), the higher its priority. Investments in System Service and System Renewal categories are prioritized in a similar fashion. Analysis of impact on customers and consideration of impact of project deferral are also considered. The compiled list of projects is reviewed and prioritized by Senior WNH Engineering, Operations, IT and Finance staff. Based on the outcome of this process, this project ranks 12 out of 15.

Analysis of the Project and Project Alternatives (5.4.5.2.B.1.c)

Effect on system operation efficiency and cost effectiveness	The 2016 capital investment of $378,363 replaces the current CIS system. The new CIS software represents a $100,000 annual reduction in CIS software related maintenance fees. This alone provides for adequate project cost justification. The new software technology solution will also position WNH to respond more efficiently and cost effectively to new public policy initiatives, regulatory changes and new Customer driven functionality. Furthermore and consistent with the results of the RFI and RFP processes, the new software provides for productivity improvements and organizational effectiveness across multiple departments including billing, metering, finance,regulatory and IT services.
Net benefits accruing to customers	The new CIS system provides for better Customer service through improved presentation and easier access to Customer account information, minimization of billing delays through enhanced billing related functionality with reduction of potential billing errors that may negatively impact a Customer. Furthermore, the new CIS system positions WNH to more efficiently and cost effectively respond to regulatory initiatives, public policy changes and Customer driven new functionality. The lower cost of the software's ongoing maintenance produces a positive impact on the management of distribution rates for our Customers.
Impact on reliability performance (including on the frequency and duration of outages)	Not Applicable

Project Alternatives

a) **Do Nothing**
This represents lost opportunities for WNH as follows:
(i) Inability to advance to new technology and design that positions WNH to respond efficiently and cost effectively to public policy initiatives, regulatory changes and Customer driven new functionality.
(ii) Not able to achieve improvements in Customer support service and interval productivity and organizational effectiveness due to restrictions in the current older software solution.
(iii) Forced to remain with the high cost of ownership for the current product causing a negative impact on OM&A and distribution rates to our Customer base.

b) **Develop an In-House CIS System**
This would require additional in-house IT resources with the appropriate subject matter expertise to conduct a lengthy process of requirements definition, systems design, coding and testing. This would be very costly (approximately $700,000) and would take an extended period of time to complete. The project risk would be high in terms of achieving a reliable, functional and comprehensive CIS system on a timely basis. WNH would also incur the high cost of retaining these new resources on a long term basis in order to ensure stable support for the new in-house developed system. This alternative also results in WNH risking a disruption of support for the solution if the IT specialized resources leave WNH due to the highly competitive IT skills market.

c) **Acquire and Implement a 3rd Party CIS Software Technology Solution:**
This option allows WNH to advance to a new CIS system, which takes into account the electricity market and related current AMI based billing processes, on a timely basis, reducing annual maintenance fees by $100,000 and enabling WNH to respond efficiently and cost effectively to public policy initiatives, regulatory changes and Customer driven new functionality.

Safety (5.4.5.2.B.2)

Not Applicable.

Cyber-security, Privacy (5.4.5.2.B.3)

The new software technology solution incorporates the appropriate security and access permissions infrastructure to meet the cyber-security standards of today for web-based software and privacy of information. This also includes the software's internal ability to prevent unauthorized access to it's Customer based information.

Co-ordination, Interoperability (5.4.5.2.B.4)

Co-ordination with utilities, regional planning and/or links with 3rd party providers and/or industry (5.4.5.2.B.4.a)

Not Applicable.

Enabling of future technological functionality or addressing of future operational requirements (5.4.5.2.B.4.b)

The new CIS software solution positions WNH on new and current web-based technology, allowing us to engage more effectively with the growing trend of integration with cloud based technology services as they apply to the energy sector.

Economic Development (5.4.5.2.B.5)

Not Applicable.

Environmental Benefits (5.4.5.2.B.6)

Not Applicable.

Category-specific requirements - General Plant (5.4.5.2.C.d.)

GENERAL PLANT SPECIFIC REQUIREMENTS (5.4.5.2.C.d)

The Results of Quantitative and Qualitative Analyses, Including Assessments of Financially Feasible Options to the Proposed Project, and Identifying the Benefits of the Proposed Investment

WNH conducted an RFI process in 2012/2013 and a 2013/2014 RFP. Both of these processes provided WNH with quantitative and qualitative information for an analysis of CIS software alternatives. The scope of the analysis included CIS software solutions and their cost of ownership including vendor licensing fees, professional service fees and annual maintenance price models now and in the future. Software functionality was assessed as it relates to the Ontario standard electricity market and related current AMI based billing processes; its ability to contribute to improved Customer service; adaptability to the initiatives in new public policy, regulatory changes and Customer driven functionality in a cost efficient manner; software functionality which allows WNH to achieve better productivity and organizational effectiveness. Vendors were asked to demonstrate a consistent history of investment in current technology, provide detail as to future software development roadmaps, demonstrate integration capability with future technology and provide evidence of portability of their product to alternative common architecture technology platforms.

Based on these processes and the information they provided to WNH, the three project alternatives are documented above in 'Project Alternatives' with references to their individual financial feasibility.

WNH has determined that Project Alternative (c): 'Acquire and Implement a 3rd Party CIS Software Technology Solution' is the best course of action.

The benefits of the proposed investment include the following:

a) Annual maintenance savings of $100,000 and lower cost of modifications. This contributes to WNH's ability to manage distribution rates to our Customers.
b) Current software technology & functional design that allows WNH to respond more efficiently and effectively to modifications required for public policy initiatives, regulatory changes and Customer driven new functionality.
c) Better design and presentation of Customer account information making it easier to respond to Customer inquiries.
d) Flexible billing & payment options for Customers
e) Web-Based Technology with Enterprise Wide Mobility providing for improved productivity and better organizational effectiveness via timely field based real-time processing of Customer service orders
f) Software design that focuses on 'exception based processing' minimizing manual intervention and resulting in improved organizational effectiveness, increased productivity and cost reduction
g) Streamlined & automated billing related processes with detail audit trails for Billing Settlement, Global Adjustment calculations, microFIT administration/billing, Unbilled Revenue projections contributing to improved productivity and organizational effectiveness

Business Case Documenting the Justifications for the Expenditure, Alternatives Considered, Benefits for Customers (short/long term), and Impact on Distributor Costs (short/long term)

Not Applicable. Although WNH recognizes that this project exceeds the materiality threshold, it is not to the level implied in Chapter 5 filing requirements as described under 5.4.5.2.C.d.second bullet.

Waterloo North Hydro Inc.

2016 Capital Project Summary

GENERAL INFORMATION ON THE PROJECT/ACTIVITY (5.4.5.2.A)

Project Name

Acquisition and Implementation of Asset Management Software

Project Category

General Plant

Project Description

Today WNH uses extensive internal manual processes to manage and interpret asset condition information for asset management purposes. Furthermore, WNH relies heavily on the experience of senior staff for asset replacement decisions. This project involves the acquisition and implementation of an Asset Management Software solution to permit asset management decisions to be conducted in a much more cost efficient manner by a larger number of staff of varying experience levels using consistent methods of quantitative analysis and weighting factors for the prioritization and monetization of asset replacement decisions.

During 2015, WNH will conduct an RFP process to review several Asset Management Software solutions available in the industry. In 2016, an acquisition decision will be made and the solution implemented. The system will be required to administer and track a road scope of asset information including the following:

a) Asset
b) Asset Purchase Date
c) Asset accumulated cost
d) Asset status/location
e) Asset movement history
f) Recommended maintenance practices & related repair parts
g) Trending of asset condition based on asset field tests with appropriate metric thresholds of acceptance.

The Asset Management solution will be capable of generating recommendations for asset replacement based on quantitative methodology using established asset health indices, weighting factors and prioritization. Additional functionality required includes predictive analysis based on trending of asset test results as collected during field inspections.

Capital Investment (5.4.5.2.A.first bullet)

Gross Capital	**$277,128**	
Customer Contribution	$0.00	
Net Capital	**$277,128**	
O&M Costs (if applicable)	**$0.00**	(not applicable)

Customer Attachments/Load (kVA) (5.4.5.2.A.second bullet)

Not Applicab
Not Applicable

Project Timing (5.4.5.2.A.third bullet)

Start Date		Jun-15
Expected In-Production Date		Dec-16
Expenditure Timing		
2016 Q1	40%	$110,851
2016 Q2	25%	$69,282
2016 Q3	25%	$69,282
2016 Q4	10%	$27,713

Risk and Risk Mitigation (5.4.5.2.A.fourth bullet)

The main risks with this project are as follows:

a) The selection of an appropriate Asset Management System as it must provide for the appropriate functionality required for Engineering
b) The solution must reflect current software technology
c) The project must proceed on a timely basis in order to achieve cutover for 2016.

WNH has mitigated these risks by scheduling the start of the selection process for June 2015 to ensure adequate time to conduct a thorough RFP process including preparation of the RFP, evaluation of the bids and construction of a detailed project implementation plan to ensure success for the deployment of the new software in 2016.

Comparative Information (5.4.5.2.A.fifth bullet)

WNH has no recently completed project which is comparable in scope and scale which can be used as a reasonable comparator.

Total Capital & OM&A Costs Associated with REG Investments (5.4.5.2.A.sixth bullet)

Not Applicable

Leave to Construct Approval (5.4.5.2.A.seventh bullet)

Not Applicable

Evaluation Criteria and information requirements

EVALUATION CRITERIA AND INFORMATION REQUIREMENTS (5.4.5.2.B)

Efficiency, Customer Value, Reliability (5.4.5.2.B.1)

Main Driver (5.4.5.2.B.1.a)	The main driver of this project is WNH's requirement to have a robust, functional Asset Management System that provides for accurate asset tracking history with predictive asset analysis based on established asset health indices. This will position WNH to further improve existing asset management practices based on reliable historical asset information.
Related Objectives/Performance Targets	WNH Strategic Imperatives 1, 5,6 (as identified in Exhibit 1)
Source and Nature of the Information Used to Justify the Investment	WNH has observed that the excessive internal manual processes currently required to manage and interpret asset condition information is very time consuming. The information is fragmented across multiple spreadsheets which makes it difficult to achieve cost effective asset condition analysis. Furthermore it does not allow for easy, cost efficient tracking of asset condition changes nor does it allow for easy integration of performance targets and health indices. This has lead WNH to act upon this observation and proceed to acquire and implement an Asset Management Software solution that provides for the proper analysis tools to determine the right assets to replace at the right time in a cost effective and efficient way.
Secondary Driver (5.4.5.2.B.1.a)	WNH has also observed that the current manual spreadsheet system of asset management typically relies heavily on the experience of senior staff and their qualitative analysis of asset condition data for asset replacement decisions. WNH recognizes that the implementation of an Asset Management solution will allow asset replacement decisions to be accomplished by a larger number of staff of varying experience levels using a balance of both qualitative and quantitative analysis in a much more efficient and cost effective manner.
Related Objectives/Performance Targets	WNH Strategic Imperatives 5 and 6 (as identified in Exhibit 1)
Source and Nature of the Information Used to Justify the Investment	The secondary driver is based on observations and feedback from the Engineering staff regarding the qualitative analysis & manual efforts required to conduct asset assessments.
Investment Priority (5.4.5.2.B.1.b)	System Access investments are ranked as top priority, since they are required to be compliant with regulations. Under the General Plant category, WNH identifies underperforming assets or processes based on feedback received from customers, staff, tracking of performance, operating and maintenance costs. WNH also identifies opportunities for improvement in its ability to meet the WNH Strategic Imperatives and compiles a complete list of projects for this category. To prioritize the execution of these projects, WNH takes into account additional drivers or benefits of completing the project. This typically includes improvements in: worker safety, ability to continue to provide services to customers, opportunity for cost reduction, increase in productivity, operating efficiency, ability to operate and maintain, ability to adapt to future needs, and regulatory compliance. The more drivers or benefits are attributed to a project (other than asset age and condition), the higher its priority. Investments in System Service and System Renewal categories are prioritized in a similar fashion. Analysis of impact on customers and consideration of impact of project deferral are also considered. The compiled list of projects is reviewed and prioritized by Senior WNH Engineering, Operations, IT and Finance staff. Based on the outcome of this process, this project ranks 15 out of 15.

Analysis of the Project and Project Alternatives (5.4.5.2.B.1.c)

Effect on system operation efficiency and cost effectiveness	The new Asset Management system will deliver annual staff productivity/capacity improvements estimated at $90,000 allowing WNH to make asset replacement decisions in a much more efficient and cost effective manner. The project is cost justified within 3 1/2 years.
Net benefits accruing to customers	The acquisition and implementation of a formal Asset Management System will improve WNH's ability to track and interpret asset condition changes in a much more efficient and cost effective manner. This facilitates in an easier fashion than possible today, monetization of risk and its effect on the prioritization of asset replacement projects.
Impact on reliability performance (including on the frequency and duration of outages)	Effective asset management is expected to have a positive impact on the reliability of the distribution system by providing WNH with meaningful asset analysis that will improve our ability to identify underperforming or prematurely depreciating assets and remove them from service before they cause an outage.

Project Alternatives

a) <u>Do Nothing</u>

This represents lost opportunities for WNH to:

a) improve productivity and organizational effectiveness by replacing time consuming manual processes that are used today with efficient, automated, metric based (performance targets, health indices) and streamlined asset management business processes.

b) improve our ability to identify underperforming or prematurely depreciating assets and remove them from service before they cause an outage

b) **Develop an In-House Asset Management System**

This would require additional in-house IT & Subject Matter Experts to conduct a lengthy process of requirements definition, systems design, coding and testing. This would be costly (in excess of approx. $400,000) and would take an extended period of time to complete. The project risk would be high in terms of achieving a reliable, functional and comprehensive Asset Management System on a timely basis. WNH would also incur the high cost of retaining these new resources on a long term basis in order to ensure stable support for the new in-house developed system. This alternative also results in WNH risking a disruption of support for the solution if the IT specialized resources leave WNH due to the highly competitive IT skills market.

c) **Acquire and Implement a 3rd Party Asset Management Software Technology Solution**

The decision to acquire a 3rd party Asset Management Software solution, available in the market today, presents the best option for WNH. This project alternative allows WNH to implement a solution on a timely basis in order to address the main project drivers. For this alternative, WNH will conduct an RFP process for selection of the product.

Safety (5.4.5.2.B.2)

This is not applicable to this project.

Cyber-security, Privacy (5.4.5.2.B.3)

WNH's current practice of using multiple spreadsheets which can reside on a local PC's hard drive does not provide for enhanced cyber-security practices and privacy of information methodology. WNH's decision to move to a formal Asset Management software solution presents an opportunity to improve this level of security by having asset condition data maintained on a server which deploys appropriate security infrastructure as per current cyber-security standards for web-based software and privacy of information. This includes the software's ability to determine and prevent unauthorized access to it's information.

Co-ordination, Interoperability (5.4.5.2.B.4)

This is not applicable to this project.

Enabling of future technological functionality or addressing of future operational requirements

WNH seeks an Asset Management Software solution that positions the corporation to take advantage of future technology. The solution of choice must therefore be based on a foundation of current technology that will permit future advancements as follows:

a) Web-based code to support in the field, 'real-time' processing for enhanced collection of asset condition information
b) Deployment of Webservices with 'Service Oriented Application Protocol' for industry standard integration with 3rd party application information (i.e. weather, enhanced performance metrics, more advanced asset analysis algorithms, automated collection of asset condition information)
c) Deployment of XML (Extended Markup Language) which is an efficient language structure that permits high performance transfer of information from one entity to another (i.e. fast transfer of high volume status information from an asset in the field to a centralized server)

Economic Development (5.4.5.2.B.5)

This is not applicable to this project.

Environmental Benefits (5.4.5.2.B.6)

This is not applicable to this project.

GENERAL PLANT SPECIFIC REQUIREMENTS (5.4.5.2.C.d)

Category-specific requirements - General Plant (5.4.5.2.C.d.)

The Results of Quantitative and Qualitative Analyses, Including Assessments of Financially Feasible Options to the Proposed Project, and Identifying the Benefits of the Proposed Investment

Currently WNH has no formal Asset Management Software solution. A functional and robust Asset Management Software solution will position WNH to conduct asset management practices in a more efficient and cost effective manner both in the short term as well as the long term.

In terms of alternatives, WNH considered doing nothing. In the short term this presents no new capital investment. However, this represents lost opportunities for WNH to improve productivity and organizational effectiveness by replacing time consuming manual processes that are used today with efficient, automated, metric based (performance targets, health indices) and streamlined asset management business processes, while improving Asset Management practices leading to a more reliable distribution system.

Alternatively, WNH considered the option to develop an in-house Asset Management System. This would be costly (in excess of approx. $400,000) and would take an extended period of time to complete.

WNH considered the best alternative to be the acquisition and implementation of a 3rd party Asset Management Software technology solution available in the market today. This option requires short term capital investment resulting in a reliable Asset Management solution that can be implemented on a timely basis.

Business Case Documenting the Justifications for the Expenditure, Alternatives Considered, Benefits for Customers (short/long term), and Impact on Distributor Costs (short/long term)

Not Applicable. Although WNH recognizes that this project exceeds the materiality threshold, it is not to the level implied in Chapter 5 filing requirements as described under 5.4.5.2.C.d.second bullet.

Waterloo North Hydro Inc.

2016 Capital Project Summary

GENERAL INFORMATION ON THE PROJECT/ACTIVITY (5.4.5.2.A)

Project Name Replacement of Truck R65 - RBD (crane)

Investment Category General Plant

Project Description

This project involves the replacement of a radial boom derrick (RBD) truck. This type of truck is a mobile crane that is used to install poles, lift heavy equipment such as poles, transformers or loadbreak switches, and haul material trailers and pole trailers to job sites. This type of truck is also used regularly to brace existing installed hydro poles supporting energized equipment to allow excavation near the base of the pole to be done safely. The unit to be replaced is WNH truck number R65, a 1996 Freightliner FL80 chassis with a Telect Model 5048 crane unit. This RBD truck will be 20 years old in 2016. The emission control system on truck R65 does not meet current emission standards for reducing the release of diesel particulate matter into the environment. The controls for the crane on this truck require the operator to stand on a platform located at the right rear corner of the truck while operating the crane. While these controls were state of the art in 1996, newer RBD's now offer an option to have the operator control the crane using a radio remote control system. This allows the operator of the crane to move to a position closer to the work zone at the lifting end of the crane. This results in better visibility for the operator of the load being lifted as well as the hazards that could impact the work when the crane is in motion. This improves both the safety of WNH workers using this truck as well as the general public near the truck's work sites. Condition assessments completed by WNH mechanics have identified that truck R65 is reaching end of life condition and there is an increasing risk of major future maintenance costs related to the truck's engine, transmission, hydraulic and crane systems. The procurement process for the replacement truck started with a tender in August, 2014. The chassis was awarded to Team Truck (Freightliner), the crane / derick was awarded to Wajax (Terex) and the body was awarded to Pride Bodies. The completed truck is scheduled for delivery in April, 2016.

Capital Investment (5.4.5.2.A.first bullet)

Gross Capital	$454,513	
Customer Contribution	$0.00	
Net Capital	$454,513	
O&M Costs (if applicable)	$0.00	(not applicable)

Customer Attachments/Load (kVA) (5.4.5.2.A.second bullet)

Customer Attachments (#):	Not applicable
Customer Load (peak KVA)	Not applicable

Project Timing (5.4.5.2.A.third bullet)

Start Date	August, 2014
Expected In-Service Date	April, 2016

Expenditure Timing

2015	Q1:	25%	$113,628
2015	Q2:	0%	$0
2015	Q3:	0%	$0
2015	Q4:	30%	$136,354
2016	Q1:	0%	$0
2016	Q2:	45%	$204,531
2016	Q3:	0%	$0
2016	Q4:	0%	$0
	Total:	100%	$454,513

Risk and Risk Mitigation (5.4.5.2.A.fourth bullet) The main risk with this project will be adherence by the suppliers to the delivery schedule. We have mitigated this risk by starting the procurement process in mid 2014 to ensure adequate lead time for the delivery of the major components of the truck. We will mitigate the risk by requesting quarterly updates of the delivery schedule from each of the vendors involved to ensure we receive the finished truck in April, 2016.

Comparative Information (5.4.5.2.A.fifth bullet) WNH purchased a similar truck (R20) that went into service in 2013 at a total cost of $395,692.25. The main reasons for the higher cost of new truck to be received in 2016 are the inclusion of an Alternate Power Unit on the new truck as well auxiliary heating and cooling systems to ensure proper operation of the truck's hydraulic systems in extreme temperature conditions.

Total Capital & OM&A Costs Associated with REG Investments (5.4.5.2.A.sixth bullet) This project is not associated with a REG investment; capital and OM&A costs related to REG will not be incurred.

Leave to Construct Approval (5.4.5.2.A.seventh bullet) Not Applicable

Evaluation Criteria and information requirements (5.4.5.2.B)

EVALUATION CRITERIA AND INFORMATION REQUIREMENTS (5.4.5.2.B)

Efficiency, Customer Value, Reliability (5.4.5.2.B.1)

Main Driver (5.4.5.2.B.1.a)	The main driver of this project is the replacement of an end of life truck that is at risk of incurring major future maintenances costs related to the engine, transmission, hydraulic and crane systems.
Related Objectives/Performance Targets	WNH Strategic Imperatives 5, 2 and 6 (as identified in Exhibit 1)
Source and Nature of the Information Used to Justify the Investment	Reports from WNH mechanics when completing the annual MTO Safety Inspection on truck R65 indicating that truck R65 is nearing end of life condition.
Secondary Driver (5.4.5.2.B.1.a)	Safety is a secondary driver, as the removal of the existing truck from service eliminates potential safety hazards to both WNH workers and the general public. The inclusion of the radio remote control feature for the crane also provides significant added safety benefits to the WNH workers using this crane as well as the general public.
Related Objectives/Performance Targets	WNH Strategic Imperatives 5, 2 and 6 (as identified in Exhibit 1)
Source and Nature of the Information Used to Justify the Investment	Reports from WNH mechanics when completing the annual MTO Safety Inspection on truck R65 indicating that truck R65 is nearing end of life condition.
Investment Priority (5.4.5.2.B.1.b)	System Access investments are ranked as top priority, since they are required to be compliant with regulations. Under the General Plant category, WNH identifies underperforming assets or processes based on feedback received from customers, staff, tracking of performance, operating and maintenance costs. WNH also identifies opportunities for improvement in its ability to meet the WNH Strategic Imperatives and compiles a complete list of projects for this category. To prioritize the execution of these projects, WNH takes into account additional drivers or benefits of completing the project. This typically includes improvements in: worker safety, ability to continue to provide services to customers, opportunity for cost reduction, increase in productivity, operating efficiency, ability to operate and maintain, ability to adapt to future needs, and regulatory compliance. The more drivers or benefits are attributed to a project (other than asset age and condition), the higher its priority. Investments in System Service and System Renewal categories are prioritized in a similar fashion. Analysis of impact on customers and consideration of impact of project deferral are also considered. The compiled list of projects is reviewed and prioritized by Senior WNH Engineering, Operations, IT and Finance staff. Based on the outcome of this process, this project ranks 13 out of 15.

Analysis of the Project and Project Alternatives (5.4.5.2.B.1.c)

Effect on system operation efficiency and cost effectiveness	The replacement for truck R65 forms part of WNH's fleet which allows WNH's employees to efficiently construct and maintain a safe and reliable electricity distribution system throughout our service territory. The replacement truck will have lower operating and maintenance costs, be more fuel efficient and utilize the current standard of emission control technology for diesel engines.
Net benefits accruing to customers	The replacement of truck R65 will allow WNH to maintain its ability to construct and maintain a safe and reliable electricity distribution system. The improved emission control technology and the use of the Auxiliary Power Unit (APU) for powering the hydraulic and auxiliary systems for this truck at work sites will reduce truck engine emissions from the truck near the worksites as well as reduce the noise generated at worksites where this truck is in operation.
Impact on reliability performance (including on the frequency and duration of outages)	The replacement of truck R65 allows for the continued efficient day to day operations of WNH. Distribution system reliability will be positively impacted. The replacement truck will have a higher level of mechanical reliability. This will help to reduce the duration of outages that can be extended when a truck fails during the replacement of distribution equipment during an outage.

Project Alternatives

WNH considered the following alternatives:
a) Do Nothing - this option results in increased risk of equipment failure, maintenance costs and staff safety as Truck R65 nears its end of life condition. For this reasons, the Do Nothing option is not considered feasible.
b) Remove Truck R65 from the fleet prior to major equipment failure - this option results in an unacceptable loss of line construction and maintenance equipment capacity.
c) Purchase a replacement for Truck R65 and share the new truck with a neighboring utility - this option was reviewed and WNH determined that the current volume of construction and maintenance work assigned to Truck R65 would exceed 4 days per week. There is not enough unused capacity to make sharing the truck with a neighboring utility practical.
d) Replace Truck R65 with a new truck - this option allows for replacement of aged equipment with current technology that meets WNH's needs.

Safety (5.4.5.2.B.2)

The new truck to replace R65 will replace an end of life asset that, if not replaced, could lead to unsafe situations for WNH workers and/or the public.

Cyber-security, Privacy (5.4.5.2.B.3)

This is not applicable to this project.

Co-ordination, Interoperability (5.4.5.2.B.4)

Co-ordination with utilities, regional planning and/or links with 3rd party providers and/or industry (5.4.5.2.B.4.a)

The option of purchasing a replacement for truck R65 and sharing the new truck with a neighboring utility was considered. This option was reviewed and WNH determined that the current volume of construction and maintenance work assigned to truck R65 would exceed 4 days per week. There is not enough unused capacity to make sharing the replacement truck with a neighboring utility practical.

Enabling of future technological functionality or addressing of future operational requirements (5.4.5.2.B.4.b)

The control system specified for the replacement RBD crane will allow the operator to use either manual controls or a radio remote to operate the crane unit. The manual controls require the operator to stand on a platform located at the right rear corner of the truck while operating the crane. While this has been the standard control method for this type of RBD crane in the past, the benefit of the radio remote control option is a significant improvement in the safety of the crane operator as well as the WNH employees and members of the general public near the truck's worksite. Using the radio remote control options allows the operator of the crane to position him/herself closer to the work zone resulting in better visibility of the load being lifted as well as the hazards that could impact the work. This improves both the safety of WNH staff using this truck as well as the general public near the truck's work site.

Economic Development (5.4.5.2.B.5)

This is not applicable to this project.

Environmental Benefits (5.4.5.2.B.6)

The new RBD truck will have the latest diesel exhaust emission reduction technology which will help to reduce the total emissions produced by the WNH fleet. The new truck will also be equipped with an Auxiliary Power Unit (APU) which will provide a reliable source of power to operate the truck's lighting and hydraulic systems when the truck is stationary at a work site. This will enable the main truck engine to be turned off and reduce the emission output related to idling the truck's main engine. The reduction in engine idling hours will also help to reduce future maintenance costs associated with the new diesel particulate filter equipment in the exhaust system of the new truck. An additional benefit is that the APU unit has a much smaller engine and a quieter exhaust system than the truck's main engine. This will reduce the sound level near the truck's work site which will benefit both the WNH workers using the truck as well as the members of the general public near the truck's work site.

Category-specific requirements - General Plant (5.4.5.2.C.d.)

GENERAL PLANT SPECIFIC REQUIREMENTS (5.4.5.2.C.d)

The Results of Quantitative and Qualitative Analyses, Including Assessments of Financially Feasible Options to the Proposed Project, and Identifying the Benefits of the Proposed Investment

WNH prioritizes vehicle replacements by reviewing vehicle condition assessments from its mechanics and tracking vehicle maintenance and operating costs. Truck R65 is nearing end of life condition and is at risk of incurring major future maintenance costs related to the truck's major components such as: engine, transmission, hydraulic system or crane. WNH reviewed several alternatives for replacing truck R65. The "Do Nothing" option was considered inappropriate because it results in increased risk of equipment failure, maintenance costs and staff safety. The alternative of purchasing a replacement truck and sharing it with a neighboring LDC was considered and determined to be impractical as the replacement truck is required for WNH project work 4 or more days per week. The alternatives considered for this project confirmed that replacing truck R65 provided the greatest benefit to WNH. The net benefit of the investment to replace truck R65 will allow WNH to keep its fleet whole, keep its workers productive and safe, and ensure WNH has the reliable equipment it needs to construct and maintain its electricity distribution system. The process WNH uses for procuring a large vehicle like this involves developing specifications for the vehicle's chassis, boom/crane and body. WNH issued separate tenders for the chassis, crane and body for truck in August of 2014. The successful bidders were: chassis -Team Truck (Freightliner), crane - Wajax (Terex), and body - Pride Bodies Inc. The replacement truck will be a new unit and as a result, the cost of maintaining this RBD will be reduced going forward compared the typical costs associated with maintaining a 20 year old RBD. This will help to lower WNH's total operating costs for fleet maintenance. The benefit of adding a radio remote control option to this RBD crane will provide long term safety benefits to both WNH workers using this RBD crane unit and the general public (WNH's customers) who are in the vicinity of this truck's work sites. The addition of the APU technology to this replacement truck will reduce operating costs related to diesel fuel consumption when the truck is stationary at a work site. It will also reduce future maintenance costs related to the emission control system on the truck by limiting the number of engine operating hours required for stationary work. Secondly, by powering the truck's hydraulic and auxiliary systems with the smaller engine of the APU, noise at this truck's work sites will be significantly reduced. This will provide long term benefits to both WNH workers using the truck as well as WNH customers near the truck's work sites.

Business Case Documenting the Justifications for the Expenditure, Alternatives Considered, Benefits for Customers (short/long term), and Impact on Distributor Costs (short/long term)

Not Applicable. Although WNH recognizes that this project exceeds the materiality threshold, it is not to the level implied in Chapter 5 filing requirements as described under 5.4.5.2.C.d.second bullet.

Appendix H: Photos of Assets in Poor Condition

Figure AH-1: Pole Top Deterioration

Figure AH-2: Padmount Transformer Deterioration (18 years - 30 years)

ATTACHMENT 2-2

OEB APPENDIX 2-FA
AND 2-FC REG
EXPANSION INVESTMENT

File Number:	EB-2015-0108
Exhibit:	2
Tab:	
Schedule:	Attachment 2-2
Page:	
Date:	May 1, 2015

Appendix 2-FA
Renewable Generation Connection Investment Summary (past investments or over the future rate setting period)

Enter the details of the Renewable Generation Connection projects as described in the appropriate section of the Filing Requirements.
All costs entered on this page will be transferred to the appropriate cells in the appendices that follow.
For Part A, Renewable Enabling Improvements (REI), these amounts will be transferred to Appendix 2 - FB
For Part B, Expansions, these amounts will be transferred to Appendix 2 - FC

If there are more than **five** projects proposed to be in-service in a certain year, please amend the tables below and ensure that the formulae for the Total Amounts in any given rate year are updated.
Based on the current methodology and allocation, amounts allocated represent 6% for REI Connection Investments and 17% for Expansion Investments. (pg 15, EB-2009-0349)

There are two scenarios described below. Separate sets of spreadsheets (2-FA, 2-FB, 2-FC) should be submited for each scenario as required.
Scenario 1: **Past Investments with No Recovery.** The distributor has made investments in the past (during the IRM Years), but has not received approval for these projects and therefore did not receive revenue from the IESO under Regulation 330/09 and did not receive ratepayer revenue for the direct benefit portion of the investment.
The WCA percentage, debt percentages, interest rates, kWh, tax rates, amortization period, CCA Class and percentage should correspond to the distributor's last Cost of Service approval.
The Direct Benefit portion of the calculated Revenue Requirement for each year should be summed and can be applied for recovery from the distributor's ratepayers through a rate rider.
The Provincial Recovery portion of the calculated Revenue Requirement for each year should be summed and can be applied for recovery from the IESO through a separate order.

Scenario 2: **Investments in the Test Year and Beyond.** Distributor plans to make investments in 2015 and/or beyond. These investments should be added to 2-FA in the appropriate year.
The WCA percentage, debt percentages, interest rates, kWh, tax rates, amortization period, CCA Class and percentage should correspond to the distributor's current application.

Part A

<u>**REI Investments (Direct Benefit at 6%)**</u>	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
Project 1									
Name: REI Connection Project									
Capital Costs	$0	$0	$0	$0	$0	$0	$0	$0	$0
OM&A (Start-Up)	$0	$0	$0	$0	$0	$0	$0	$0	$0
OM&A (Ongoing)	$0	$0	$0	$0	$0	$0	$0	$0	$0
Project 2									
Name: REI Connection Project									
Capital Costs	$0	$0	$0	$0	$0	$0	$0	$0	$0
OM&A (Start-Up)	$0	$0	$0	$0	$0	$0	$0	$0	$0
OM&A (Ongoing)	$0	$0	$0	$0	$0	$0	$0	$0	$0
Project 3									
Name: REI Connection Project									
Capital Costs	$0	$0	$0	$0	$0	$0	$0	$0	$0
OM&A (Start-Up)	$0	$0	$0	$0	$0	$0	$0	$0	$0
OM&A (Ongoing)	$0	$0	$0	$0	$0	$0	$0	$0	$0
Project 4									
Name: REI Connection Project									
Capital Costs	$0	$0	$0	$0	$0	$0	$0	$0	$0
OM&A (Start-Up)	$0	$0	$0	$0	$0	$0	$0	$0	$0
OM&A (Ongoing)	$0	$0	$0	$0	$0	$0	$0	$0	$0
Project 5									
Name: REI Connection Project									
Capital Costs	$0	$0	$0	$0	$0	$0	$0	$0	$0
OM&A (Start-Up)	$0	$0	$0	$0	$0	$0	$0	$0	$0
OM&A (Ongoing)	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Capital Costs	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**
Total OM&A (Start-Up)	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**
Total OM&A (Ongoing)	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**

Part B

Expansion Investments (Direct Benefit at 17%)	2011	2012	2013	2014	2015	2016	2017	2018	2019
Project 1									
Name: Expansion Connection Project									
Capital Costs	$0	$0	$117,320	$0	$0	$0	$0	$0	$0
OM&A (Start-Up)	$0	$0	$0	$0	$0	$0	$0	$0	$0
OM&A (Ongoing)	$0	$0	$0	$0	$0	$0	$0	$0	$0
Project 2									
Name: Expansion Connection Project									
Capital Costs	$0	$0	$0	$0	$0	$0	$0	$0	$0
OM&A (Start-Up)	$0	$0	$0	$0	$0	$0	$0	$0	$0
OM&A (Ongoing)	$0	$0	$0	$0	$0	$0	$0	$0	$0
Project 3									
Name: Expansion Connection Project									
Capital Costs	$0	$0	$0	$0	$0	$0	$0	$0	$0
OM&A (Start-Up)	$0	$0	$0	$0	$0	$0	$0	$0	$0
OM&A (Ongoing)	$0	$0	$0	$0	$0	$0	$0	$0	$0
Project 4									
Name: Expansion Connection Project									
Capital Costs	$0	$0	$0	$0	$0	$0	$0	$0	$0
OM&A (Start-Up)	$0	$0	$0	$0	$0	$0	$0	$0	$0
OM&A (Ongoing)	$0	$0	$0	$0	$0	$0	$0	$0	$0
Project 5									
Name: Expansion Connection Project									
Capital Costs	$0	$0	$0	$0	$0	$0	$0	$0	$0
OM&A (Start-Up)	$0	$0	$0	$0	$0	$0	$0	$0	$0
OM&A (Ongoing)	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Capital Costs	**$ -**	**$ -**	**$ 117,320**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**
Total OM&A (Start-Up)	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**
Total OM&A (Ongoing)	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**

File Number:	EB-2015-0108
Exhibit:	2
Tab:	
Schedule:	Attachment 2-2
Page:	
Date:	May 1, 2015

Appendix 2-FC

Calculation of Renewable Generation Connection Direct Benefits/Provincial Amount: Renewable Expansion Investments

This table will calculate the distributor/provincial shares of the investments entered in Part B of Appendix 2-FA.
Enter values in green shaded cells: WCA percentage, debt percentages, interest rates, kWh, tax rates, amortization period, CCA Class and percentage.
For historical investments, enter these variables for your last cost of service test year. For 2015 and beyond, enter vaiables as in the application.
Rate Riders are not calculated for Test Year as these assets and costs are already in the distributors rate base.

			2011			2012			2013			2014		
			Total	Direct Benefit 17%	Provincial 83%	Total	Direct Benefit 17%	Provincial 83%	Total	Direct Benefit 17%	Provincial 83%	Total	Direct Benefit 17%	Provincial 83%
Net Fixed Assets (average)			$ -	$ -	$ -	$ -	$ -	$ -	$ 58,008	$ 9,861	$ 48,147	$ 114,713	$ 19,501	$ 95,212
Incremental OM&A (on-going, N/A for Provincial Recovery)			$0	$ -		$0	$ -		$0	$ -		$0	$ -	
Incremental OM&A (start-up, applicable for Provincial Recovery)			$0	$ -	$ -	$0	$ -	$ -	$0	$ -	$ -	$0	$ -	$ -
WCA	13%			$ -	$ -		$ -	$ -		$ -	$ -		$ -	$ -
Rate Base				$ -	$ -		$ -	$ -		$ 9,861	$ 48,147		$ 19,501	$ 95,212
Deemed ST Debt	4%			$ -	$ -		$ -	$ -		$ 394	$ 1,926		$ 780	$ 3,808
Deemed LT Debt	56%			$ -	$ -		$ -	$ -		$ 5,522	$ 26,962		$ 10,921	$ 53,319
Deemed Equity	40%			$ -	$ -		$ -	$ -		$ 3,945	$ 19,259		$ 7,800	$ 38,085
	Historial/Bridge	Test												
ST Interest	2.46%	2.16%		$ -	$ -		$ -	$ -		$ 10	$ 47		$ 19	$ 94
LT Interest	5.22%	4.23%		$ -	$ -		$ -	$ -		$ 288	$ 1,406		$ 570	$ 2,781
ROE	9.58%	9.30%		$ -	$ -		$ -	$ -		$ 378	$ 1,845		$ 747	$ 3,649
Cost of Capital Total				$ -	$ -		$ -	$ -		$ 676	$ 3,299		$ 1,336	$ 6,523
OM&A				$ -	$ -		$ -	$ -		$ -	$ -		$ -	$ -
Amortization			$ -	$ -	$ -	$ -	$ -	$ -	$ 1,304	$ 222	$ 1,082	$ 3,911	$ 665	$ 3,246
Grossed-up PILs				$ -	$ -		$ -	$ -		$ -	$ -		$ -	$ -
Revenue Requirement				$ -	$ -		$ -	$ -		$ 897	$ 4,381		$ 2,001	$ 9,769
Provincial Rate Protection					$ -			$ -			$ 4,381			$ 9,769
Monthly Amount Paid by IESO					$ -			$ -			$ 365			$ 814

Note 1: The difference between the actual costs of approved eligible investments and revenue received from the IESO should be recorded in a variance account. The Board may provide regulatory accounting guidance regarding a variance account either in an individual proceeding or on a generic basis.
Note 2: For the 2015 Test Year, Costs and Revenues of the Direct Benefit are to be included in the test year applicant Rate Base and Revenues.

PILs Calculation

	2011		2012		2013		2014	
Income Tax	Direct Benefit	Provincial	Direct Benefit	Provincial	Direct Benefit	Provincial	Direct Benefit	Provincial
Net Income - ROE on Rate Base	$ -	$ -	$ -	$ -	$ 378	$ 1,845	$ 747	$ 3,649
Amortization (17% DB and 83% P)	$ -	$ -	$ -	$ -	$ 222	$ 1,082	$ 665	$ 3,246
CCA (17% DB and 83% P)	$ -	$ -	$ -	$ -	-$ 798	-$ 3,895	-$ 1,532	-$ 7,478
Taxable income	$ -	$ -	$ -	$ -	-$ 198	-$ 968	-$ 120	-$ 584
Tax Rate (to be entered)								
Income Taxes Payable	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Gross Up								
Income Taxes Payable	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Grossed Up PILs	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -

Net Fixed Assets

		2011	2012	2013	2014	2015	2016	2017	2018	2019
Enter applicable amortization in years:	45									
Opening Gross Fixed Assets			$ -	$ -	$ 117,320	$ 117,320	$ 117,320	$ 117,320	$ 117,320	$ 117,320
Gross Capital Additions		$ -	$ -	$ 117,320	$ -	$ -	$ -	$ -	$ -	$ -
Closing Gross Fixed Assets		$ -	$ -	$ 117,320	$ 117,320	$ 117,320	$ 117,320	$ 117,320	$ 117,320	$ 117,320
Opening Accumulated Amortization			$ -	$ -	$ 1,304	$ 3,911	$ 6,518	$ 9,125	$ 11,732	$ 14,339
Current Year Amortization (before additions)			$ -	$ -	$ 2,607	$ 2,607	$ 2,607	$ 2,607	$ 2,607	$ 2,607
Additions (half year)		$ -	$ -	$ 1,304	$ -	$ -	$ -	$ -	$ -	$ -
Closing Accumulated Amortization		$ -	$ -	$ 1,304	$ 3,911	$ 6,518	$ 9,125	$ 11,732	$ 14,339	$ 16,946
Opening Net Fixed Assets		$ -	$ -	$ -	$ 116,017	$ 113,410	$ 110,802	$ 108,195	$ 105,588	$ 102,981
Closing Net Fixed Assets		$ -	$ -	$ 116,017	$ 113,410	$ 110,802	$ 108,195	$ 105,588	$ 102,981	$ 100,374
Average Net Fixed Assets		$ -	$ -	$ 58,008	$ 114,713	$ 112,106	$ 109,499	$ 106,892	$ 104,285	$ 101,678

UCC for PILs Calculation

		2014	2014	2014	2014	2015	2016	2017	2018	2019
Opening UCC			$ -	$ -	$ 112,627	$ 103,617	$ 95,328	$ 87,702	$ 80,685	$ 74,231
Capital Additions (from Appendix 2-FA)		$ -	$ -	$ 117,320	$ -	$ -	$ -	$ -	$ -	$ -
UCC Before Half Year Rule		$ -	$ -	$ 117,320	$ 112,627	$ 103,617	$ 95,328	$ 87,702	$ 80,685	$ 74,231
Half Year Rule (1/2 Additions - Disposals)		$ -	$ -	$ 58,660	$ -	$ -	$ -	$ -	$ -	$ -
Reduced UCC		$ -	$ -	$ 58,660	$ 112,627	$ 103,617	$ 95,328	$ 87,702	$ 80,685	$ 74,231
CCA Rate Class (to be entered)	47	47	47	47	47	47	47	47	47	47
CCA Rate (to be entered)	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%
CCA		$ -	$ -	$ 4,693	$ 9,010	$ 8,289	$ 7,626	$ 7,016	$ 6,455	$ 5,938
Closing UCC		$ -	$ -	$ 112,627	$ 103,617	$ 95,328	$ 87,702	$ 80,685	$ 74,231	$ 68,292

Appendix 2-FC
Calculation of Renewable Generation Connection Direct

This table will calculate the distributor/provincial shares of the investments entered in Part E
Enter values in green shaded cells: WCA percentage, debt percentages, interest rates,
For historical investments, enter these variables for your last cost of service test year. For 2015 and beyond, enter vaiables as in the application.
Rate Riders are not calculated for Test Year as these assets and costs are already in the di

			2015 BRIDGE YEAR			2016 TEST YEAR		
			Total	Direct Benefit 17%	Provincial 83%	Total	Direct Benefit 17%	Provincial 83%
Net Fixed Assets (average)			$ 112,106	$ 19,058	$ 93,048	$ 109,499	$ 18,615	$ 90,884
Incremental OM&A (on-going, N/A for Provincial Recovery)			$0	$ -		$0	$ -	
Incremental OM&A (start-up, applicable for Provincial Recovery)			$0	$ -	$ -	$0	$ -	$ -
WCA	13%			$ -	$ -		$ -	$ -
Rate Base				$ 19,058	$ 93,048		$ 18,615	$ 90,884
Deemed ST Debt	4%			$ 762	$ 3,722		$ 745	$ 3,635
Deemed LT Debt	56%			$ 10,672	$ 52,107		$ 10,424	$ 50,895
Deemed Equity	40%			$ 7,623	$ 37,219		$ 7,446	$ 36,354
	Historial/Bridge	Test						
ST Interest	2.46%	2.16%		$ 19	$ 92		$ 16	$ 79
LT Interest	5.22%	4.23%		$ 557	$ 2,718		$ 441	$ 2,152
ROE	9.58%	9.30%		$ 730	$ 3,566		$ 692	$ 3,381
Cost of Capital Total				$ 1,306	$ 6,375		$ 1,149	$ 5,612
OM&A				$ -	$ -		$ -	$ -
Amortization			$ 2,607	$ 443	$ 2,164	$ 2,607	$ 443	$ 2,164
Grossed-up PILs				$ -	$ -		$ -	$ -
Revenue Requirement				$ 1,749	$ 8,539		$ 1,593	$ 7,776
Provincial Rate Protection					$ 8,539			$ 7,776
Monthly Amount Paid by IESO					$ 712			$ 648

	2017			2018			2019		
	Total	Direct Benefit 17%	Provincial 83%	Total	Direct Benefit 17%	Provincial 83%	Total	Direct Benefit 17%	Provincial 83%
Net Fixed Assets (average)	$ 106,892	$ 18,172	$ 88,720	$ 104,285	$ 17,728	$ 86,556	$ 101,678	$ 17,285	$ 84,392
Incremental OM&A (on-going, N/A for Provincial Recovery)	$0	$ -		$0	$ -		$0	$ -	
Incremental OM&A (start-up, applicable for Provincial Recovery)	$0	$ -	$ -	$0	$ -	$ -	$0	$ -	$ -
WCA		$ -	$ -		$ -	$ -		$ -	$ -
Rate Base		$ 18,172	$ 88,720		$ 17,728	$ 86,556		$ 17,285	$ 84,392
Deemed ST Debt		$ 727	$ 3,549		$ 709	$ 3,462		$ 691	$ 3,376
Deemed LT Debt		$ 10,176	$ 49,683		$ 9,928	$ 48,471		$ 9,680	$ 47,260
Deemed Equity		$ 7,269	$ 35,488		$ 7,091	$ 34,622		$ 6,914	$ 33,757
ST Interest		$ 16	$ 77		$ 15	$ 75		$ 15	$ 73
LT Interest		$ 430	$ 2,101		$ 420	$ 2,050		$ 409	$ 1,998
ROE		$ 676	$ 3,300		$ 659	$ 3,220		$ 643	$ 3,139
Cost of Capital Total		$ 1,122	$ 5,478		$ 1,095	$ 5,344		$ 1,067	$ 5,211
OM&A		$ -	$ -		$ -	$ -		$ -	$ -
Amortization	$ 2,607	$ 443	$ 2,164	$ 2,607	$ 443	$ 2,164	$ 2,607	$ 443	$ 2,164
Grossed-up PILs		$ -	$ -		$ -	$ -		$ -	$ -
Revenue Requirement		$ 1,565	$ 7,642		$ 1,538	$ 7,508		$ 1,510	$ 7,375
Provincial Rate Protection			$ 7,642			$ 7,508			$ 7,375
Monthly Amount Paid by IESO			$ 637			$ 626			$ 615

Note 1: The difference between the actual costs of approved eligible investments and revenue received from the IESO should be recorded in a variance account. The Board may provide regulatory accounting guidance regarding a variance account either in an individual proceeding or on a generic basis.
Note 2: For the 2015 Test Year, Costs and Revenues of the Direct Benefit are to be included in the test year applicant Rate Base and Revenues.

PILs Calculation

	2015 TEST YEAR		2016			2017			2018			2019	
Income Tax	Direct Benefit	Provincial	Direct Benefit	Provincial	Total	Direct Benefit	Provincial	Total	Direct Benefit	Provincial	Total	Direct Benefit	Provincial
Net Income - ROE on Rate Base	$ 730	$ 3,566	$ 692	$ 3,381		$ 676	$ 3,300		$ 659	$ 3,220		$ 643	$ 3,139
Amortization (17% DB and 83% P)	$ 443	$ 2,164	$ 443	$ 2,164		$ 443	$ 2,164		$ 443	$ 2,164		$ 443	$ 2,164
CCA (17% DB and 83% P)	-$ 1,409	-$ 6,880	-$ 1,296	-$ 6,330		-$ 1,193	-$ 5,823		-$ 1,097	-$ 5,358		-$ 1,010	-$ 4,929
Taxable income	-$ 236	-$ 1,151	-$ 161	-$ 785		-$ 74	-$ 359		$ 5	$ 26		$ 77	$ 374
Tax Rate (to be entered)													
Income Taxes Payable	$ -	$ -	$ -	$ -		$ -	$ -		$ -	$ -		$ -	$ -
Gross Up													
Income Taxes Payable	$ -	$ -	$ -	$ -		$ -	$ -		$ -	$ -		$ -	$ -
Grossed Up PILs	**$ -**	**$ -**	**$ -**	**$ -**		**$ -**	**$ -**		**$ -**	**$ -**		**$ -**	**$ -**

Net Fixed Assets

	Enter applicable amortization in years:	45
Opening Gross Fixed Assets		
Gross Capital Additions		
Closing Gross Fixed Assets		
Opening Accumulated Amortization		
Current Year Amortization (before additions)		
Additions (half year)		
Closing Accumulated Amortization		
Opening Net Fixed Assets		
Closing Net Fixed Assets		
Average Net Fixed Assets		

UCC for PILs Calculation

Opening UCC	
Capital Additions (from Appendix 2-FA)	
UCC Before Half Year Rule	
Half Year Rule (1/2 Additions - Disposals)	
Reduced UCC	
CCA Rate Class (to be entered)	47
CCA Rate (to be entered)	8%
CCA	
Closing UCC	