Welland Hydro
ELECTRIC SYSTEM CORP.

POWERING WELLAND'S FUTURE

**EXHIBIT 3
CUSTOMER AND LOAD FORECAST**

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3 Customer and Load Forecast

3.1 Load Forecasts

The purpose of this exhibit is to present the process used by Welland Hydro-Electric System Corp ("WHESC") to prepare the weather normalized load and customer/connection forecast used to design the proposed 2025 distribution rates.

As a starting point, WHESC used the same regression analysis methodology approved by the Ontario Energy Board (the "Board") in its 2017 Cost of Service ("COS") Application (EB-2016-0110) and updated the analysis for actual power purchases to the end of 2023. Regarding the overall process of load forecasting, WHESC believes that conducting a regression analysis on historical electricity purchases to produce an equation that will predict purchases is appropriate. WHESC has data for the amount of electricity (in kWh) purchased from the IESO for use by WHESC's customers. With a regression analysis, these purchases can be related to other monthly explanatory variables, such as heating degree days and cooling degree days which occur in the same month. The results of the regression analysis produces an equation that predicts the purchases based on the explanatory variables. This prediction model is then used as the basis to forecast the total level of weather normalized purchases for the Bridge Year and the Test Year, which is converted to billed kWh and kW, where applicable, by rate class. A detailed explanation of the process is provided later in this evidence.

Based on the OEB's approval of this methodology in WHESC's last COS application, in addition to the OEB's approval of the same method in recent COS applications of other applicants, WHESC submits the load forecasting methodology is reasonable for the purpose of this Application.

The following provides the material to support the weather normalized load forecast used by WHESC in this Application.

Table 3-1, Table 3-2 and Table 3-3 below provide a summary of the weather normalized load and customer/connection forecast used in this Application.

1   **Table 3-1: Summary of Load and Customer/Connection Forecast**

Year	Billed Actual (GWh)	Growth (GWh)	Billed Weather Normal (GWh)	Growth (GWh)	Customer/ Connection Count	Growth
Billed Energy (GWh) and Customer Count / Connections						
2017 Board Approved			360.5		30,582	
2014	380.9		384.3		29,944	
2015	356.4	(24.5)	358.5	(25.8)	30,128	184
2016	363.4	7.0	354.8	(3.7)	30,347	219
2017	353.7	(9.7)	358.8	4.1	30,565	217
2018	379.1	25.4	369.9	11.1	30,910	346
2019	370.6	(8.5)	371.8	1.9	31,266	356
2020	364.6	(6.0)	363.2	(8.6)	31,606	341
2021	368.5	3.8	367.6	4.5	32,121	514
2022	377.1	8.6	376.3	8.7	32,609	488
2023	370.8	(6.3)	380.4	4.1	33,276	666
2024 Bridge			380.4	0.0	33,679	404
2025 Test			381.0	0.6	34,090	410

3   In the above Table 3-1, the billed GWh data from 2014 to 2023 reflects actual weather and weather normal
4   conditions in each year. The weather normal values are the actual values adjusted by the weather normal
5   conversion factor outlined in Table 3-5. The weather normal conversion factor is determined consistent with
6   the approach outlined by the OEB in Board Appendix 2-IA (See Appendix 3-B for 2-I Chapter 2 Appendices
7   Schedules). For 2024 and 2025, the forecasted billed GWh is on a weather normal basis.

8   Customer/Connection values are on an average basis for the purpose of rate design. Street Lights, Sentinel
9   Lights and Unmetered Scattered Loads are measured as connections.

10   Table 3-2 provides the historical billed amounts on an actual and weather normalized basis by rate class
11   using the weather normal conversation factor from Table 3-5. The forecasted billed amounts for 2024 and
12   2025 are also provided by rate class.

1

Table 3-2: Billed Energy by Rate Class

Year	Residential	General Service < 50 kW	General Service 50 to 4,999 kW	Sentinel Lights	Street Lights	Unmetered Scattered Loads	Large User	Total
Billed Energy (GWh) - Actual								
2014	158.2	53.9	144.2	0.8	2.5	1.0	20.4	380.9
2015	158.0	54.3	139.8	0.8	2.3	1.0	0.3	356.4
2016	163.1	53.5	143.4	0.7	1.6	1.0	0.0	363.4
2017	153.8	52.3	144.5	0.7	1.4	1.0	0.0	353.7
2018	170.5	53.0	152.6	0.7	1.4	1.0	0.0	379.1
2019	165.8	50.5	151.4	0.6	1.4	1.0	0.0	370.6
2020	179.9	48.5	133.3	0.5	1.4	0.9	0.0	364.6
2021	182.9	54.2	128.5	0.5	1.4	0.9	0.0	368.5
2022	182.6	55.7	136.0	0.4	1.4	0.9	0.0	377.1
2023	177.4	54.3	136.4	0.4	1.5	0.9	0.0	370.8
Billed Energy (GWh) - Weather Normal								
Approved	165.1	53.8	138.6	0.7	1.3	1.0	0	360.5
2014	159.6	54.4	145.5	0.8	2.5	1.0	20.5	384.3
2015	158.9	54.6	140.6	0.8	2.3	1.0	0.3	358.5
2016	159.2	52.3	140.0	0.7	1.5	1.0	0.0	354.8
2017	156.1	53.1	146.6	0.7	1.4	1.0	0.0	358.8
2018	166.3	51.7	148.9	0.7	1.4	0.9	0.0	369.9
2019	166.3	50.7	151.8	0.6	1.4	1.0	0.0	371.8
2020	179.2	48.3	132.7	0.5	1.4	0.9	0.0	363.2
2021	182.5	54.1	128.2	0.5	1.4	0.9	0.0	367.6
2022	182.2	55.6	135.7	0.4	1.4	0.9	0.0	376.3
2023	182.0	55.7	139.9	0.4	1.5	0.9	0.0	380.4
2024 Bridge	184.8	56.1	136.9	0.4	1.5	0.8	0.0	380.4
2025 Test	187.4	56.4	134.5	0.4	1.5	0.8	0.0	381.0

2

3   Table 3-3 shows the historical and forecasted number of customers/connections by rate class, along with

4   the historical usage per customer/connection on an actual and weather normalized basis. The 2024 and

5   2025 forecasted usage per customer/connection is also provided on a weather normalized basis.

1   **Table 3-3: Number of Customers/Connections and Annual Normalized Usage by Rate Class**

Year	Residential	General Service < 50 kW	General Service 50 to 4,999 kW	Sentinel Lights	Street Lights	Unmetered Scattered Loads	Large User	Total
Number of Customers/Connections								
2017 Board Approved	21,025	1,777	154	509	6,856	261	0	30,582
2014	20,472	1,743	165	519	6,784	259	1	29,944
2015	20,636	1,769	159	515	6,793	257	0	30,128
2016	20,823	1,771	159	509	6,825	261	0	30,347
2017	20,987	1,791	159	500	6,865	262	0	30,565
2017	21,242	1,798	164	487	6,956	263	0	30,910
2019	21,580	1,797	166	454	7,007	262	0	31,266
2020	21,927	1,788	161	406	7,067	258	0	31,606
2021	22,396	1,837	140	378	7,115	256	0	32,121
2022	22,849	1,838	139	345	7,186	252	0	32,609
2023	23,410	1,845	142	342	7,336	200	0	33,276
2024 Bridge	23,762	1,857	140	326	7,400	194	0	33,679
2025 Test	24,119	1,869	137	311	7,464	189	0	34,090
Actual Annual Energy Usage per Customer/Connection (kWh per customer/connection)								
2014	7,727	30,928	872,132	1,478	369	3,729	20,367,511	
2015	7,655	30,701	880,149	1,464	336	3,779	0	
2016	7,833	30,242	902,086	1,473	231	3,737	0	
2017	7,330	29,206	907,791	1,458	203	3,660	0	
2018	8,025	29,464	930,550	1,389	202	3,638	0	
2019	7,683	28,101	910,847	1,287	201	3,639	0	
2020	8,205	27,154	827,425	1,321	201	3,644	0	
2021	8,166	29,529	919,846	1,276	198	3,594	0	
2022	7,994	30,314	980,393	1,226	197	3,552	0	
2023	7,577	29,414	960,789	1,228	198	4,256	0	
Normalized Annual Energy Usage per Customer/Connection (kWh per customer/connection)								
2017 Board Approved	7,850	30,292	900,130	1,472	188	3,693	0	
2014	7,796	31,204	879,910	1,491	372	3,762	20,549,149	
2015	7,700	30,882	885,328	1,472	338	3,802	0	
2016	7,648	29,525	880,696	1,438	225	3,649	0	
2017	7,436	29,629	920,935	1,479	206	3,713	0	
2018	7,831	28,751	908,051	1,356	197	3,550	0	
2019	7,708	28,191	913,757	1,291	201	3,651	0	
2020	8,172	27,044	824,071	1,315	201	3,629	0	
2021	8,147	29,460	917,681	1,273	198	3,585	0	
2022	7,976	30,246	978,182	1,223	197	3,544	0	
2023	7,773	30,172	985,536	1,260	203	4,366	0	
2024 Bridge	7,776	30,183	980,372	1,228	198	4,256	0	
2025 Test	7,772	30,169	980,003	1,228	198	4,256	0	

2

3   ### 3.1.1   Multivariate Regression Model

4   WHESC's weather normalized load forecast is developed in a three-step process. First, a total system

5   weather normalized purchased energy forecast is developed based on a multivariate regression model that

6   incorporates historical load, weather, and other variables that impact electricity usage. Second, the weather

7   normalized purchased energy forecast is adjusted by a historical loss factor to produce a weather

8   normalized billed energy forecast. Finally, the forecast of billed energy by rate class is developed based on

9   a forecast of customer/connection numbers and historical usage patterns per customer/connection. For the

10   rate classes that have weather sensitive load, their forecasted billed energy is adjusted to ensure that the

1   total billed energy forecast by rate class is equivalent to the total weather normalized billed energy forecast
2   that has been determined from the regression model. The forecast of customers by rate class is determined
3   using a geometric mean. For those rate classes that use kW for the distribution volumetric billing
4   determinant, an adjustment factor is applied to the class energy forecast based on the historical relationship
5   between kW and kWh. The following will explain the forecasting process in more detail.

6   ### 3.1.1.1   Purchased kWh Load Forecast

7   An equation to predict total system purchased energy is developed using a multivariate regression model
8   with the independent variables outlined below. The regression model uses monthly kWh and monthly values
9   of independent variables from January 2014 to December 2023 to determine the monthly regression
10 coefficients. This provides 120 monthly data points which is a reasonable data set for use in a multiple
11 regression analysis.

12 With regards to weather normalization, WHESC submits that it is appropriate to review the impact of
13 weather over the ten-year period from January 2014 to December 2023, since it is consistent with the time-
14 period outlined in the filing requirements and it is reflective of recent weather conditions. The average
15 weather conditions over this period are applied in the prediction formula to determine a weather normalized
16 forecast. WHESC customer demographics have been included in Appendix 3-C.

17 The multivariate regression model has determined the drivers of year-over-year changes in WHESC's load
18 growth are:

19 - weather (heating and cooling degree days);
20 - calendar variables (days in month and seasonal spring/fall flag);
21 - the number of customers in the Residential, GS <50kW and GS 50 to 4,999kW rate classes.
22
23 These factors are captured within the multivariate regression. Weather impacts on load are apparent in
24 both the winter heating season, and in the summer cooling season. For that reason, both Heating Degree
25 Days (i.e. a measure of coldness in winter) and Cooling Degree Days (i.e. a measure of summer heat) are
26 modeled.

27 The following outlines the prediction model used by WHESC to predict weather normal purchases for 2024
28 and 2025:

1   WHESC monthly predicted kWh purchases

2   = Heating Degree Days * 10,438

3   + Cooling Degree Days * 91,005

4   + Number of Days in the Month * 1,256,415

5   + Spring Fall Flag * (2,373,776)

6   + Number of Customers * 436

7   + Constant of (20,790,886)

8   The monthly data used in the regression model and the resulting monthly predictions for the actual and

9   forecasted years are provided in Appendix 3-A and have also been filed in live excel format.

10   The sources of data for the various data points are:

11   •   Environment Canada's weather station data for monthly heating degree day and cooling degree

12   information. Weather data was obtained from the Welland-Pelham weather station. This is the same

13   weather station used in WHESC's 2017 COS and is the closest in proximity to WHESC's service

14   territory;

15   •   Calendar-based number of days in the month and identification of the spring/fall flag;

16   •   The number of customers in the Residential, GS <50kW and GS 50 to 4,999kW rate classes is

17   based on monthly historical actuals from 2014 to 2023.

18   The prediction formula has the following statistical results which generally indicate the formula has a very

19   good fit to the actual data set.

20   **Table 3-4: Statistical Results**

R Square	88.9%
Adjusted R Square	88.4%
F Test	183
MAPE (Monthly)	2.8%
Durbin-Watson	1.1008
T-stats by Coefficient	
Heating Degree Days	16.0
Cooling Degree Days	18.1
Days in Month	7.7
Spring Fall Flag	(7.5)
Number of Customers	3.7
Constant	(3.7)

21

22   The annual results of the above prediction formula compared to the actual annual purchases from 2014 to

23   2023 are shown below in Table 3-5, along with the predicted total system purchases for WHESC for 2024

24   and 2025 on a weather normal basis. Information is also provided to show the Weather Normal Conversion

1   Factor which is used to weather normalize actual volume data. In Table 3-5, the Predicted Weather Normal

2   values are similar to the Predicted amounts, but the weather normalized Heating Degree Days and Cooling

3   Degree Days used to determine the weather normal forecast for 2024 and 2025 are used in the prediction

4   formula in place of actual Heating Degree and Cooling Degree Days. The ratio of Predicted Weather Normal

5   to Predicted values results in a Weather Normal Conversion Factor. This factor is applied to the Actual

6   amount which results in the Actual Weather Normal value.

7   **Table 3-5: Total System Purchases**

Year	Actual	Predicted	% Difference	Predicted Weather Normal	Weather Normal Conversion Factor	Actual Weather Normal
Purchased Energy (GWh)						
2014	391.7	373.6	(4.6%)	376.9	1.0089	395.2
2015	372.7	375.7	0.8%	377.9	1.0059	374.9
2016	380.0	389.4	2.5%	380.1	0.9763	371.0
2017	368.6	374.4	1.6%	379.8	1.0145	373.9
2018	393.9	390.7	(0.8%)	381.2	0.9758	384.4
2019	384.8	381.8	(0.8%)	383.0	1.0032	386.0
2020	380.1	387.6	2.0%	386.0	0.9959	378.6
2021	383.9	388.3	1.1%	387.4	0.9976	383.0
2022	392.6	390.6	(0.5%)	389.7	0.9977	391.7
2023	386.6	382.9	(1.0%)	392.7	1.0258	396.6
2024 Bridge		395.9		395.9	1.0000	
2025 Test		396.5		396.5	1.0000	

8

9   The weather normalized amount for 2024 and 2025 is determined by using the 2024 and 2025 dependant

10   variables in the prediction formula on a monthly-basis, along with the average of heating degree days and

11   cooling degree days which have occurred from January 2014 to December 2023 (i.e. 10 years).

12   ### 3.1.1.2 Billed kWh Load Forecast

13   To determine the total weather normalized energy billed forecast, the total system weather normalized

14   purchases forecast is adjusted by a historical loss factor. The historical loss factor used is 4.07% which

15   represents the average loss factor from 2014 to 2023. With this average loss factor the total weather

16   normalized billed energy before adjustments discussed below will be 380.4 GWh for 2024 (i.e.

17   395.9/1.0407) and 381.0 GWh for 2025 (i.e. 396.5/1.0407).

1 ### 3.1.1.3 Billed kWh Load Forecast and Customer/Connection Forecast by Rate Class

2 Once the total weather normalized billed energy amount is known, this amount needs to be distributed by

3 rate class for rate design purposes taking into consideration the customer/connection forecast and expected

4 usage per customer by rate class.

5 The next step in the forecasting process is to determine a customer/connection forecast. The

6 customer/connection forecast is based on reviewing historical customer/connection data that is available

7 as shown in the following Table 3-6.

8 **Table 3-6: Historical Customer/Connection Data**

Year	Residential	General Service < 50 kW	General Service 50 to 4,999 kW	Sentinel Lights	Street Lights	Unmetered Scattered Loads	Large User	Total
Number of Customers/Connections								
2014	20,472	1,743	165	519	6,784	259	1	29,944
2015	20,636	1,769	159	515	6,793	257	0	30,128
2016	20,823	1,771	159	509	6,825	261	0	30,347
2017	20,987	1,791	159	500	6,865	262	0	30,565
2018	21,242	1,798	164	487	6,956	263	0	30,910
2019	21,580	1,797	166	454	7,007	262	0	31,266
2020	21,927	1,788	161	406	7,067	258	0	31,606
2021	22,396	1,837	140	378	7,115	256	0	32,121
2022	22,849	1,838	139	345	7,186	252	0	32,609
2023	23,410	1,845	142	342	7,336	200	0	33,276

10 From the historical customer/connection data the growth rate in customer/connection can be evaluated,

11 which is provide in the following Table 3-7.

12 **Table 3-7: Growth Rate in Customer/Connections**

Year	Residential	General Service < 50 kW	General Service 50 to 4,999 kW	Sentinel Lights	Street Lights	Unmetered Scattered Loads	Large User
Growth Rate in Customers/Connections							
2014							
2015	0.8%	1.5%	(3.9%)	(0.8%)	0.1%	(1.0%)	(100.0%)
2016	0.9%	0.1%	0.1%	(1.2%)	0.5%	1.8%	0.0%
2017	0.8%	1.2%	0.1%	(1.7%)	0.6%	0.2%	0.0%
2018	1.2%	0.4%	3.0%	(2.7%)	1.3%	0.3%	0.0%
2019	1.6%	(0.1%)	1.3%	(6.8%)	0.7%	(0.4%)	0.0%
2020	1.6%	(0.5%)	(3.1%)	(10.5%)	0.9%	(1.4%)	0.0%
2021	2.1%	2.7%	(13.2%)	(6.9%)	0.7%	(0.9%)	0.0%
2022	2.0%	0.1%	(0.7%)	(8.7%)	1.0%	(1.5%)	0.0%
2023	2.5%	0.4%	2.3%	(0.9%)	2.1%	(20.6%)	0.0%
Geometric Mean	**1.5%**	**0.6%**	**(1.7%)**	**(4.5%)**	**0.9%**	**(2.8%)**	

14 The growth factor resulting from the geometric mean analysis from 2014 to 2023 is applied to the 2023

15 customer numbers to determine the forecast of customer/connections for 2024. The factor is then applied

16 again to the 2024 forecast to determine the 2025 forecast.

1 Table 3-8 outlines the forecast of customers/connections by rate class for the 2024 Bridge Year and 2025

2 Test Year.

3 **Table 3-8: Customer/Connection Forecast**

Year	Residential	General Service < 50 kW	General Service 50 to 4,999 kW	Sentinel Lights	Street Lights	Unmetered Scattered Loads	Total
Forecast Number of Customers/Connections							
2024 Bridge	23,762	1,857	140	326	7,400	194	33,679
2025 Test	24,119	1,869	137	311	7,464	189	34,090

4

5 The next step in the process is to review the historical customer/connection usage and to reflect this usage

6 per customer in the forecast. Table 3-9 below provides the average annual usage per customer by rate

7 class from 2014 to 2023.

8 **Table 3-9: Historical Annual Usage per Customer**

Year	Residential	General Service < 50 kW	General Service 50 to 4,999 kW	Sentinel Lights	Street Lights	Unmetered Scattered Loads	Large User
Annual kWh Usage Per Customer/Connection							
2014	7,727	30,928	872,132	1,478	369	3,729	20,367,511
2015	7,655	30,701	880,149	1,464	336	3,779	0
2016	7,833	30,242	902,086	1,473	231	3,737	0
2017	7,330	29,206	907,791	1,458	203	3,660	0
2018	8,025	29,464	930,550	1,389	202	3,638	0
2019	7,683	28,101	910,847	1,287	201	3,639	0
2020	8,205	27,154	827,425	1,321	201	3,644	0
2021	8,166	29,529	919,846	1,276	198	3,594	0
2022	7,994	30,314	980,393	1,226	197	3,552	0
2023	7,577	29,414	960,789	1,228	198	4,256	0

9

10 As can been seen from the above table, usage per customer/connection is variable throughout the historical

11 period. It is WHESC's view that this variability is largely attributed to year-over-year fluctuation in the

12 occurrence of extreme cold/heat periods. The variability in usage per connection can be generally

13 correlated to Heating Degree Day and Cooling Degree Day data.

14 For all customer classes, the 2024 and 2025 forecast of usage per customer have been held constant at

15 the 2023 level.

16 **Table 3-10: Forecast Annual kWh Usage per Customer/Connection**

Year	Residential	General Service < 50 kW	General Service 50 to 4,999 kW	Sentinel Lights	Street Lights	Unmetered Scattered Loads
Forecast Annual kWh Usage per Customers/Connection						
2024 Bridge	7,577	29,414	960,789	1,228	198	4,256
2025 Test	7,577	29,414	960,789	1,228	198	4,256

17

1 The preceding information is used to determine the non-normalized weather billed energy forecast by

2 applying the forecast number of customer/connection from Table 3-8 by the forecast of annual usage per

3 customer/connection from Table 3-10. The resulting non-normalized weather billed energy forecast is

4 shown in the following Table 3-11.

5 **Table 3-11: Non-normalized Weather Billed Energy Forecast**

Year	Residential	General Service < 50 kW	General Service 50 to 4,999 kW	Sentinel Lights	Street Lights	Unmetered Scattered Loads	Total
NON-normalized Weather Billed Energy Forecast (GWh)							
2024 Bridge	180.1	54.6	134.1	0.4	1.5	0.8	371.5
2025 Test	182.8	55.0	131.9	0.4	1.5	0.8	372.3

6

7 The non-normalized weather billed energy forecast has been determined but needs to be adjusted in order

8 to be aligned with the total weather normalized billed energy forecast. As previously determined, the total

9 weather normalized billed energy forecast is 380.4 GWh for 2024 and 381.0 GWh for 2025.

10 The difference between the non-normalized and normalized forecast adjustment is 8.9 GWh in 2024 (i.e.

11 380.4 – 371.5) and 8.7 GWh in 2025 (i.e. 381.0 – 372.3). The difference is assumed to be the adjustment

12 needed to move the forecast to a weather normal basis and this amount will be assigned to those rate

13 classes that are weather sensitive. Based on the weather normalization work completed by Hydro One for

14 2004 informing the original cost allocation informational study it was determined that the weather sensitivity

15 by rate classes is as presented in Table 3-12. The values in the table are consistent with the rate class

16 weather sensitivity used in WHESC's 2017 COS application.

17 **Table 3-12: Weather Sensitivity by Rate Class**

Residential	General Service < 50 kW	General Service 50 to 4,999 kW	Sentinel Lights	Street Lights	Unmetered Scattered Loads
Weather Sensitivity					
82%	82%	64%	0%	0%	0%

18

19 For the GS > 50 kW class the weather sensitivity amount of 64% was provided in the weather normalization

20 work completed by Hydro One. For the Residential and General Service < 50 kW classes, it was assumed

21 in the 2017 COS application that the weather sensitivity for the Residential and General Service < 50 kW

22 classes was mid-way between 100% and 64%, or 82%. This assumption has been maintained in this

23 application.

24 The difference between the non-normalized and normalized forecast of 8.9 GWh in 2024 and 8.7 GWh in

25 2025 has been assigned on a pro rata basis to each rate class based on the above level of weather

1   sensitivity. The following Table 3-13 outlines how the classes have been adjusted to align the non-

2   normalized forecast with the normalized forecast.

3   **Table 3-13: Alignment of Non-normal to Weather Normal Forecast**

Year	Residential	General Service < 50 kW	General Service 50 to 4,999 kW	Sentinel Lights	Street Lights	Unmetered Scattered Loads	Total
Non-normalized Weather Billed Energy Forecast (GWh)							
2024 Bridge	180.1	54.6	134.1	0.4	1.5	0.8	371.5
2025 Test	182.8	55.0	131.9	0.4	1.5	0.8	372.3
Weather Adjustment (GWh)							
2024 Bridge	4.7	1.4	2.7	0.0	0.0	0.0	8.9
2025 Test	4.7	1.4	2.6	0.0	0.0	0.0	8.7
Weather Normalized Billed Energy Forecast (GWh)							
2024 Bridge	184.8	56.1	136.9	0.4	1.5	0.8	380.4
2025 Test	187.4	56.4	134.5	0.4	1.5	0.8	381.0

4

3.1.1.4   Billed kW Load Forecast

6   There are three rate classes that are charged volumetric distribution on a per kW basis. These include

7   General Service 50 to 4,999 kW, Street Lights and Sentinel Lights. The forecast of kW for these classes is

8   based on a review of the historical ratio of kW to kWh and applying the average ratio to the forecasted kWh

9   to produce the required kW.

10 The following Table 3-14 outlines the annual demand units by applicable rate class.

11 **Table 3-14: Historical Annual kW per Applicable Rate Class**

Year	General Service 50 to 4,999 kW	Sentinel Lights	Street Lights	Total	General Service 50 to 4,999 kW	Sentinel Lights	Street Lights	Total
Billed Annual kW								
	Actual				**Weather Normal**			
2014	402,375	2,120	6,992	411,487	405,963	2,139	7,054	415,157
2015	402,768	2,077	6,476	411,321	405,138	2,089	6,514	413,741
2016	396,528	2,061	4,561	403,150	387,126	2,012	4,453	393,591
2017	397,736	2,012	3,890	403,638	403,495	2,041	3,946	409,482
2018	413,412	1,898	3,915	419,225	403,417	1,852	3,820	409,089
2019	415,535	1,605	3,924	421,064	416,863	1,610	3,937	422,409
2020	381,721	1,474	3,960	387,154	380,173	1,468	3,944	385,585
2021	349,225	1,328	3,934	354,486	348,403	1,324	3,924	353,652
2022	357,213	1,162	3,955	362,331	356,408	1,160	3,947	361,514
2023	353,804	1,153	4,057	359,014	362,917	1,183	4,161	368,261

12

13 The following Table 3-15 shows the historical ratio of kW/kWh as well as the average.

1

Table 3-15: Historical kW/kWh Ratio per Applicable Rate Class

Year	General Service 50 to 4,999 kW	Sentinel Lights	Street Lights
Ratio of kW to kWh			
2014	0.2791%	0.2763%	0.2793%
2015	0.2881%	0.2755%	0.2835%
2016	0.2765%	0.2750%	0.2895%
2017	0.2753%	0.2759%	0.2792%
2018	0.2709%	0.2808%	0.2789%
2019	0.2745%	0.2749%	0.2790%
2020	0.2864%	0.2750%	0.2781%
2021	0.2717%	0.2755%	0.2789%
2022	0.2626%	0.2748%	0.2789%
2023	0.2593%	0.2748%	0.2792%
Average	**0.2744%**	**0.2758%**	**0.2804%**

2

3 The following Table 3-16 outlines the forecast of kW for the applicable rate classes which reflects the ratio

4 in Table 3-15 being applied to the results in Table 3-13.

5

Table 3-16: kW Forecast by Applicable Rate Class

Year	General Service 50 to 4,999 kW	Sentinel Lights	Street Lights	Total
Predicted Billed kW				
2024 Bridge	375,641	1,105	4,111	380,857
2025 Test	369,205	1,055	4,147	374,407

6

7 Table 3-17 provides a summary of the total load forecast on a billing determinant basis by rate class.

1

Table 3-17: Summary of Total Load Forecast

	2017 Board Approved	2017 Actual	2018 Actual	2019 Actual	2020 Actual	2021 Actual	2022 Actual	2023 Actual	2024 Bridge Weather Normal	2025 Test Weather Normal
Purchases										
Actual kWh Purchases		368,596,645	393,889,926	384,791,777	380,093,690	383,895,273	392,612,236	386,633,788		
Predicted kWh		374,426,765	390,694,844	381,803,843	387,589,449	388,275,738	390,620,164	382,872,652	395,877,443	396,543,028
% Difference between actual and predicted		1.6%	(0.8%)	(0.8%)	2.0%	1.1%	(0.5%)	(1.0%)		
Loss Factor									1.0407	1.0407
Total Billed		353,716,802	379,090,833	370,608,216	364,637,107	368,482,783	377,130,671	370,827,913	380,386,005	381,025,544
Billing Determinants										
Residential										
Customers	21,025	20,987	21,242	21,580	21,927	22,396	22,849	23,410	23,762	24,119
kWh	165,126,793	153,825,741	170,461,439	165,806,296	179,914,470	182,892,382	182,644,897	177,391,636	184,759,792	187,443,401
General Service < 50 kW										
Customers	1,777	1,791	1,798	1,797	1,788	1,837	1,838	1,845	1,857	1,869
kWh	53,852,706	52,319,962	52,983,337	50,506,435	48,537,507	54,230,050	55,719,442	54,279,425	56,052,591	56,382,524
General Service 50 to 4,999 kW										
Customers	154	159	164	166	161	140	139	142	140	137
kWh	138,669,285	144,490,127	152,610,121	151,352,404	133,284,409	128,548,463	136,029,471	136,432,090	136,879,400	134,534,275
kW	390,635	397,736	413,412	415,535	381,721	349,225	357,213	353,804	375,641	369,205
Sentinel Lights										
Connections	509	500	487	454	406	378	345	342	326	311
kWh	749,437	729,133	675,874	583,837	535,935	481,895	422,907	419,671	400,619	382,432
kW	2,061	2,012	1,898	1,605	1,474	1,328	1,162	1,153	1,105	1,055
Street Lights										
Connections	6,856	6,865	6,956	7,007	7,067	7,115	7,186	7,336	7,400	7,464
kWh	1,286,433	1,393,112	1,403,956	1,406,314	1,423,807	1,410,628	1,418,460	1,453,176	1,465,852	1,478,639
kW	3,582	3,890	3,915	3,924	3,960	3,934	3,955	4,057	4,111	4,147
Unmetered Scattered Loads										
Connections	261	262	263	262	258	256	252	200	194	189
kWh	963,825	958,727	956,107	952,930	940,979	919,365	895,494	851,915	827,752	804,273
Total										
Customer/Connections	30,582	30,565	30,910	31,266	31,606	32,121	32,609	33,276	33,679	34,090
kWh	360,648,479	353,716,802	379,090,833	370,608,216	364,637,107	368,482,783	377,130,671	370,827,913	380,386,005	381,025,544
kW	396,278	403,638	419,225	421,064	387,154	354,486	362,331	359,014	380,857	374,407

2

3.1.2 Normalized Average Use per Customer Model

WHESC used a regression analysis to complete the Load Forecast, thus this methodology was not utilized.

3.1.3 Incorporating CDM Impacts in the Load Forecast for Distributors

Given the long-term presence of CDM, WHESC's load forecast inherently incorporates CDM impacts into the regression through the historical data in the dependent and independent variables.

3.2 Accuracy of Load Forecast and Variance Analyses

This section provides a year-over year variance analysis for WHESC's billing determinants. WHESC's last rebasing application was for a 2017 test year (EB-2016-0110). The variance analysis will compare 2017 Board Approved to 2017 Actual; 2017 Actual to 2018 Actual; 2018 Actual to 2019 Actual; 2019 Actual to 2020 Actual; 2020 Actual to 2021 Actual; 2021 Actual to 2022 Actual; 2022 Actual to 2023 Actual; 2023 Actual to 2024 Bridge Year and 2024 Bridge Year to 2025 Test Year.

1 Customer counts are shown in average annual format.

3.2.1 2017 Board Approved vs 2017 Actual

3 **Table 3-18: Billing Determinants – 2017 Board Approved vs 2017 Actual**

| | | | | | | | | | | | | | Weather Normal Conversion Factor | | 1.0145 |

Rate Class	Customers / Connections		Units	Volume		Volume (Wthr Nrml)		Annual Usage per Customer / Connection		Annual Usage per Customer / Connection (Wthr Nrml)	
	2017 Board Approved	2017 Actual		2017 Board Approved	2017 Actual	2017 Board Approved	2017 Actual	2017 Board Approved	2017 Actual	2017 Board Approved	2017 Actual
Residential	21,025	20,987	kWh	165,052,031	153,825,741	165,052,031	156,053,011	7,850	7,330	7,850	7,436
GS <50	1,777	1,791	kWh	53,828,309	52,319,962	53,828,309	53,077,512	30,292	29,206	30,292	29,629
GS >50	154	159	kW	390,496	397,736	390,496	397,736	2,536	2,499	2,536	2,499
Sentinel Lights	509	500	kW	2,061	2,012	2,061	2,012	4	4	4	4
Street Lights	6,856	6,865	kW	3,582	3,890	3,582	3,890	1	1	1	1
USL	261	262	kWh	963,825	958,727	963,825	972,609	3,693	3,660	3,693	3,713
Total	30,582	30,565									
Variance	**Count**	**%**		**Volume**	**%**	**Volume**	**%**	**Volume**	**%**	**Volume**	**%**
Residential	(38)	-0.2%	kWh	(11,226,290)	-6.8%	(8,999,020)	-5.5%	(521)	-6.6%	(414)	-5.3%
GS <50	14	0.8%	kWh	(1,508,347)	-2.8%	(750,797)	-1.4%	(1,086)	-3.6%	(663)	-2.2%
GS >50	5	3.4%	kW	7,240	1.9%	7,240	1.9%	(37)	-1.5%	(37)	-1.5%
Sentinel Lights	(9)	-1.8%	kW	(49)	-2.4%	(49)	-2.4%	(0)	-0.6%	(0)	-0.6%
Street Lights	9	0.1%	kW	308	8.6%	308	8.6%	0	8.5%	0	8.5%
USL	1	0.4%	kWh	(5,098)	-0.5%	8,784	0.9%	(32)	-0.9%	21	0.6%
Total	(18)	-0.1%									

5 Table 3-18 compares customer counts and volumes between 2017 Board Approved and 2017 Actuals.

6 The 2017 Board Approved customer count of 21,025 for the Residential Class was not reached until the
7 first quarter of 2018. The 2017 board approved kWh for the Residential Class was achieved in 2018 and all
8 subsequent years through to 2023 with the highest total reaching 182,892,382 kWh in 2021.

9 In aggregate, the total customer count for 2017 Actuals was 0.1% below 2017 Board Approved.

3.2.2 2017 Actual vs 2018 Actual

11 **Table 3-19: Billing Determinants – 2017 Actual vs 2018 Actual**

| | | | | | | | | | | | | Weather Normal Conversion Factor 2017 | 1.0145 |
| | | | | | | | | | | | | Weather Normal Conversion Factor 2018 | 0.9758 |

Rate Class	Customers / Connections		Units	Volume		Volume (Wthr Nrml)		Annual Usage per Customer / Connection		Annual Usage per Customer / Connection (Wthr Nrml)	
	2017 Actual	2018 Actual		2017 Actual	2018 Actual	2017 Actual	2018 Actual	2017 Actual	2018 Actual	2017 Actual	2018 Actual
Residential	20,987	21,242	kWh	153,825,741	170,461,439	156,053,011	166,340,027	7,330	8,025	7,436	7,831
GS <50	1,791	1,798	kWh	52,319,962	52,983,337	53,077,512	51,702,307	29,206	29,464	29,629	28,751
GS >50	159	164	kW	397,736	413,412	397,736	413,412	2,499	2,521	2,499	2,521
Sentinel Lights	500	487	kW	2,012	1,898	2,012	1,898	4	4	4	4
Street Lights	6,865	6,956	kW	3,890	3,915	3,890	3,915	1	1	1	1
USL	262	263	kWh	958,727	956,107	972,609	932,990	3,660	3,638	3,713	3,550
Total	30,565	30,910									
Variance	**Count**	**%**		**Volume**	**%**	**Volume**	**%**	**Dollars**	**%**	**Dollars**	**%**
Residential	256	1.2%	kWh	16,635,698	10.8%	10,287,015	6.6%	695	9.5%	395	5.3%
GS <50	7	0.4%	kWh	663,375	1.3%	(1,375,205)	-2.6%	258	0.9%	(877)	-3.0%
GS >50	5	3.0%	kW	15,676	3.9%	15,676	3.9%	22	0.9%	22	0.9%
Sentinel Lights	(14)	-2.7%	kW	(114)	-5.7%	(114)	-5.7%	(0)	-3.0%	(0)	-3.0%
Street Lights	91	1.3%	kW	25	0.6%	25	0.6%	(0)	-0.7%	(0)	-0.7%
USL	1	0.3%	kWh	(2,620)	-0.3%	(39,618)	-4.1%	(23)	-0.6%	(164)	-4.4%
Total	346	1.1%									

1 Trends in both customer/connection count and variable billing determinants were largely consistent with

2 WHESC's average year-over-year experience from 2017 to 2018, with the exception of the GS>50kW rate

3 class, wherein 5 new customers were added resulting in a 3.9% increase to kW billing determinants.

3.2.3 2018 Actual vs 2019 Actual

5 **Table 3-20: Billing Determinants – 2018 Actual vs 2019 Actual**

| | | | | | | Weather Normal Conversion Factor 2018 | 0.9758 |
| | | | | | | Weather Normal Conversion Factor 2019 | 1.0032 |

Rate Class	Customers / Connections		Units	Volume		Volume (Wthr Nrml)		Annual Usage per Customer / Connection		Annual Usage per Customer / Connection (Wthr Nrml)	
	2018 Actual	2019 Actual		2018 Actual	2019 Actual	2018 Actual	2019 Actual	2018 Actual	2019 Actual	2018 Actual	2019 Actual
Residential	21,242	21,580	kWh	170,461,439	165,806,296	166,340,027	166,335,984	8,025	7,683	7,831	7,708
GS <50	1,798	1,797	kWh	52,983,337	50,506,435	51,702,307	50,667,783	29,464	28,101	28,751	28,191
GS >50	164	166	kW	413,412	415,535	413,412	415,535	2,521	2,501	2,521	2,501
Sentinel Lights	487	454	kW	1,898	1,605	1,898	1,605	4	4	4	4
Street Lights	6,956	7,007	kW	3,915	3,924	3,915	3,924	1	1	1	1
USL	263	262	kWh	956,107	952,930	932,990	955,974	3,638	3,639	3,550	3,651
Total	30,910	31,266									
Variance	**Count**	**%**		**Volume**	**%**	**Volume**	**%**	**Dollars**	**%**	**Dollars**	**%**
Residential	338	1.6%	kWh	(4,655,143)	-2.7%	(4,043)	0.0%	(341)	-4.3%	(123)	-1.6%
GS <50	(1)	-0.1%	kWh	(2,476,902)	-4.7%	(1,034,524)	-2.0%	(1,363)	-4.6%	(561)	-2.0%
GS >50	2	1.3%	kW	2,123	0.5%	2,123	0.5%	(20)	-0.8%	(20)	-0.8%
Sentinel Lights	(33)	-6.8%	kW	(293)	-15.4%	(293)	-15.4%	(0)	-9.3%	(0)	-9.3%
Street Lights	51	0.7%	kW	9	0.2%	9	0.2%	(0)	-0.5%	(0)	-0.5%
USL	(1)	-0.4%	kWh	(3,177)	-0.3%	22,984	2.5%	2	0.0%	101	2.9%
Total	356	1.2%									

7 In 2019 the pace of Residential customer growth increased over the previous year's growth (1.6% relative

8 to 1.2%). 2019 Actuals are also notable for the significant reduction in both Sentinel Light connection count

9 and weather-normalized variable billing determinants, at (6.8%) and (15.4%) respectively.

3.2.4 2019 Actual vs 2020 Actual

11 **Table 3-21: Billing Determinants – 2019 Actual vs 2020 Actual**

| | | | | | | Weather Normal Conversion Factor 2019 | 1.0032 |
| | | | | | | Weather Normal Conversion Factor 2020 | 0.9959 |

Rate Class	Customers / Connections		Units	Volume		Volume (Wthr Nrml)		Annual Usage per Customer / Connection		Annual Usage per Customer / Connection (Wthr Nrml)	
	2019 Actual	2020 Actual		2019 Actual	2020 Actual	2019 Actual	2020 Actual	2019 Actual	2020 Actual	2019 Actual	2020 Actual
Residential	21,580	21,927	kWh	165,806,296	179,914,470	166,335,984	179,185,135	7,683	8,205	7,708	8,172
GS <50	1,797	1,788	kWh	50,506,435	48,537,507	50,667,783	48,340,746	28,101	27,154	28,191	27,044
GS >50	166	161	kW	415,535	381,721	415,535	381,721	2,501	2,370	2,501	2,370
Sentinel Lights	454	406	kW	1,605	1,474	1,605	1,474	4	4	4	4
Street Lights	7,007	7,067	kW	3,924	3,960	3,924	3,960	1	1	1	1
USL	262	258	kWh	952,930	940,979	955,974	937,164	3,639	3,644	3,651	3,629
Total	31,266	31,606									
Variance	**Count**	**%**		**Volume**	**%**	**Volume**	**%**	**Dollars**	**%**	**Dollars**	**%**
Residential	347	1.6%	kWh	14,108,174	8.5%	12,849,151	7.7%	522	6.8%	464	6.0%
GS <50	(10)	-0.5%	kWh	(1,968,927)	-3.9%	(2,327,037)	-4.6%	(947)	-3.4%	(1,147)	-4.1%
GS >50	(5)	-3.1%	kW	(33,814)	-8.1%	(33,814)	-8.1%	(131)	-5.2%	(131)	-5.2%
Sentinel Lights	(48)	-10.5%	kW	(131)	-8.2%	(131)	-8.2%	0	2.6%	0	2.6%
Street Lights	60	0.9%	kW	36	0.9%	36	0.9%	0	0.1%	0	0.1%
USL	(4)	-1.4%	kWh	(11,951)	-1.3%	(18,810)	-2.0%	4	0.1%	(22)	-0.6%
Total	340	1.1%									

13 2020 observed the continuation of Residential customer growth consistent with 2019, as well as continued

14 reductions to Sentinel Light connection counts and variable billing determinants. 2020 also observed the

15 loss of 5 GS>50kW customers, resulting in an 8.1% reduction to GS>50kW variable billing determinants.

1 WHESC attributes these customer count reductions to the onset of the COVID-19 pandemic, which had a

2 particular impact on commercial customers.

3 ### 3.2.5 2020 Actual vs 2021 Actual

4 **Table 3-22: Billing Determinants – 2020 Actual vs 2021 Actual**

									Weather Normal Conversion Factor 2020		0.9959
									Weather Normal Conversion Factor 2021		0.9976
Rate Class	Customers / Connections		Units	Volume		Volume (Wthr Nrml)		Annual Usage per Customer / Connection		Annual Usage per Customer / Connection (Wthr Nrml)	
	2020 Actual	2021 Actual		2020 Actual	2021 Actual	2020 Actual	2021 Actual	2020 Actual	2021 Actual	2020 Actual	2021 Actual
Residential	21,927	22,396	kWh	179,914,470	182,892,382	179,185,135	182,461,990	8,205	8,166	8,172	8,147
GS <50	1,788	1,837	kWh	48,537,507	54,230,050	48,340,746	54,102,433	27,154	29,529	27,044	29,460
GS >50	161	140	kW	381,721	349,225	381,721	349,225	2,370	2,499	2,370	2,499
Sentinel Lights	406	378	kW	1,474	1,328	1,474	1,328	4	4	4	4
Street Lights	7,067	7,115	kW	3,960	3,934	3,960	3,934	1	1	1	1
USL	258	256	kWh	940,979	919,365	937,164	917,202	3,644	3,594	3,629	3,585
Total	31,606	32,121									
Variance	Count	%		Volume	%	Volume	%	Dollars	%	Dollars	%
Residential	469	2.1%	kWh	2,977,911	1.7%	3,276,855	1.8%	(39)	-0.5%	(25)	-0.3%
GS <50	49	2.7%	kWh	5,692,543	11.7%	5,761,687	11.9%	2,375	8.7%	2,416	8.9%
GS >50	(21)	-13.2%	kW	(32,496)	-8.5%	(32,496)	-8.5%	129	5.5%	129	5.5%
Sentinel Lights	(28)	-6.9%	kW	(146)	-9.9%	(146)	-9.9%	(0)	-3.2%	(0)	-3.2%
Street Lights	48	0.7%	kW	(26)	-0.7%	(26)	-0.7%	(0)	-1.3%	(0)	-1.3%
USL	(2)	-0.9%	kWh	(21,614)	-2.3%	(19,963)	-2.1%	(50)	-1.4%	(44)	-1.2%
Total	514	1.6%									

6 2021 shows a marked increase in the number of Residential customer additions, with a growth rate of 2.1%,

7 accompanied by slightly lower increases to electricity consumption at 1.8% on a weather-normal basis.

8 WHESC attributes these changes to the migration of residential customers in the early years of the COVID-

9 19 pandemic away from large urban centres such as Toronto, toward proximate smaller communities such

10 as Welland. At the same time, 2021 observed the addition of 49 GS<50kW customers, and the loss of 21

11 GS>50kW customers. Though some GS<50kW additions were the result of growth, and some GS>50kW

12 customer losses were the result of moves and shutdowns, WHESC attributes the majority of these changes

13 in commercial customer composition to the reclassification of customers from GS>50kW into the GS<50kW

14 rate class. WHESC observed a decrease in utilization in the general service classes due to the economic

15 impacts of COVID, resulting in reclassifications.

1 ### 3.2.6   2021 Actual vs 2022 Actual

2 **Table 3-23: Billing Determinants – 2021 Actual vs 2022 Actual**

								Weather Normal Conversion Factor 2021		0.9976		
								Weather Normal Conversion Factor 2022		0.9977		

Rate Class	Customers / Connections		Units	Volume		Volume (Wthr Nrml)		Annual Usage per Customer / Connection		Annual Usage per Customer / Connection (Wthr Nrml)	
	2021 Actual	2022 Actual		2021 Actual	2022 Actual	2021 Actual	2022 Actual	2021 Actual	2022 Actual	2021 Actual	2022 Actual
Residential	22,396	22,849	kWh	182,892,382	182,644,897	182,461,990	182,232,986	8,166	7,994	8,147	7,976
GS <50	1,837	1,838	kWh	54,230,050	55,719,442	54,102,433	55,593,780	29,529	30,314	29,460	30,246
GS >50	140	139	kW	349,225	357,213	349,225	357,213	2,499	2,575	2,499	2,575
Sentinel Lights	378	345	kW	1,328	1,162	1,328	1,162	4	3	4	3
Street Lights	7,115	7,186	kW	3,934	3,955	3,934	3,955	1	1	1	1
USL	256	252	kWh	919,365	895,494	917,202	893,474	3,594	3,552	3,585	3,544
Total	32,121	32,609									
Variance	Count	%		Volume	%	Volume	%	Dollars	%	Dollars	%
Residential	453	2.0%	kWh	(247,485)	-0.1%	(229,004)	-0.1%	(173)	-2.1%	(172)	-2.1%
GS <50	2	0.1%	kWh	1,489,392	2.7%	1,491,347	2.8%	785	2.7%	786	2.7%
GS >50	(1)	-0.7%	kW	7,988	2.3%	7,988	2.3%	76	3.0%	76	3.0%
Sentinel Lights	(33)	-8.7%	kW	(165)	-12.5%	(165)	-12.5%	(0)	-4.1%	(0)	-4.1%
Street Lights	71	1.0%	kW	22	0.6%	22	0.6%	(0)	-0.4%	(0)	-0.4%
USL	(4)	-1.5%	kWh	(23,871)	-2.6%	(23,727)	-2.6%	(41)	-1.1%	(41)	-1.1%
Total	488	1.5%									

4 2022 observed a continuation of elevated growth above historical levels in the Residential customer class,

5 at 2.0%. Relative to 2021, the 2022 year observed the stabilization of GS<50kW and GS>50kW customer

6 counts. The historical steady decline in Sentinel Light connections and variable billing determinants

7 continued in 2022.

8 ### 3.2.7   2022 Actual vs 2023 Actual

9 **Table 3-24: Billing Determinants – 2022 Actual vs 2023 Actual**

								Weather Normal Conversion Factor 2022		0.9977		
								Weather Normal Conversion Factor 2023		1.0258		

Rate Class	Customers / Connections		Units	Volume		Volume (Wthr Nrml)		Annual Usage per Customer / Connection		Annual Usage per Customer / Connection (Wthr Nrml)	
	2022 Actual	2023 Actual		2022 Actual	2023 Actual	2022 Actual	2023 Actual	2022 Actual	2023 Actual	2022 Actual	2023 Actual
Residential	22,849	23,410	kWh	182,644,897	177,391,636	182,232,986	181,960,545	7,994	7,577	7,976	7,773
GS <50	1,838	1,845	kWh	55,719,442	54,279,425	55,593,780	55,677,448	30,314	29,414	30,246	30,172
GS >50	139	142	kW	357,213	353,804	357,213	353,804	2,575	2,492	2,575	2,492
Sentinel Lights	345	342	kW	1,162	1,153	1,162	1,153	3	3	3	3
Street Lights	7,186	7,336	kW	3,955	4,057	3,955	4,057	1	1	1	1
USL	252	200	kWh	895,494	851,915	893,474	873,857	3,552	4,256	3,544	4,366
Total	32,609	33,276									
Variance	Count	%		Volume	%	Volume	%	Dollars	%	Dollars	%
Residential	561	2.5%	kWh	(5,253,260)	-2.9%	(272,441)	-0.1%	(416)	-5.2%	(203)	-2.5%
GS <50	7	0.4%	kWh	(1,440,017)	-2.6%	83,668	0.2%	(899)	-3.0%	(73)	-0.2%
GS >50	3	2.3%	kW	(3,409)	-1.0%	(3,409)	-1.0%	(83)	-3.2%	(83)	-3.2%
Sentinel Lights	(3)	-0.9%	kW	(9)	-0.8%	(9)	-0.8%	0	0.1%	0	0.1%
Street Lights	150	2.1%	kW	102	2.6%	102	2.6%	0	0.5%	0	0.5%
USL	(52)	-20.6%	kWh	(43,579)	-4.9%	(19,617)	-2.2%	704	19.8%	821	23.2%
Total	666	2.0%									

11 2023 was another year of elevated Residential customer count growth, with more muted Residential

12 consumption largely due to weather. Growth in the GS<50kW rate class was muted in 2023 at 0.4%, while

13 the GS>50kW rate class added 3 customers resulting in growth of 2.3%. While there was only a loss of 3

14 Sentinel Light connections from 2022 to 2023, USL connections reduced by 20.6%.

1 ### 3.2.8   2023 Actual vs 2024 Bridge Year

2 **Table 3-25: Billing Determinants – 2023 Actual vs 2024 Bridge Year**

| | | | | | | | | | | | | Weather Normal Conversion Factor 2023 | 1.0258 |
| | | | | | | | | | | | | Weather Normal Conversion Factor 2024 | 1.0000 |

Rate Class	Customers / Connections		Units	Volume		Volume (Wthr Nrml)		Annual Usage per		Annual Usage per Customer	
	2023 Actual	2024 Bridge		2023 Actual	2024 Bridge	2023 Actual	2024 Bridge	2023 Actual	2024 Bridge	2023 Actual	2024 Bridge
Residential	23,410	23,762	kWh	177,391,636	184,759,792	181,960,545	184,759,792	7,577	7,776	7,773	7,776
GS <50	1,845	1,857	kWh	54,279,425	56,052,591	55,677,448	56,052,591	29,414	30,183	30,172	30,183
GS >50	142	140	kW	353,804	375,641	353,804	375,641	2,492	2,690	2,492	2,690
Sentinel Lights	342	326	kW	1,153	1,105	1,153	1,105	3	3	3	3
Street Lights	7,336	7,400	kW	4,057	4,111	4,057	4,111	1	1	1	1
USL	200	194	kWh	851,915	827,752	873,857	827,752	4,256	4,256	4,366	4,256
Total	33,276	33,679									
Variance	Count	%		Volume	%	Volume	%	Dollars	%	Dollars	%
Residential	351	1.5%	kWh	7,368,156	4.2%	2,799,247	1.5%	198	2.6%	3	0.0%
GS <50	12	0.6%	kWh	1,773,166	3.3%	375,143	0.7%	769	2.6%	11	0.0%
GS >50	(2)	-1.7%	kW	21,837	6.2%	21,837	6.2%	199	8.0%	199	8.0%
Sentinel Lights	(16)	-4.5%	kW	(48)	-4.2%	(48)	-4.2%	0	0.4%	0	0.4%
Street Lights	64	0.9%	kW	54	1.3%	54	1.3%	0	0.5%	0	0.5%
USL	(6)	-2.8%	kWh	(24,163)	-2.8%	(46,105)	-5.3%	-	0.0%	(110)	-2.5%
Total	404	1.2%									

4 As noted in this Exhibit, the customer/connection count forecast for the 2024 Bridge Year carries forward
5 the 10-year average growth rate for each rate class based on a Geomean calculation. As such, WHESC
6 forecasts continued growth in the Residential class, modest growth in GS<50kW, modest declines in the
7 GS>50kW rate class, modest increases in the number of Street Light connections, and continued
8 decreases in the Sentinel and USL connection counts.

9 ### 3.2.9   2024 Bridge Year vs 2025 Test Year

10 **Table 3-26: Billing Determinants – 2023 Actual vs 2024 Bridge Year**

Rate Class	Customers / Connections		Units	Volume (Wthr Nrml)		Annual Usage per Customer / Connection (Wthr Nrml)	
	2024 Bridge	2025 Test		2024 Bridge	2025 Test	2024 Bridge	2025 Test
Residential	23,762	24,119	kWh	184,759,792	187,443,401	7,776	7,772
GS <50	1,857	1,869	kWh	56,052,591	56,382,524	30,183	30,169
GS >50	140	137	kW	375,641	369,205	2,690	2,689
Sentinel Lights	326	311	kW	1,105	1,055	3	3
Street Lights	7,400	7,464	kW	4,111	4,147	1	1
USL	194	189	kWh	827,752	804,273	4,256	4,256
Total	33,679	34,090					
Variance	Count	%		Volume	%	Dollars	%
Residential	357	1.5%	kWh	2,683,609	1.5%	(4)	0.0%
GS <50	12	0.6%	kWh	329,933	0.6%	(15)	0.0%
GS >50	(2)	-1.7%	kW	(6,436)	-1.7%	(1)	0.0%
Sentinel Lights	(15)	-4.5%	kW	(50)	-4.5%	-	0.0%
Street Lights	65	0.9%	kW	36	0.9%	-	0.0%
USL	(6)	-2.8%	kWh	(23,478)	-2.8%	-	0.0%
Total	410	1.2%					

12 The 2025 Test Year forecast continues the methodologies employed to forecast the 2024 Bridge Year
13 customer/connection count and billing determinants.

Appendix 3-A
MONTHLY DATA USED FOR REGRESSION ANALYSIS

	Power Purchased	Heating Degree Days	Cooling Degree Days	Days in Month	Spring Fall Flag	Number of Customers	Predicted Purchases
Jan-14	40,172,298	783	0	31	0	22,329	36,078,059
Feb-14	35,904,109	744	0	28	0	22,326	31,895,194
Mar-14	37,359,874	692	0	31	1	22,340	32,760,250
Apr-14	29,870,903	338	0	30	1	22,334	27,807,129
May-14	27,607,357	144	7	31	1	22,336	27,698,518
Jun-14	32,169,591	21	63	30	0	22,351	32,593,463
Jul-14	33,916,846	14	51	31	0	22,375	32,707,166
Aug-14	33,253,613	12	57	31	0	22,386	33,240,250
Sep-14	28,705,908	85	28	30	0	22,411	30,075,226
Oct-14	29,560,490	223	5	31	1	22,460	28,324,528
Nov-14	30,512,368	466	0	30	1	22,458	29,190,031
Dec-14	32,708,611	541	0	31	1	22,470	31,235,594
Jan-15	35,265,002	753	0	31	0	22,484	35,831,514
Feb-15	32,520,528	872	0	28	0	22,480	33,300,583
Mar-15	32,214,659	637	0	31	1	22,502	32,253,716
Apr-15	27,411,227	320	0	30	1	22,537	27,699,484
May-15	28,734,001	97	34	31	1	22,526	29,734,694
Jun-15	29,750,993	36	29	30	0	22,535	29,713,800
Jul-15	35,320,000	8	79	31	0	22,560	35,281,464
Aug-15	33,778,593	12	59	31	0	22,588	33,510,416
Sep-15	32,399,240	37	54	30	0	22,606	32,104,190
Oct-15	27,207,724	252	1	31	1	22,626	28,374,153
Nov-15	27,907,417	337	0	30	1	22,650	27,930,425
Dec-15	30,150,194	409	0	31	1	22,667	29,945,811
Jan-16	33,030,100	657	0	31	0	22,670	34,911,663
Feb-16	30,335,368	587	0	29	0	22,695	31,678,024
Mar-16	29,470,506	449	0	31	1	22,699	30,375,218
Apr-16	27,500,007	353	0	30	1	22,717	28,124,589
May-16	28,052,825	145	24	31	1	22,722	29,430,465
Jun-16	31,979,034	29	52	30	0	22,733	31,832,485
Jul-16	38,582,729	0	141	31	0	22,761	40,895,747
Aug-16	41,437,080	0	159	31	0	22,775	42,595,589
Sep-16	31,887,812	34	47	30	0	22,784	31,507,557
Oct-16	27,632,020	185	5	31	1	22,793	28,121,544
Nov-16	28,072,690	357	0	30	1	22,824	28,211,995
Dec-16	32,042,035	568	0	31	1	22,852	31,683,095
Jan-17	32,603,244	594	0	31	0	22,862	34,334,717
Feb-17	28,442,345	488	0	28	0	22,870	29,461,467
Mar-17	31,091,148	555	0	31	1	22,881	31,566,317
Apr-17	26,726,382	262	1	30	1	22,886	27,293,969
May-17	27,100,631	168	7	31	1	22,907	28,129,604
Jun-17	31,069,771	33	62	30	0	22,911	32,901,208
Jul-17	35,551,343	2	83	31	0	22,937	35,744,547
Aug-17	34,125,261	19	51	31	0	22,952	32,998,190
Sep-17	31,037,007	67	49	30	0	22,968	32,105,978
Oct-17	28,262,231	149	6	31	1	22,997	27,953,104
Nov-17	29,451,607	411	0	30	1	23,027	28,871,560
Dec-17	33,135,674	692	0	31	1	23,048	33,066,105

Jan-18	34,633,273	731	0	31	0	23,089	35,864,864
Feb-18	29,707,123	540	0	28	0	23,082	30,101,995
Mar-18	31,571,359	565	0	31	1	23,104	31,759,671
Apr-18	29,502,213	438	0	30	1	23,133	29,198,608
May-18	29,818,036	75	30	31	1	23,168	29,411,367
Jun-18	32,564,168	21	48	30	0	23,182	31,590,014
Jul-18	41,016,277	0	111	31	0	23,194	38,409,178
Aug-18	39,071,849	2	124	31	0	23,239	39,601,278
Sep-18	33,330,014	58	69	30	0	23,272	33,968,977
Oct-18	29,522,757	246	11	31	1	23,305	29,527,752
Nov-18	30,788,860	463	0	30	1	23,321	29,534,305
Dec-18	32,363,997	550	0	31	1	23,366	31,726,835
Jan-19	35,287,777	726	0	31	0	23,414	35,957,642
Feb-19	31,413,450	588	0	28	0	23,414	30,742,702
Mar-19	32,753,175	598	0	31	1	23,448	32,259,480
Apr-19	28,598,242	327	0	30	1	23,474	28,188,786
May-19	27,905,719	174	2	31	1	23,504	28,018,791
Jun-19	30,246,127	34	32	30	0	23,505	30,404,336
Jul-19	40,514,962	0	144	31	0	23,545	41,520,016
Aug-19	36,599,467	5	76	31	0	23,610	35,426,277
Sep-19	30,196,024	32	12	30	0	23,624	28,597,098
Oct-19	27,971,860	221	4	31	1	23,662	28,771,540
Nov-19	30,548,760	503	0	30	1	23,658	30,099,951
Dec-19	32,756,213	547	0	31	1	23,664	31,817,223
Jan-20	32,984,746	552	0	31	0	23,709	34,262,829
Feb-20	31,066,268	587	0	29	0	23,738	32,131,124
Mar-20	30,079,085	434	0	31	1	23,774	30,687,798
Apr-20	26,605,232	373	0	30	1	23,805	28,809,224
May-20	28,255,543	208	23	31	1	23,829	30,428,715
Jun-20	33,406,975	27	70	30	0	23,871	33,980,656
Jul-20	42,688,000	0	169	31	0	23,900	43,922,763
Aug-20	37,930,770	2	71	31	0	23,924	35,086,076
Sep-20	29,216,230	75	10	30	0	23,945	29,044,600
Oct-20	27,410,042	253	0	31	1	23,961	28,876,959
Nov-20	28,047,138	329	0	30	1	23,995	28,435,994
Dec-20	32,403,661	540	0	31	1	24,054	31,922,710
Jan-21	32,846,158	627	0	31	0	24,074	35,206,033
Feb-21	30,819,474	667	0	28	0	24,154	31,893,405
Mar-21	30,429,326	451	0	31	1	24,237	31,067,311
Apr-21	26,763,135	307	0	30	1	24,275	28,326,463
May-21	28,296,553	185	17	31	1	24,299	29,822,512
Jun-21	34,399,007	18	85	30	0	24,365	35,440,074
Jul-21	36,416,582	7	71	31	0	24,389	35,332,102
Aug-21	41,970,615	2	137	31	0	24,447	41,313,625
Sep-21	30,974,507	40	18	30	0	24,480	29,673,013
Oct-21	28,889,124	142	11	31	1	24,539	28,934,469
Nov-21	29,524,971	419	0	30	1	24,577	29,623,168
Dec-21	32,565,824	490	0	31	1	24,627	31,643,562

Jan-22	35,465,006	793	0	31	0	24,639
Feb-22	31,523,311	617	0	28	0	24,652
Mar-22	32,353,240	499	0	31	1	24,687
Apr-22	27,915,177	337	0	30	1	24,739
May-22	29,942,359	113	24	31	1	24,766
Jun-22	32,984,458	30	47	30	0	24,790
Jul-22	39,133,030	1	102	31	0	24,818
Aug-22	39,821,521	0	104	31	0	24,861
Sep-22	31,429,526	66	25	30	0	24,901
Oct-22	28,375,440	260	0	31	1	24,980
Nov-22	29,798,652	378	2	30	1	25,014
Dec-22	33,870,515	550	0	31	1	25,063
Jan-23	33,991,812	566	0	31	0	25,081
Feb-23	30,665,858	479	0	28	0	25,093
Mar-23	32,629,382	519	0	31	1	25,129
Apr-23	28,070,849	281	0	30	1	25,213
May-23	28,924,412	172	5	31	1	25,301
Jun-23	32,337,605	33	42	30	0	25,386
Jul-23	39,594,891	0	103	31	0	25,423
Aug-23	35,523,358	14	49	31	0	25,474
Sep-23	31,570,923	46	29	30	0	25,548
Oct-23	29,609,701	195	11	31	1	25,670
Nov-23	30,895,717	423	0	30	1	25,701
Dec-23	32,819,280	452	0	31	1	25,753
Jan-24		678	0	31	0	25,754
Feb-24		617	0	29	0	25,755
Mar-24		540	0	31	1	25,755
Apr-24		334	0	30	1	25,756
May-24		148	17	31	1	25,757
Jun-24		28	53	30	0	25,758
Jul-24		3	105	31	0	25,758
Aug-24		7	89	31	0	25,759
Sep-24		54	34	30	0	25,760
Oct-24		212	5	31	1	25,761
Nov-24		409	0	30	1	25,761
Dec-24		534	0	31	1	25,762
Jan-25		678	0	31	0	25,818
Feb-25		617	0	28	0	25,873
Mar-25		540	0	31	1	25,929
Apr-25		334	0	30	1	25,984
May-25		148	17	31	1	26,040
Jun-25		28	53	30	0	26,096
Jul-25		3	105	31	0	26,152
Aug-25		7	89	31	0	26,209
Sep-25		54	34	30	0	26,265
Oct-25		212	5	31	1	26,321
Nov-25		409	0	30	1	26,378
Dec-25		534	0	31	1	26,435

Appendix 3-B
OEB Appendices 2-IB: Load Forecast Analysis

Customers/Connections

Rate Class	Historical 2017	Historical 2018	Historical 2019	Historical 2020	Historical 2021	Historical 2022	Historical 2023	Bridge Year 2024	Test Year 2025
Residential	20,987	21,242	21,580	21,927	22,396	22,849	23,410	23,762	24,119
General Service < 50 kW	1,791	1,798	1,797	1,788	1,837	1,838	1,845	1,857	1,869
General Service >= 50 kW	158	163	165	160	139	138	141	139	136
Unmetered Scattered Load Connections	262	263	262	258	256	252	200	194	189
Sentinel Lighting Connections	500	487	454	406	378	345	342	326	311
Street Lighting Connections	6,865	6,956	7,007	7,067	7,115	7,186	7,336	7,400	7,464
Wholesale Market Participants (GS>50)	1	1	1	1	1	1	1	1	1

Customers/Connections Variance Analysis

Rate Class	Historical 2017	Historical 2018	Historical 2019	Historical 2020	Historical 2021	Historical 2022	Historical 2023	Bridge Year 2024	Test Year 2025
Residential	0%	1%	2%	2%	2%	2%	2%	2%	2%
General Service < 50 kW	0%	0%	0%	-1%	3%	0%	0%	1%	1%
General Service >= 50 kW	0%	3%	1%	-3%	-13%	-1%	2%	-2%	-2%
Unmetered Scattered Load Connections	0%	0%	0%	-1%	-1%	-1%	-21%	-3%	-3%
Sentinel Lighting Connections	0%	-3%	-7%	-11%	-7%	-9%	-1%	-5%	-5%
Street Lighting Connections	0%	1%	1%	1%	1%	1%	2%	1%	1%
Wholesale Market Participants (GS>50)	0%	0%	0%	0%	0%	0%	0%	0%	0%

Consumption (Actual)

Rate Class	Historical 2017	Historical 2018	Historical 2019	Historical 2020	Historical 2021	Historical 2022	Historical 2023	Bridge Year 2024	Test Year 2025
Residential	153,825,741	170,461,439	165,806,296	179,914,470	182,892,382	182,644,896	177,391,636	184,759,792	187,443,401
General Service < 50 kW	52,319,962	52,983,337	50,506,434	48,537,506	54,230,050	55,719,443	54,279,425	56,052,591	56,382,524
General Service >= 50 kW	141,476,347	149,687,059	148,522,986	130,526,635	125,804,033	133,364,273	133,760,896	134,199,447	131,900,238
Unmetered Scattered Load Connections	958,727	956,107	952,930	940,979	919,365	895,494	851,915	827,752	804,273
Sentinel Lighting Connections	729,133	675,874	583,837	535,935	481,895	422,907	419,671	400,619	382,432
Street Lighting Connections	1,393,112	1,403,956	1,406,314	1,423,808	1,410,628	1,418,460	1,453,176	1,465,852	1,478,639
Wholesale Market Participants (GS>50)	3,013,780	2,923,062	2,829,418	2,757,773	2,744,430	2,665,199	2,671,194	2,679,952	2,634,037

Consumption (Actual) Variance Analysis

Rate Class	Historical 2017	Historical 2018	Historical 2019	Historical 2020	Historical 2021	Historical 2022	Historical 2023	Bridge Year 2024	Test Year 2025
Residential	0%	11%	-3%	9%	2%	0%	-3%	4%	1%
General Service < 50 kW	0%	1%	-5%	-4%	12%	3%	-3%	3%	1%
General Service >= 50 kW	0%	6%	-1%	-12%	-4%	6%	0%	0%	-2%
Unmetered Scattered Load Connections	0%	0%	0%	-1%	-2%	-3%	-5%	-3%	-3%
Sentinel Lighting Connections	0%	-7%	-14%	-8%	-10%	-12%	-1%	-5%	-5%
Street Lighting Connections	0%	1%	0%	1%	-1%	1%	2%	1%	1%
Wholesale Market Participants (GS>50)	0%	-3%	-3%	-3%	0%	-3%	0%	0%	-2%

Demand (Actual)

Rate Class	Historical 2017	Historical 2018	Historical 2019	Historical 2020	Historical 2021	Historical 2022	Historical 2023	Bridge Year 2024	Test Year 2025
Residential	-	-	-	-	-	-			
General Service < 50 kW	-	-	-	-	-	-			
General Service >= 50 kW	392,218	408,125	410,421	376,797	344,248	352,484	348,923	370,459	364,112
Unmetered Scattered Load Connections	-	-	-	-	-	-			
Sentinel Lighting Connections	2,012	1,898	1,605	1,474	1,328	1,162	1,153	1,105	1,055
Street Lighting Connections	3,890	3,915	3,924	3,960	3,934	3,955	4,057	4,111	4,147
Wholesale Market Participants (GS>50)	5,518	5,287	5,114	4,924	4,976	4,730	4,881	5,182	5,093

Demand (Actual) Variance Analysis

Rate Class	Historical 2017	Historical 2018	Historical 2019	Historical 2020	Historical 2021	Historical 2022	Historical 2023	Bridge Year 2024	Test Year 2025
Residential	0%								
General Service < 50 kW	0%								
General Service >= 50 kW	0%	4%	1%	-8%	-9%	2%	-1%	6%	-2%
Unmetered Scattered Load Connections	0%								
Sentinel Lighting Connections	0%	-6%	-15%	-8%	-10%	-13%	-1%	-4%	-5%
Street Lighting Connections	0%	1%	0%	1%	-1%	1%	3%	1%	1%
Wholesale Market Participants (GS>50)	0%	-4%	-3%	-4%	1%	-5%	3%	6%	-2%

Consumption (Weather Normalized)

Rate Class	Historical 2017	Historical 2018	Historical 2019	Historical 2020	Historical 2021	Historical 2022	Historical 2023	Bridge Year 2024	Test Year 2025
Residential	156,053,011	166,340,027	166,335,984	179,185,135	182,461,990	182,232,986	181,960,545	184,759,792	187,443,401
General Service < 50 kW	53,077,512	51,702,307	50,667,783	48,340,746	54,102,433	55,593,780	55,677,448	56,052,591	56,382,524
General Service >= 50 kW	143,524,808	146,067,929	148,997,460	129,997,508	125,507,984	133,063,502	137,206,048	134,199,447	131,900,238
Unmetered Scattered Load Connections	972,609	932,990	955,974	937,164	917,202	893,474	873,857	827,752	804,273
Sentinel Lighting Connections	739,690	659,533	585,702	533,762	480,761	421,953	430,480	400,619	382,432
Street Lighting Connections	1,413,283	1,370,011	1,410,807	1,418,035	1,407,308	1,415,261	1,490,604	1,465,852	1,478,639
Wholesale Market Participants (GS>50)	3,057,417	2,852,388	2,838,457	2,746,594	2,737,972	2,659,188	2,739,994	2,679,952	2,634,037

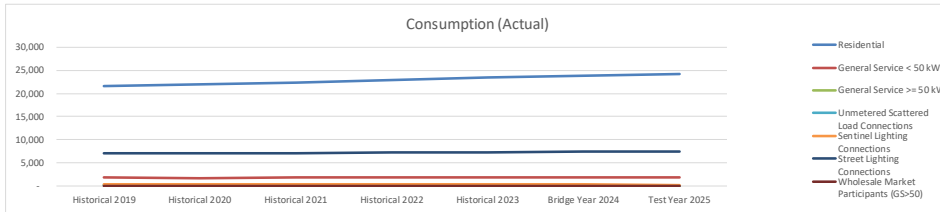**Consumption (Weather Normalized) Variance Analysis**

| Rate Class	Historical 2017	Historical 2018	Historical 2019	Historical 2020	Historical 2021	Historical 2022	Historical 2023	Bridge Year 2024	Test Year 2025
Residential	0%	7%	0%	8%	2%	0%	0%	2%	1%
General Service < 50 kW	0%	-3%	-2%	-5%	12%	3%	0%	1%	1%
General Service >= 50 kW	0%	2%	2%	-13%	-3%	6%	3%	-2%	-2%
Unmetered Scattered Load Connections	0%	-4%	2%	-2%	-2%	-3%	-2%	-5%	-3%
Sentinel Lighting Connections	0%	-11%	-11%	-9%	-10%	-12%	2%	-7%	-5%
Street Lighting Connections	0%	-3%	3%	1%	-1%	1%	5%	-2%	1%
Wholesale Market Participants (GS>50)	0%	-7%	0%	-3%	0%	-3%	3%	-2%	-2%

Demand (Weather Normalized)

Rate Class	Historical 2017	Historical 2018	Historical 2019	Historical 2020	Historical 2021	Historical 2022	Historical 2023	Bridge Year 2024	Test Year 2025
Residential									
General Service < 50 kW									
General Service >= 50 kW	392,218	408,125	410,421	376,797	344,248	352,484	348,923	370,459	364,112
Unmetered Scattered Load Connections									
Sentinel Lighting Connections	2,012	1,898	1,605	1,474	1,328	1,162	1,153	1,105	1,055
Street Lighting Connections	3,890	3,915	3,924	3,960	3,934	3,955	4,057	4,111	4,147
Wholesale Market Participants (GS>50)	5,518	5,287	5,114	4,924	4,976	4,730	4,881	5,182	5,093

Demand (Weather Normalized) Variance Analysis

| Rate Class	Historical 2017	Historical 2018	Historical 2019	Historical 2020	Historical 2021	Historical 2022	Historical 2023	Bridge Year 2024	Test Year 2025
Residential	0%								
General Service < 50 kW	0%								
General Service >= 50 kW	0%	4%	1%	-8%	-9%	2%	-1%	6%	-2%
Unmetered Scattered Load Connections	0%								
Sentinel Lighting Connections	0%	-6%	-15%	-8%	-10%	-13%	-1%	-4%	-5%
Street Lighting Connections	0%	1%	0%	1%	-1%	1%	3%	1%	1%
Wholesale Market Participants (GS>50)	0%	-4%	-3%	-4%	1%	-5%	3%	6%	-2%

Consumption (Actual)

Consumption (Weather Normalized)
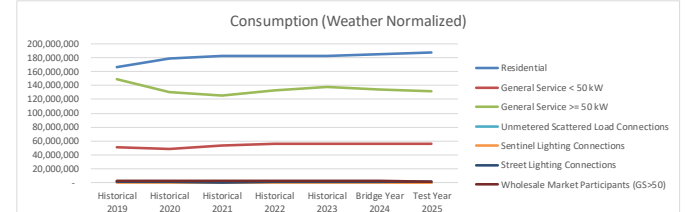
Demand (Actual)
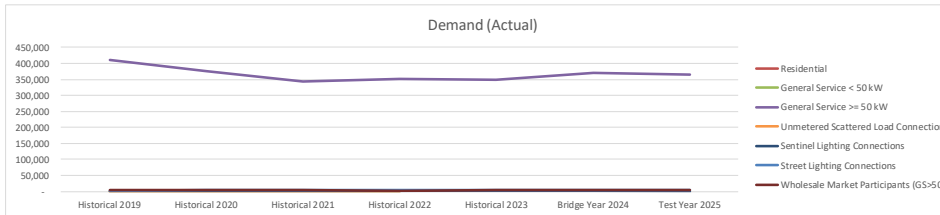
Demand (Weather Normalized)
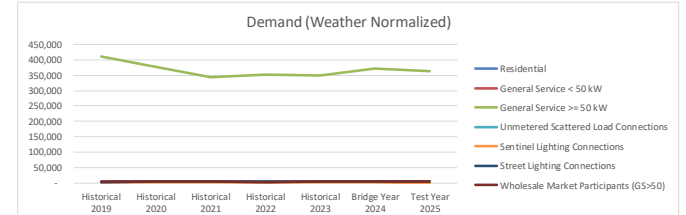
Appendix 3-C
Customer Demographics

WHESC Customer Demographics

Customer Location	
Municipality	Percent of Customers (%)
Welland	100%

Census Population Data	
	Welland*
Population in 2016	52,293
Population in 2021	55,750
Population Percentage Change 2016-2021	6.6%

*Statistics Canada. 2023. (table). Census Profile. 2021 Census of Population. Statistics Canada Catalogue no. 98-316-X2021001. Ottawa. Released November 15, 2023. https://www12.statcan.gc.ca/census-recensement/2021/dp-pd/prof/index.cfm?Lang=E (accessed August 21, 2024).