



## **Operations Monitoring Report**

**Third Quarter FY16**

**Prepared by:**

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## **I. Executive Summary**

A review of the fiscal year 2016 (FY16) Third Quarter performance and contract obligations between Constellation New Energy (CNE) and the Metropolitan Government of Nashville and Davidson County (Metro) is presented in this report by Thermal Engineering Group, Inc (TEG). The status of the available funds for all active capital construction and repair and improvement projects are also presented. For the fiscal year 2016 to date, CNE has satisfactorily met all of the contract obligations to Metro and has had no contract violations.

For the Third Quarter FY16, the chilled water sales increased 20.2% over the previous Third Quarter (FY15). The chilled water sendout was also up 12.5% over the previous Third Quarter. However, the system losses were down approximately 65.2%. The Third Quarter FY16 saw a significant increase in cooling degree days. The peak chilled water demand for the current quarter was 11,180 tons, which is 10.4% higher than the previous Third Quarter.

Steam sendout for the current quarter decreased by approximately 10.1% over the previous Third Quarter with a 20.4% decrease in heating degree days. Likewise, steam sales also decreased by approximately 10.7% over the previous Third Quarter. Steam system losses, as a percentage of sendout, increased, and the total losses decreased approximately 2.1% over the previous Third Quarter. The peak steam demand for the current quarter was 141,813 pounds per hour, which represents a decrease in the Third Quarter demand by approximately 14.6%.

The Energy Generating Facility (EGF) performance continues to surpass the System Performance Guarantee (Guaranteed Maximum Quantity or GMQ) levels. The chilled water plant electric consumption continues to perform lower than the guaranteed levels and has decreased in the Third Quarter. The steam plant electric consumption decreased over the previous Third Quarter, and the amount of electricity per unit of sales of steam decreased by approximately 2.4%. The total water consumption for the steam and chilled water plants increased 6.7% from the previous Third Quarter marked by a 21.8% increase in the EDS make-up for the chilled water system and a 22.3% decrease in the steam plant usage.

The steam plant fuel efficiency has typically remained consistent with previous years and quarters, but a mechanical issue with the boilers during the Second Quarter caused a significant decrease in plant fuel efficiency. This issue was repaired in January, but the average plant efficiency for the Third Quarter remains slightly higher than it was historically.

Work continued on DES Capital and Repair & Improvement Projects during the Third Quarter of FY16. Repair and Improvements to the EDS continue as scheduled. Construction was completed on DES117 during the Second Quarter FY16 and was closed out during the Third Quarter FY16. DES112 is awaiting confirmation of redline drawing dimensions. Once these are received and confirmed, the record drawings will be completed and this project will be closed. DES120 Manhole B2 Sump Pump Installation, DES121 Miscellaneous Manhole Repairs, DES122 Manhole 13 Structural Repairs, DES123 John Sevier Condensate Return Piping Replacement, DES124 CJC Redevelopment, DES125 Chilled Water Leak Exploratory

Excavations on 1<sup>st</sup> Avenue and DES126 Chilled Water Leak Exploratory Excavations on 3<sup>rd</sup> Avenue were opened during the Third Quarter FY16.

The current fiscal year system operating costs to date are \$14,704,105. This value represents approximately 67.4% of the total budgeted operating cost for FY16. The customer revenues from the sales of steam and chilled water for FY16 (to date) are \$13,423,090 which is approximately 67.0% of the budgeted amount. The difference between the operating costs and customer revenue is the Metro funding amount (MFA), which represents the shortfall in cash flow for the system. The MFA transferred to date for FY16 is \$1,794,000 (100% of budget). However, the actual MFA required cannot be accurately calculated due to outstanding invoices.

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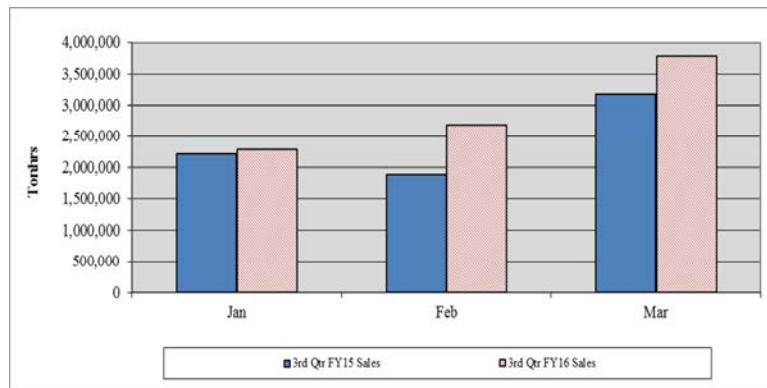
## II. Energy Distribution Sales and Performance

### A. Chilled Water

This section of the report discusses and presents performance information regarding the operation of the EGF for the periods described. Charts and tabular data are also presented to provide a more detailed description of the actual EGF performance.

#### 1. Sales and Sendout

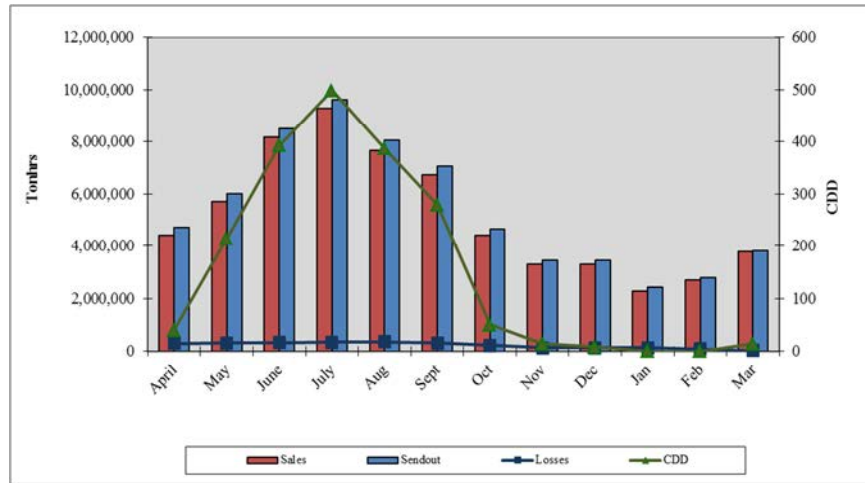
A comparison for the Third Quarter chilled water sales is shown in Figure 1. This data reflects a 20.2% increase in sales for the current quarter over the same quarter of the previous fiscal year. The increase in chilled water sales is largely due to a warmer than normal January and February.



**Figure 1. Chilled Water Sales Comparison**

The peak chilled water demand for the current quarter was 11,180 tons, which represents an approximate 10.4% increase over the previous Third Quarter.

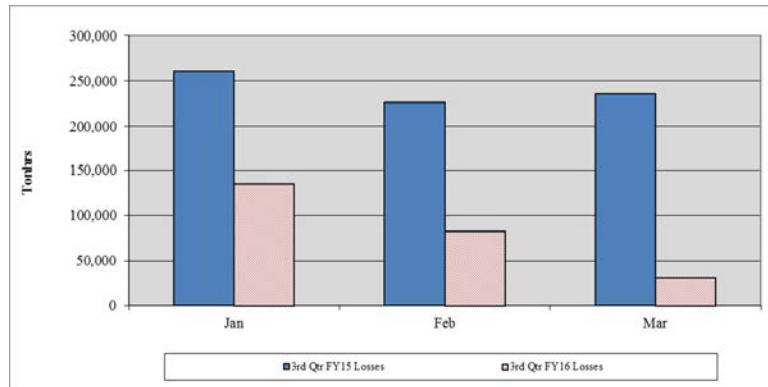
Figure 2 shows the chilled water sales, sendout and losses for the previous twelve months. The losses on this figure are defined as the difference in tonhrs per month between the recorded sendout and sales values and represent the total energy loss for chilled water in the EDS. The number of cooling degree days per month are also tracked for comparison.



**Figure 2. Chilled Water Sales, Sendout, Losses and CDD for the Previous Twelve Months**

2. Losses

A comparison of the total, chilled water energy losses in the EDS for the Third Quarter is shown in Figure 3. These losses are the difference in chilled water sendout and sales.

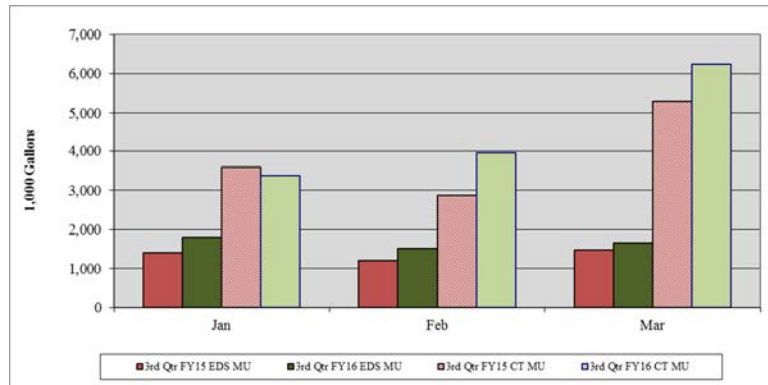


**Figure 3. Chilled Water System Loss Comparison**

The EDS make-up increased by approximately 21.8% over the previous Third Quarter. CNE is continuing to investigate the sources of the chilled water leaks that cause the increase in EDS make-up. A new project (DES-125) has been implemented and has included several excavations in suspected areas to find the sources of the leaks. The total EDS water usage represents only a small part of the total EGF water usage for the quarter, but the percentage is increasing.

The total energy losses have decreased by approximately 65.2% over the previous Third Quarter. The make-up to the cooling towers increased 15.4% during the quarter due largely to an increase in chilled water sales. The number of cycles of

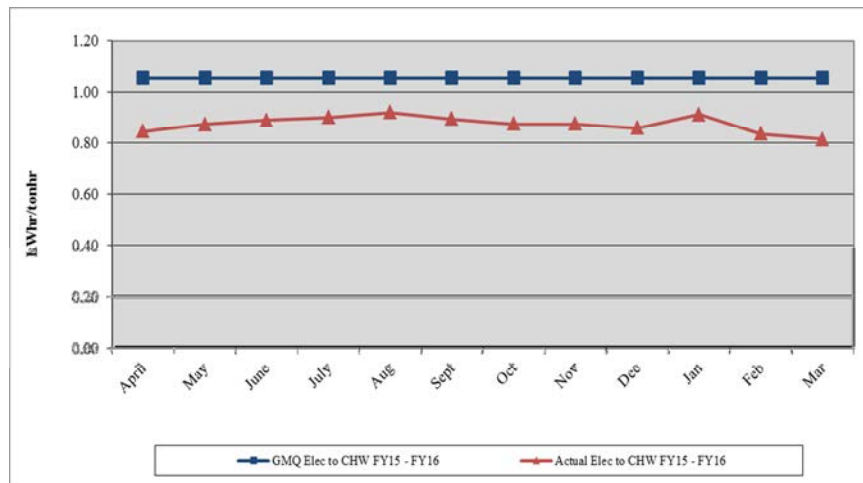
concentration in the condensing water circuit experienced a 1.9% increase during the current quarter. The overall city water make-up comparison for the chilled water system is shown in Figure 4.



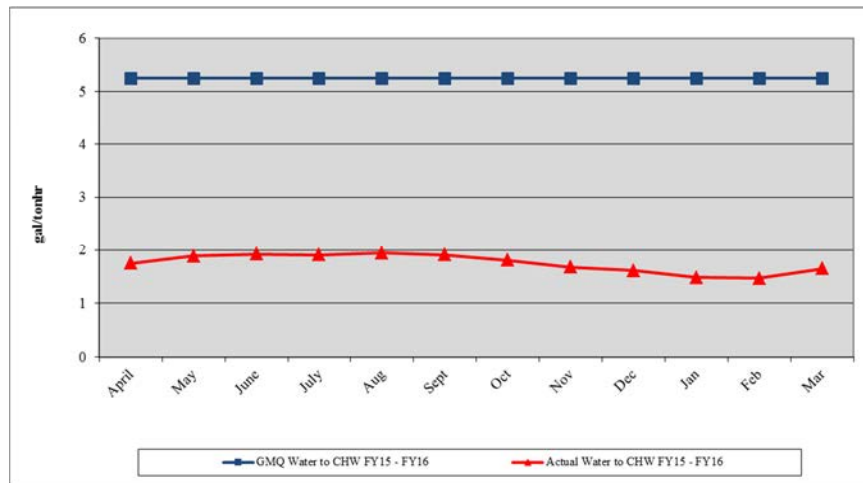
**Figure 4. Chilled Water System City Water Usage Comparison**

### 3. Performance

The performance of the chilled water aspect of the EGF is presented by the following two charts, Figures 5 and 6, for the previous twelve months. Under the management of CNE, the System Performance Guarantee levels as described in the ARMA are being achieved quite satisfactorily.



**Figure 5. Chiller Plant Electric Performance Guarantee Comparison for the Previous Twelve Months**



**Figure 6. Chiller Plant Water Consumption Performance Guarantee Comparison for the Previous Twelve Months**

The chilled water allocation of the electric consumption falls under the GMQ limit of 1.055 kWhr per tonhr for the current quarter, and no excursion is reported for the current fiscal year. The steady increase in electric consumption previously reported has been remedied through operational changes made by CNE. The electric usage per unit of sales decreased approximately 8.8% over the Third Quarter for FY15 (Figure 5). TEG will continue to monitor CNE’s performance in operating the chiller plant to ensure continued efficient operation.

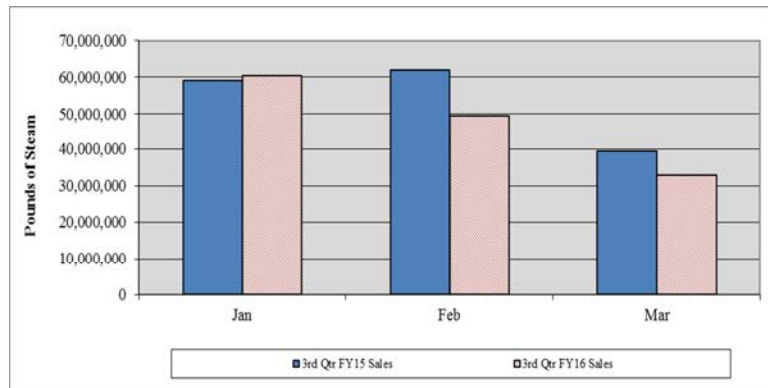
The actual chilled water plant water conversion factor decreased approximately 2.6% over the previous Third Quarter. However, the total consumption of city water for the chiller plant for the current quarter increased 17.0% due largely to an increase in chilled water sales.

**B. Steam**

**1. Sales and Sendout**

The steam sendout decreased by approximately 10.1% over the previous Third Quarter (FY15), and the sales also decreased by approximately 10.7%. The Quarter experienced a 20.4% decrease in the number of heating degree days. The steam system losses increased 2.1% over the previous Third Quarter. A comparison for the Third Quarter steam sales is shown in Figure 7.

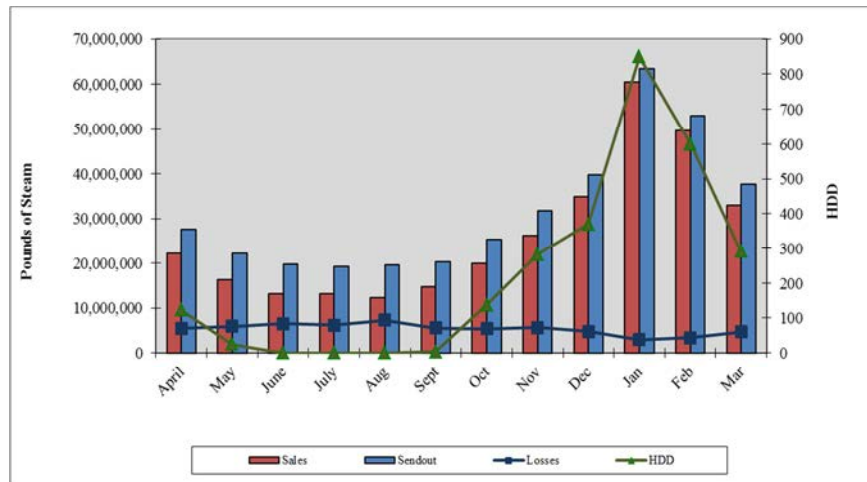




**Figure 7. Steam Sales Comparison**

The peak steam demand for the current quarter was 141,813 pph, which reflects an approximate 14.6% decrease in the peak steam production over the previous Third Quarter.

Figure 8 shows the steam sales, sendout and losses for the previous twelve months. The losses on this figure are defined as the difference in pounds per month between the recorded sendout and sales values and represent the total mass loss in the EDS between the EGF and the customer meters.

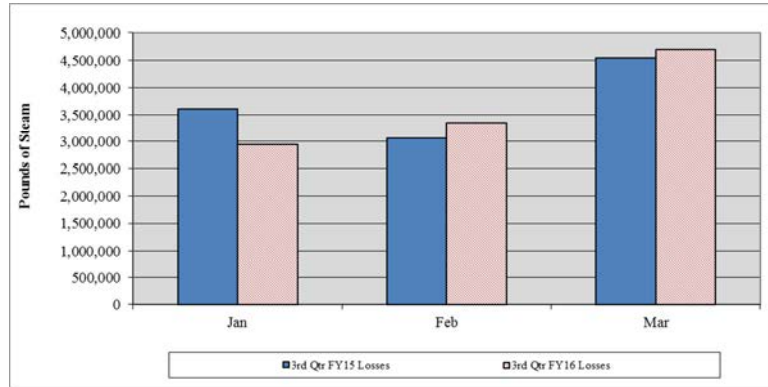


**Figure 8. Steam Sales, Sendout, Losses and HDD for the Previous Twelve Months**

## 2. Losses

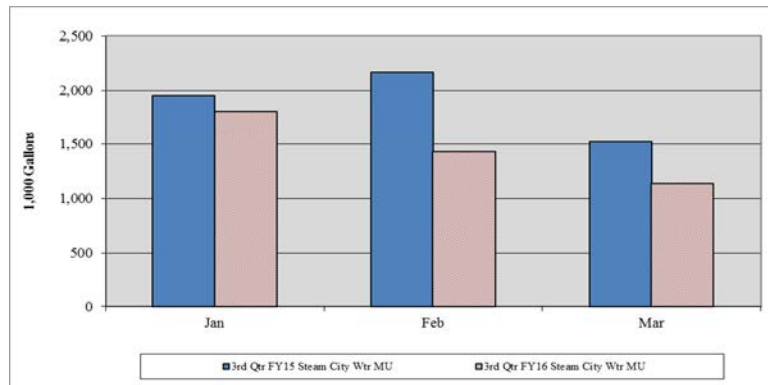
A comparison of the total steam mass losses in the EDS for the Third Quarter is shown in Figure 9. The mass loss is caused by the heat loss in the EDS between the EGF and the customer meters, resulting in a mass loss at steam traps. Faulty traps, steam leaks or meter error could also be a contributing cause of these losses. Whenever steam sales decrease from the previous quarter, the percent of system

losses can be expected to increase since the majority of these losses are based on a near constant heat loss of the system.



**Figure 9. Steam System Losses**

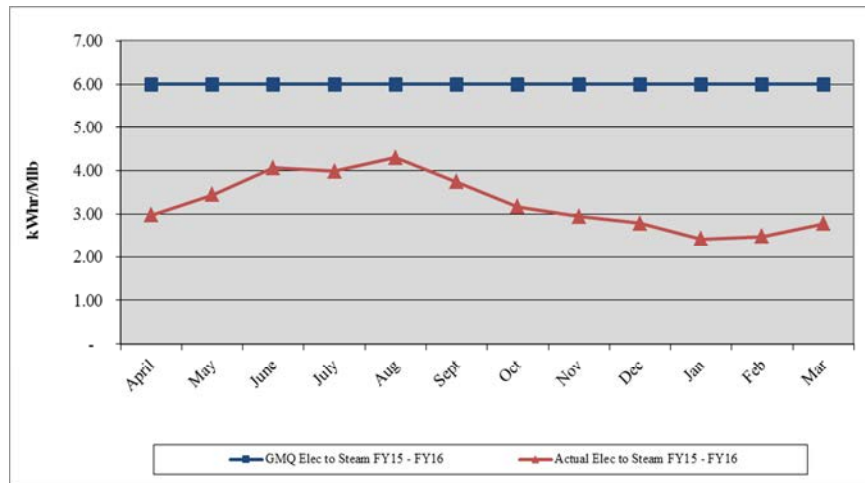
The amount of city water make-up (MU) to the steam system consists of the loss in mass between the EGF and the customers, in the condensate return from the customers to the EGF and losses at the EGF. This data is shown in the comparison of Second Quarter data in Figure 10.



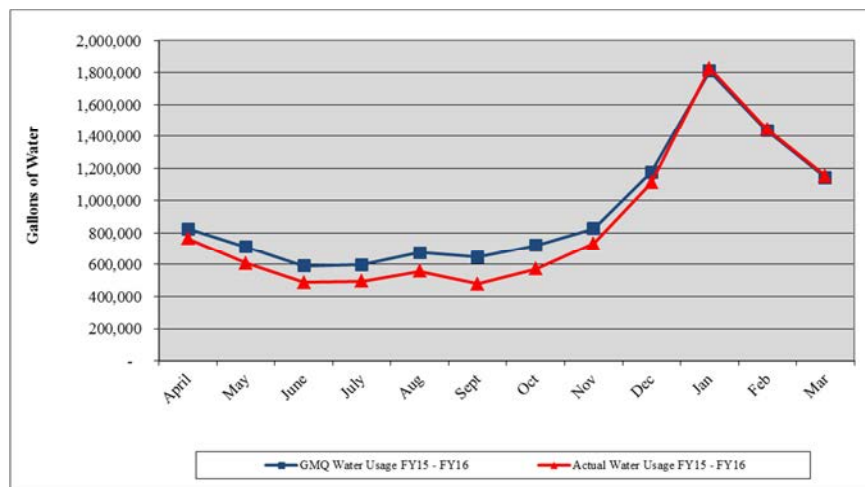
**Figure 10. Steam System City Water Make-up Comparison**

### 3. Performance

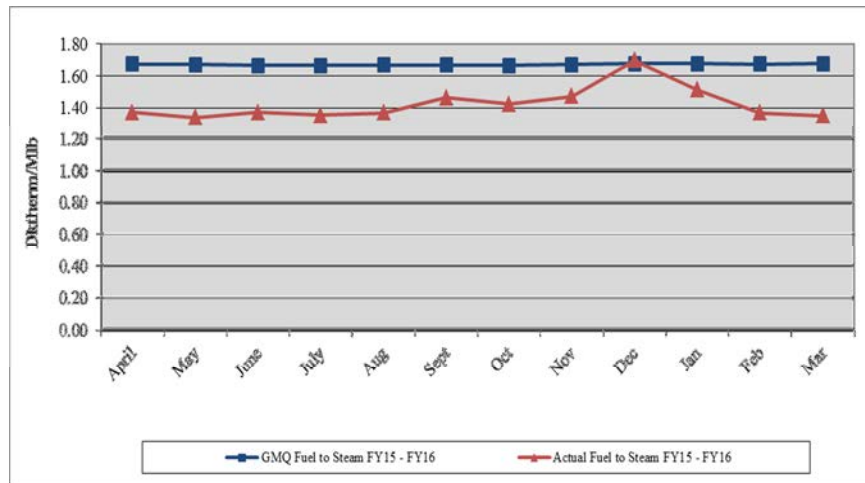
The performance of the steam system aspect of the EGF is presented by the following three charts, Figures 11, 12 and 13. Under the management of CNE, the System Performance Guarantee levels as described in the ARMA are being achieved satisfactorily.



**Figure 11. Steam Plant Electric Performance Guarantee for the Previous Twelve Months**



**Figure 12. Steam Plant Water Performance Guarantee for the Previous Twelve Months**



**Figure 13. Steam Plant Fuel Performance Guarantee for the Previous Twelve Months**

The current quarter experienced a 12.8% decrease in the steam plant electric consumption while experiencing a 2.4% decrease in the electric conversion factor. The water consumption for the steam plant decreased 22.3% this quarter as compared to the previous Third Quarter. The fuel consumption per unit of steam sales recovered to similar historic values during the quarter. However, the average efficiency for the quarter remains 2.2% lower than the previous Third Quarter due to the January performance. The February and March values are more consistent and represent much improved performance.

### C. Contract Guarantee Performance

The production and sales performance for the EGF and EDS are summarized in Table 1 for the current quarter. Additional parameters, such as cooling tower blow-down and peak demands are listed in this table, as well. Table 2 presents the Third Quarter comparisons of the Guaranteed Maximum Quantities (GMQ) of the criteria commodities (fuel, water and electricity).

**Table 1. Third Quarter FY16 Production, Sales and Consumption Summary**

Item	Unit	Third Quarter FY16	Third Quarter FY15	*Percent Difference
	days	91	90	1.11%
<b>Total Electric Use</b>	kWhrs	7,765,275	7,169,428	8.31%
Chilled Water	kWhrs	7,405,189	6,756,302	9.60%
Steam	kWhrs	360,086	413,126	-12.84%
<b>Total Water Use</b>	kgal	22,936	21,491	6.72%
Total Chilled Water	kgal	18,557	15,854	17.05%
EDS Make-up	kgal	4,979	4,089	21.77%
Cooling Towers	kgal	13,578	11,765	15.41%
Calc CT Evaporation	kgal	11,640	10,058	15.73%
CT Blowdown	kgal	1,938	1,707	13.53%
Calc # Cycles		6.01	5.89	1.93%
Steam	kgal	4,379	5,637	-22.32%
<b>Total Fuel Use</b>	mmBTU	219,426	238,906	-8.15%
Natural Gas	mmBTU	219,401	220,695	-0.59%
Propane	mmBTU	25	18,211	-99.86%
<b>Condensate Return</b>	kgal	15,073	15,920	-5.32%
	lbs	122,936,389	129,842,763	-5.32%
Avg Temp	°F	174.0	170.7	1.95%
<b>Sendout</b>				
Chilled Water	tonhrs	9,000,400	8,000,500	12.50%
Steam	lbs	154,052,000	171,390,000	-10.12%
Peak CHW Demand	tons	11,180	10,130	10.37%
Peak Steam Demand	lb/hr	141,813	166,094	-14.62%
CHW LF		36.86%	36.56%	0.81%
Steam LF		49.74%	47.77%	4.12%
<b>Sales</b>				
Chilled Water	tonhrs	8,749,357	7,278,454	20.21%
Steam	lbs	143,068,498	160,171,677	-10.68%
<b>Losses</b>				
Chilled Water	tonhrs	251,043	722,046	-65.23%
Steam	lbs	10,983,502	11,218,323	-2.09%
		7.13%	6.55%	8.93%
<b>Degree Days</b>				
CDD		14	2	600.00%
HDD		1,740	2,186	-20.40%

\*positive percent difference values imply an increase from FY15 to FY16

**Table 2. Second Quarter FY16 Performance Guarantee Comparison for Steam and Chilled Water**

GMQ Calculations	Unit	Third Quarter FY16	Third Quarter FY15	*Percent Difference
<b>Steam</b>				
GMQ Elec Conversion	kWhr/Mlb	6.00	6.00	
Electric Conversion	kWhr/Mlb	2.52	2.58	-2.42%
GMQ Plant Efficiency	Dth/Mlb	1.675	1.687	
Plant Efficiency	Dth/Mlb	1.424	1.394	2.18%
Actual %CR		79.80%	75.76%	5.34%
Avg CR Temp	°F	174	171	1.95%
GMQ Water Conversion	gal	4,387,397	5,858,289	
Water Conversion	gal	4,422,790	5,693,370	-22.32%
<b>Chilled Water</b>				
GMQ Elec Conversion	kWhr/tonhr	1.055	1.055	
Electric Conversion	kWhr/tonhr	0.846	0.928	-8.82%
GMQ Water Conversion	gal/tonhr	5.25	5.25	
Water Conversion	gal/tonhr	2.12	2.18	-2.63%

\*positive percent difference values imply an increase from FY15 to FY16

#### D. Operating Costs

The fixed operating costs for the DES include the management fee to CNE, debt service payments on the bonds and engineering and administration costs and are charged to the customers relative to their contract demand. The variable costs are dependent on the amounts of steam and chilled water produced and sold to the customers. These latter costs include the utility and chemical treatment costs. The vast majority of the costs incurred for the operation of the DES are passed onto the customers in the form of the demand charges (fixed costs) and energy charges (variable costs). A summary of the total operating costs for the fiscal year to date are shown in Table 3.

The revenues shown reflect the charges to the customers for their respective steam and chilled water service. The difference between the total costs and revenues from the customers is the shortfall that must be paid by Metro. The shortfall exists due to the remaining capacity at the EGF that was included in the original construction and remains unsold and the debt service for bonds to which the customers do not directly contribute.

The system operating costs for FY16 to date are \$14,704,105. This value represents approximately 67.4% of the total budgeted operating cost for FY16 and includes expenses to date that have been invoiced but were not paid at the time of this report. Additional invoices that would be charged to the Third Quarter have not been issued or

paid at the time of this report. The customer revenues from the sales of steam and chilled water for FY16 are \$13,423,090 which is approximately 67.0% of the budgeted amount. The MFA transferred to date is \$1,794,000 (100% of budget). However, the actual MFA required cannot be accurately calculated due to the outstanding invoices.

**Table 3. DES Expenses and Revenues to Date**

Item	FY16 Budget	First Quarter Expenses	Second Quarter Expenses	Third Quarter Expenses	Fourth Quarter Expenses	Total Spending to Date	% of Budget
<b>Operating Management Fee</b>							
<b>FOC: Basic</b>	\$ 4,433,800	\$ 1,076,159	\$ 1,076,159	\$ 1,076,159	\$ -	\$ 3,228,476	72.82%
9th Chiller	\$ 41,600	\$ 10,084	\$ 10,084	\$ 10,084	\$ -	\$ 30,251	72.72%
C/O 6A	\$ 82,000	\$ 19,908	\$ 19,908	\$ 19,908	\$ -	\$ 59,725	72.84%
C/O 6B	\$ 71,800	\$ 17,429	\$ 17,429	\$ 17,429	\$ -	\$ 52,287	72.82%
C/O 7	\$ 27,100	\$ 6,566	\$ 6,566	\$ 6,566	\$ -	\$ 19,698	72.69%
C/O 8	\$ 11,900	\$ 2,873	\$ 2,873	\$ 2,873	\$ -	\$ 8,620	72.44%
<b>Pass-thru Charges:</b>	\$ 139,500	\$ 42,247	\$ 47,778	\$ 44,552	\$ -	\$ 134,577	96.47%
Insurance	\$ 32,100	\$ 2,675	\$ -	\$ -	\$ -	\$ 2,675	8.33%
<b>Marketing:</b>	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	n.a.
CNE Sales Activity	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	n.a.
Incentive Payments	\$ 12,800	\$ 3,139	\$ 3,139	\$ 3,139	\$ -	\$ 9,418	73.58%
<b>FEA:</b>	\$ -	\$ 13,900	\$ 10,873	\$ 32,049	\$ -	\$ 56,822	n.a.
Steam	\$ -	\$ 13,900	\$ 10,873	\$ 32,049	\$ -	\$ 56,822	n.a.
Chilled Water	\$ -	\$ 144,264	\$ 76,510	\$ 60,336	\$ -	\$ 281,109	n.a.
<b>Misc:</b>	\$ -	\$ (226,605)	\$ (123,280)	\$ (93,914)	\$ -	\$ (443,798)	n.a.
Metro Credit	\$ -	\$ (226,605)	\$ (123,280)	\$ (93,914)	\$ -	\$ (443,798)	n.a.
ARFA	\$ -	\$ 15,630	\$ 15,630	\$ 15,630	\$ -	\$ 46,889	n.a.
Deferral	\$ -	\$ -	\$ (7,016)	\$ (92,385)	\$ -	\$ (99,401)	n.a.
<b>Subtotal - Man Fee =</b>	<b>\$ 4,852,600</b>	<b>\$ 1,354,873</b>	<b>\$ 1,279,932</b>	<b>\$ 1,196,339</b>	<b>\$ -</b>	<b>\$ 3,831,145</b>	<b>78.95%</b>
<b>Reimbursed Management Fee + Chem Treatment</b>		\$ 1,352,198	\$ 1,295,351	\$ 398,748	\$ -	\$ 3,046,297	0.00%
<b>Metro Costs</b>							
<b>Pass-thru Charges:</b>	\$ 9,000	\$ 33,421	\$ 9,093	\$ 2,682	\$ -	\$ 45,195	502.17%
Engineering	\$ 9,000	\$ 33,421	\$ 9,093	\$ 2,682	\$ -	\$ 45,195	502.17%
EDS R&I Transfers	\$ 282,100	\$ 70,525	\$ 70,525	\$ 70,822	\$ 23,508	\$ 235,380	83.44%
Metro Marketing	\$ 10,000	\$ -	\$ -	\$ -	\$ -	\$ -	0.00%
Project Administration	\$ 54,400	\$ -	\$ -	\$ -	\$ -	\$ -	0.00%
Metro Incremental Cost	\$ 529,600	\$ 143,244	\$ 121,775	\$ 133,734	\$ 24,231	\$ 422,983	79.87%
<b>Utility Costs:</b>	\$ 745,400	\$ 210,481	\$ 109,117	\$ 82,802	\$ -	\$ 402,400	53.98%
Water/Sewer	\$ -	\$ 40	\$ 40	\$ 82	\$ -	\$ 162	n.a.
EDS Water/Sewer	\$ -	\$ 16,124	\$ 14,163	\$ 11,112	\$ -	\$ 41,398	n.a.
EDS Electricity	\$ -	\$ 2,336,989	\$ 1,018,806	\$ 705,802	\$ -	\$ 4,061,597	62.05%
Electricity	\$ 6,545,700	\$ 2,336,989	\$ 1,018,806	\$ 705,802	\$ -	\$ 4,061,597	62.05%
Natural Gas Consultant	\$ 100,900	\$ 1,893	\$ 2,480	\$ 2,240	\$ -	\$ 6,613	6.55%
Natural Gas Transport	\$ -	\$ 48,964	\$ 75,416	\$ 98,592	\$ -	\$ 222,972	n.a.
Natural Gas Fuel	\$ 3,287,100	\$ 269,087	\$ 459,057	\$ 608,950	\$ -	\$ 1,337,094	40.68%
Propane	\$ -	\$ -	\$ 89,658	\$ -	\$ -	\$ 89,658	n.a.
<b>Subtotal - Metro Costs =</b>	<b>\$ 11,564,200</b>	<b>\$ 3,130,767</b>	<b>\$ 1,970,130</b>	<b>\$ 1,716,817</b>	<b>\$ 47,739</b>	<b>\$ 6,865,453</b>	<b>59.37%</b>
<b>Subtotal - Operations =</b>	<b>\$ 16,416,800</b>	<b>\$ 4,485,640</b>	<b>\$ 3,250,062</b>	<b>\$ 2,913,157</b>	<b>\$ 47,739</b>	<b>\$ 10,696,598</b>	<b>65.16%</b>
<b>Debt Service</b>							
2012 Bonds	\$ 3,479,500	\$ 869,313	\$ 870,075	\$ 870,075	\$ -	\$ 2,609,463	75.00%
2005 Bonds -Self Funded	\$ 762,200	\$ -	\$ -	\$ 762,175	\$ -	\$ 762,175	100.00%
2007 Bonds -Self Funded	\$ 204,400	\$ -	\$ -	\$ -	\$ -	\$ -	0.00%
2008 Bonds -Self Funded	\$ 203,400	\$ -	\$ -	\$ -	\$ -	\$ -	0.00%
2010 Bonds -Self Funded	\$ 202,400	\$ -	\$ -	\$ -	\$ -	\$ -	0.00%
MCCC Fund -Self Funded	\$ 714,000	\$ -	\$ 662,100	\$ -	\$ -	\$ 662,100	92.73%
Interest & Misc Revenue	\$ (156,900)	\$ (6,747)	\$ (12,737)	\$ (6,747)	\$ -	\$ (26,230)	16.72%
MIP	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	n.a.
Oper. Reserve Fund	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	n.a.
<b>Subtotal - Capital =</b>	<b>\$ 5,409,000</b>	<b>\$ 862,566</b>	<b>\$ 1,519,438</b>	<b>\$ 1,625,503</b>	<b>\$ -</b>	<b>\$ 4,007,507</b>	<b>74.09%</b>
<b>Total =</b>	<b>\$ 21,825,800</b>	<b>\$ 5,348,206</b>	<b>\$ 4,769,500</b>	<b>\$ 4,538,660</b>	<b>\$ 47,739</b>	<b>\$ 14,704,105</b>	<b>67.37%</b>
<b>Customer Revenues</b>							
Taxes Collected	\$ 113,667	\$ 84,311	\$ 84,311	\$ 76,813	\$ -	\$ 274,791	n.a.
Taxes Paid	\$ 113,666	\$ 84,311	\$ 84,311	\$ 51,761	\$ -	\$ 249,738	n.a.
Penalty Revenues/Credits	\$ (38,116)	\$ 7,910	\$ 7,910	\$ 7,038	\$ -	\$ (23,168)	n.a.
Energy Revenues Collected	\$ 5,444,128	\$ 4,112,868	\$ 4,112,868	\$ 3,864,210	\$ -	\$ 13,421,205	n.a.
<b>Revenues =</b>	<b>\$ 20,031,300</b>	<b>\$ 5,406,013</b>	<b>\$ 4,120,778</b>	<b>\$ 3,896,299</b>	<b>\$ -</b>	<b>\$ 13,423,090</b>	<b>67.01%</b>
<b>Metro Funding Amount =</b>	<b>\$ 1,794,500</b>	<b>\$ (57,806)</b>	<b>\$ 648,722</b>	<b>\$ 642,360</b>	<b>\$ 47,739</b>	<b>\$ 1,281,015</b>	<b>71.39%</b>

The DES serves 28 customers and 41 buildings in downtown Nashville. These customers are divided into three categories: 1) Private customers who privately own their buildings, 2) State of TN owned buildings and 3) Metro owned buildings. A summary of the annual costs for each of these three categories is presented in Table 4. These values include late fees and penalties and any unpaid balances.

**Table 4. Customer Revenue Summary to Date**

Building	Chilled Water			Steam		
	Total Cost	Consumption (tonhrs/yr)	Unit Cost (\$/tonhr)	Total Cost	Consumption (Mlb/yr)	Unit Cost (\$/Mlb)
Private Customers	\$ 2,756,597	13,408,003	\$ 0.2056	\$ 1,078,367	71,769	\$ 15.0256
State Government	\$ 2,518,777	10,384,920	\$ 0.2425	\$ 1,317,402	77,214	\$ 17.0616
Metro Government	\$ 4,131,013	19,697,789	\$ 0.2097	\$ 1,619,050	115,399	\$ 14.0300
New Customers	\$ 2,502,068	11,704,480	\$ 0.2138	\$ 849,742	73,880	\$ 11.5016
<b>Total</b>	<b>\$ 9,406,387</b>	<b>43,490,712</b>	<b>\$ 0.2163</b>	<b>\$ 4,014,818</b>	<b>264,383</b>	<b>\$ 15.1856</b>

Total Revenue \$ 13,421,206  
 True-up and Adjustments (Net) \$ 1,884  
 Net Revenue \$ 13,423,090

### III. EGF Operations

Items relating to the facility operations presented herein are derived from the monthly reports issued by CNE for FY16. Communication between TEG and CNE continues to be excellent, and CNE has reported and managed all EGF operations satisfactorily and according to the ARMA with no contract violations.

#### A. Reliability

The principle issues surrounding the reliable operation of the EGF relates to the ability to operate without significant interruption, exclusive of planned outages, and disruption of service to the customers. The following disruptions in service occurred during the quarter.

- A significant chilled water leak was discovered in January at the John Sevier building which caused the system pressure to drop. The building was isolated until repairs could be made by State personnel. Chilled water service to other customers was not interrupted.
- The main natural gas pressure regulator was not operating properly in January which caused the boilers to trip on low gas pressure. Piedmont was notified and made repairs to their regulator. The steam pressure dropped during the repair period since the boiler firing rate was decreased to accommodate temporarily bypassing the regulator.
- In February, while replacing the batteries on the plant UPS, control power was lost to the chillers, causing them to trip. The units were restarted immediately, but the chilled water supply temperature exceeded 43°F for 38 minutes.
- Steam pressure dropped to 144 psig in February while placing another boiler on-line.
- While performing preventative maintenance on the chillers in March, the chilled water supply temperature exceeded 43°F for thirty minutes on two separate occasions.
- Excursions and disruptions in operations that have occurred throughout the year are included in the individual Monthly Operational Reports from CNE.



B. Efficiency

The operation of the EGF satisfied the guaranteed levels for all commodity usage during the quarter. There were no significant excursions above the guaranteed levels for the current quarter. A more detailed discussion of the contract guarantee performance was presented previously in this report.

C. Environment, Health and Safety

No environmental violations were reported during the quarter.

Monthly safety meetings were held on Lock Out/Tag Out Safety, Safe Work Practices and Elevated Work and Vehicle Safety.

CNE continues cross-training its maintenance employees to fill in as relief operators.

D. Personnel

The EGF currently has twenty-five full time employees. Of the current number of employees, seventeen were previously employed by Nashville Thermal Transfer Corporation.

E. Training

Staff training for this quarter consisted of the Health and Safety training discussed previously. CNE continues cross training maintenance personnel to perform the tasks of the operators at the EGF in case of emergency or need.

F. Water Treatment

The water treatment program consists of regular testing and monitoring of the water chemistry in the steam, chilled water and condensing water systems. Chemicals are added to control the water hardness, chlorine levels and biologicals. Remote testing of the condensate at the AA Birch, Tennessee Tower and the Andrew Jackson also occurs regularly to monitor the concentration and distribution of the steam system chemicals.

- Steam System
  - The condensate return averaged approximately 79.8% of the steam sendout during the quarter which represents a 5.3% increase over the previous Third Quarter.
  - Feedwater iron and hardness remained excellent during the quarter.
- Condensing Water System
  - The conductivity of the condensing water continues normal with only a few excursions resulting in high cycles of concentration and low blowdown rates.

- Chilled Water System
  - CNE continues to monitor and test for the presence of bacteria in the system. The continuous dosage of the biocide continues. At this point, the biological growth in the system has been stopped.

#### G. Maintenance and EGF Repairs

CNE continues to report on the numerous routine maintenance and preventive maintenance activities performed on the EGF primary and ancillary equipment. The principle items are discussed herein as they relate to the repair, maintenance or replacement of equipment or devices at the facility and are not considered extraordinary. The cost for these items is included as part of the FOCs.

- All four boilers were tuned in January and again in February after the replacement of the natural gas pressure regulator.
- A tube leak on boiler #2 was repaired in January.
- A Maxon Valve on #1 Boiler was replaced.
- Belts were adjusted on #1 and #11 Cooling Towers
- Repairs were made on several chemical feed lines.
- The gasket on #5 Chiller condenser head was replaced.
- A new flame scanner on #2 Boiler was installed in January.
- The Boiler Master Pressure controller was replaced and the pressure transmitters were all calibrated.
- The motor on condenser water pump #5 was replaced.
- The actuator on #1 chiller condenser water inlet valve was replaced.
- Other minor repairs and maintenance were made during the quarter and are listed in the monthly reports issued by CNE.

#### H. EGF Walk-through

A quarterly Walk-through of the EGF was performed on March 29, 2016, by Kevin Jacobs, P.E. with TEG. This review involved a tour of the facility with the primary points of interest and concern noted herein.

- Some of the housekeeping items noted in the previous walk-through have been repaired or resolved.
- Some of the riser pipes in the cooling towers have been painted, but some repairs remain. CNE has dedicated itself to repaint these riser pipes as the tower basins are repaired and the fill is replaced. They estimate a complete restoration of these components over the next couple of winters.
- The repairs to the water meter boxes along KVB have not been made, but CNE intends on installing a concrete collar around the boxes and lids. This solution is acceptable.

- Cobwebs have reformed in various places throughout the plant and on motor control center #4 located near the boilers; these should be removed. However, progress has been made in removing some of these cobwebs.
- CNE previously installed “No Trespassing” signs at an area on the western wall of the EGF at the instruction of Metro Police so that they could assist in removing unauthorized people from camping in the area under the trees. The unauthorized people have been removed, but this issue has been a recurring problem in warmer months.
- A number of items are being stored on the mezzanine level near the water treatment area. Some of these items are project related and should be installed soon or discarded, as appropriate.

#### **IV. Capital Projects**

The Capital Projects discussed in this section are those projects funded through the issuance of bonds by Metro. Costs for these projects will be paid from funds already appropriated. The statuses of the projects are discussed, and the project cost-to-date and bond balances are also presented.

##### **A. Third Quarter FY16 Open Projects**

The following projects remained open at the end of the Second Quarter FY16.

##### **1. DES033 – Manhole Lid and Ring Replacement/Restoration**

This project relates to the repair and replacement of manhole lids and rings whenever Metro Public Works performs Street re-paving. This project will remain open and on-going.

##### **2. DES090 – Manhole & Tunnel Insulation Repair (Revised from DES060)**

Work associated with this project will be on-going as required.

##### **3. DES104 –NES Time of Use Rates**

CNE is progressing in the development of the programming and procedural changes in order to implement the TOU charges. CNE anticipates the final implementation of the programming changes during the Fourth Quarter FY16 and in time for the customer invoices beginning in FY17.

##### **4. DES110 – EGF Alternative Fuel**

The installation of a second propane tank in the EGF parking lot requires the permanent loss of at least two parking spaces. Since CNE now has a propane acquisition plan and has a program to pre-purchase propane, the DES has elected

to not install a second propane tank or pursue other alternative fuel sources at this time. This project is closed.

5. DES111 – DES Combined Heat and Power

I.C. Thomasson and Associates (ICT) began developing the economic analysis of the proposed CHP project. A meeting between DES, TEG and ICT was held in February to discuss the initial steps and project schedule. A preliminary meeting on the project economics is anticipated in Fourth Quarter.

6. DES112 – Condensate Return Piping Replacement  
at the Cordell Hull Building

Construction was completed on this project during the First Quarter FY16. Once questions related to redline drawing dimensions are answered, this project will be closed.

7. DES119 - Chilled Water System Delta T Issue

The Base Line test for the Hydroflow device was performed by TEG and CNE in March. The unit became operational soon thereafter. The data gathered from the Base Line test will be used to compare to a final test during the Fourth Quarter to determine the effectiveness of the device in improving the performance the chilled water heat exchanger at the Metro Courthouse.

8. DES120 – Manhole B2 Sump Pump Installation

A local developer is constructing a new building along Molloy Street between 1<sup>st</sup> and 2<sup>nd</sup> Avenue. Because of the demolition work which is taking place, and since Manhole B2's manways will be in the sidewalk just outside this new building, the developer agreed to install a buried conduit and a drain line to Manhole B2 to reduce the frequency that CNE will need to visit the manhole to pump out groundwater. The installation of the conduit, drain line and sump pump was completed during the Third Quarter FY16. It is anticipated that this project will be closed out during the Fourth Quarter FY16.

9. DES121 – Miscellaneous Manhole Repairs

Miscellaneous repairs are needed inside several manholes. These repairs include the replacement of several entry ladders, the repair/replacement of some insulation and the removal of a steel ceiling which is beginning to fail. This project involves these repairs.

A pre-bid meeting was conducted, bids were received and an award was made during the Third Quarter FY16. Construction will begin during the Fourth Quarter FY16.

10. DES122 – Manhole 13 Structural Repairs

Through CNE's monthly manhole inspections, it was noted that the degradation of Manhole 13's structural concrete has worsened. TEG reviewed the condition of the manhole with a registered structural engineer and it was determined that repairs were needed within a 6 to 12 month timeframe.

Engineering and design has begun for the needed repairs however it is not anticipated that construction will begin until late summer, early fall for these repairs.

11. DES123 – John Sevier Building Condensate Return Piping Replacement

The State of Tennessee is demolishing the Central Services Building just east of the Capital Building. It was discovered by State personnel that sometime in the past, the condensate return piping from the John Sevier Building had failed and rather than replacing the piping, the condensate discharge was re-routed to the Central Services Building to be combined with the Central Services condensate before it was pumped to the State Tunnel condensate main. The John Sevier Building's condensate return piping now needs to be replaced to allow for the demolition for the Central Services Building.

Design and construction drawings were developed and the project was bid and awarded during the Third Quarter FY16. Construction was also begun during the Third Quarter FY16. It is anticipated that construction will be completed during the Fourth Quarter FY16.

12. DES124 - Criminal Justice Center Redevelopment

DES became aware during the quarter of the intention of Metro to demolish the existing Criminal Justice Center and construct a new facility in its place. The DES will be required to develop a plan to demolish the services entering the property line so that these lines will be out of the way of the building demolition. A new design will also be required to reconnect the services in the future. Demolition is anticipated in the First Quarter FY17. The demolition design will be completed in the Fourth Quarter FY16.

An economic model of the continued costs for DES services as compared to the anticipated costs for self-generation was developed during the quarter and will be shared with the General Services' engineer. This model will be used to validate the savings associated with continued DES service.

13. DES125 – Chilled Water Leak Exploratory Excavation on 1<sup>st</sup> Avenue

The Metro Sewer and Water Department contacted a CNE representative to discuss that green water was draining into the Cumberland River along the western riverbank just south of the Gay Street connector. Upon investigation, CNE determined that this green water was likely chilled water from a chilled water leak. An investigation was started which included the hiring of a leak detection expert to help locate this potential chilled water leak. The leak detection expert used electronic devices to listen to the piping, listen along the piping route and deploy correlation devices to try and locate the source of the leak. In addition, two exploratory excavations were done along 1<sup>st</sup> Avenue at potential leak points. This investigation has been unable to determine the location of this leak.

CNE will continue to monitor the situation. It is anticipated that this project will be closed out during the Fourth Quarter FY16.

14. DES126 – Chilled Water Leak Exploratory Excavation on 3<sup>rd</sup> Avenue

CNE has noted green dye in the bottom of Manhole D Sump in 3<sup>rd</sup> Avenue which is an indication of a chilled water leak. An exploratory excavation(s) will be conducted to try and locate the chilled water leak.

B. Third Quarter FY16 Closed Projects

DES110 and DES117 were closed during the Third Quarter FY16.

C. Capital Projects Budget

The following table summarizes the costs and remaining balance of the DES capital projects based on reported expenditures to date. Open projects or completed projects that require some additional management are shown. Total costs for projects that are closed are shown with a gray highlight. Only the funds currently available are shown.

For FY16, a new bond fund, 49116, was established for the DES to fund DES111 and other future projects. Previous payments from the fund 49109 are expected to be transferred to this bond in the Fourth Quarter.

**Table 5. Capital Projects Expense Summary**

DES Project #	Description	Total Budget	FY16 Spending to Date	Total Spent to Date	Remaining Balance
<b>2010 Bond Projects-49109</b>					
DES070	MH 6 to 23 Cond Line	\$ 20,000	\$ -	\$ 527	\$ 19,473
DES071	Hermitage Hotel Ser Modifications	\$ 20,000	\$ -	\$ 1,119	\$ 18,881
DES119	DES Delta T Issue	\$ 100,000	\$ 53,935	\$ 53,935	\$ 46,065
DES117	Manhole S5 Modifications	\$ 160,000	\$ 180,161	\$ 180,161	\$ (20,161)
Total Closed Projects		\$ 2,323,533	\$ (69,664)	\$ 2,241,470	\$ 82,063
Metro Project Admin		\$ -	\$ -	\$ -	\$ -
Project Man, Development, etc		\$ 22,383	\$ -	\$ -	\$ 22,383
<b>Total 2010 Bond</b>		<b>\$ 2,645,916</b>	<b>\$ 164,432</b>	<b>\$ 2,477,211</b>	<b>\$ 168,705</b>
<b>Customer Connection Fund-49107</b>					
DES104	Time of Use/ Customer Billing	\$ 30,000	\$ 12,807	\$ 19,160	\$ 10,840
DES110	Alternative Fuel Source for EGF	\$ 50,000	\$ 4,229	\$ 23,470	\$ 26,530
DES124	CJC Redevelopment	\$ 300,000	\$ 10,406	\$ 10,406	\$ 289,594
Total Closed Projects		\$ 7,233,827	\$ 1,697	\$ 6,630,778	\$ 603,049
Metro Project Admin		\$ 80,000	\$ 22,105	\$ 79,051	\$ 949
Project Man, Development, etc		\$ 815,173	\$ -	\$ -	\$ 815,173
<b>Customer Connection Fund</b>		<b>\$ 8,509,000</b>	<b>\$ 51,245</b>	<b>\$ 6,762,866</b>	<b>\$ 1,746,134</b>
<b>CHP and EDS Repairs-49116</b>					
DES111	DES CHP	\$ 26,000,000	\$ 89,431	\$ 89,431	\$ 25,910,569
Total Closed Projects		\$ -	\$ -	\$ -	\$ -
Metro Project Admin		\$ -	\$ -	\$ -	\$ -
Project Man, Development, etc		\$ -	\$ -	\$ -	\$ -
<b>CHP and EDS Repairs</b>		<b>\$ 26,000,000</b>	<b>\$ 89,431</b>	<b>\$ 89,431</b>	<b>\$ 25,910,569</b>

## V. Energy Distribution System Repairs, Improvements, PM and Emergencies

Several EDS repairs and improvements were made during the Third Quarter. The principle items for discussion are presented in the following sections.

### A. Repairs and Improvements

Several repairs were made to the EDS and at customer buildings during the quarter. The remaining value of the R&I budget at the end of the current quarter is \$18,318. Table 6 provides a summary of the FY16 expenditures and revenues to date associated with the R&I budget.

**Table 6. Repair and Improvement Expenditure and Revenue Summary**

Description	Date	Tracking #	Vendor	Expenditure	Transfers	Net Market Adjustment	Market Value	Balance
<b>Value at end of FY15</b>						\$ -	\$ 46,884.53	\$ 46,884.53
Reimbursement for Symphony Line Damage	7/29/2015	N/A	N/A	\$ (23,197.62)				
Reimbursement for MCC Line Damage	7/29/2015	N/A	N/A	\$ (31,628.93)				
Reimbursement for MCC Line Damage	7/29/2015	N/A	N/A	\$ (22,294.00)				
CNE June R&I	8/13/2015	DES-1938	CNE	\$ 1,820.59				
DES-107 MH A&B Mech	8/6/2015	DES-2038	TEG	\$ 1,366.75				
DES-112 Cordell Hall	8/6/2015	DES-2038	TEG	\$ 1,565.60				
DES-113 Malley Bridg	8/6/2015	DES-2038	TEG	\$ 85.50				
DES-117 M/H S5 Modification	8/6/2015	DES-2038	TEG	\$ 4,607.90				
DES-118 2015 Steam Outage	8/6/2015	DES-2038	TEG	\$ 1,039.45				
DES-107 MH A&B Mech Rebuild	9/17/2015	DES-2050	TEG	\$ 3,229.50				
DES-112 Cordell Hall Condens	9/17/2015	DES-2050	TEG	\$ 3,214.40				
DES-113 Malloy Bridgestone C	9/17/2015	DES-2050	TEG	\$ 213.75				
DES-117 M/H S5 Modificaton	9/17/2015	DES-2050	TEG	\$ 2,561.15				
DES-118 2015 Steam Outage	9/17/2015	DES-2050	TEG	\$ 156.20				
DES-107 MH M, B & 2	9/30/2015	DES-2060	CNE	\$ 12,766.11				
CNE July R&I	9/30/2015	DES-2061	CNE	\$ 3,027.55				
DES-118 2015 Steam Outage	9/30/2015	DES-2062	CNE	\$ 7,643.86				
DES-118 2015 Steam Outage	9/30/2015	DES-2063	CNE	\$ 105,923.70				
DES-107 MH M, B & 2	9/30/2015	DES-2064	CNE	\$ 28,360.11				
<b>Sub-Total First Quarter</b>				<b>\$ 100,461.57</b>	<b>\$ 70,524.99</b>	<b>\$ -</b>	<b>\$ (29,936.58)</b>	<b>\$ (29,936.58)</b>
DES-107 MH M, B & 2	10/2/2015	DES-2068	TEG	\$ 1,063.40				
DES-109 Indigo Hotel	10/2/2015	DES-2068	TEG	\$ 117.15				
DES-112 Cordell Hull Condensate	10/2/2015	DES-2068	TEG	\$ 2,152.65				
DES-117 M/H S5 Modificaton	10/2/2015	DES-2068	TEG	\$ 7,910.65				
DES-118 2015 Steam Outage	10/2/2015	DES-2068	TEG	\$ 334.60				
DES-107 MH M, B & 2	10/13/2015	DES-2072	TEG	\$ 546.70				
DES-109 Indigo Hotel	10/13/2015	DES-2072	TEG	\$ 312.40				
DES-112 Cordell Hull Condensate	10/13/2015	DES-2072	TEG	\$ 2,310.47				
DES-117 M/H S5 Modificaton	10/13/2015	DES-2072	TEG	\$ 8,610.40				
CNE Aug R&I	10/23/2015	DES-2083	CNE	\$ 5,393.98				
DES-107 MH M, B & 2	11/10/2015	DES-2089	TEG	\$ 195.25				
DES-109 Indigo Hotel	11/10/2015	DES-2089	TEG	\$ 117.15				
DES-112 Cordell Hull Condensate	11/10/2015	DES-2089	TEG	\$ 1,169.45				
DES-117 M/H S5 Modificaton	11/10/2015	DES-2089	TEG	\$ 7,071.35				
DES-112 Cordell Hull Condensate	11/30/2015	DES-2097	CNE	\$ 36,064.80				
CNE Sept R&I	11/30/2015	DES-2094	CNE	\$ 3,720.98				
CNE Oct R&I	12/18/2015	DES-2109	CNE	\$ 481.25				
DES-112 Cordell Hull Condensate	12/18/2015	DES-2110	TEG	\$ 771.55				
DES-117 M/H S5 Modificaton	12/18/2015	DES-2110	TEG	\$ 1,475.95				
<b>Sub-Total Second Quarter</b>				<b>\$ 79,820.13</b>	<b>\$ 70,524.99</b>	<b>\$ -</b>	<b>\$ (9,295.14)</b>	<b>\$ (9,295.14)</b>
DES-112 Cordell Hull Condensate	01/28/16	DES-2226	TEG	\$ 124.55				
DES-117 M/H S5 Modificaton	01/28/16	DES-2226	TEG	\$ 1,632.50				
DES-120 MH B Sump Pump	01/28/16	DES-2226	TEG	\$ 1,117.55				
CNE Nov R&I	01/28/16	DES-2225	CNE	\$ 10,302.69				
DES-112 Cordell Hull Condensate	01/29/16	DES-2231	CNE	\$ 48,387.18				
CES EMR15-006 Manhole 18 Emergency 12/15	01/29/16	DES-2229	CNE	\$ 2,045.76				
CNE Dec R&I	03/04/16	DES-2254	CNE	\$ 5,020.53				
DES-117 M/H S5 Modificaton	03/04/16	DES-2255	TEG	\$ 332.88				
DES-120 MH B Sump Pump	03/04/16	DES-2255	TEG	\$ 132.75				
DES-121 Misc MH Repairs	03/04/16	DES-2255	TEG	\$ 1,052.05				
DES-122 MH-13	03/04/16	DES-2255	TEG	\$ 424.40				
DES-123 Central Services	03/04/16	DES-2255	TEG	\$ 1,992.30				
March 2015 TEG Services	03/18/16	DES-22261	TEG	\$ 1,054.35				
CNE Jan R&I	03/21/16	DES-2264	CNE	\$ 3,108.90				
<b>Sub-Total Third Quarter</b>				<b>\$ 76,728.39</b>	<b>\$ 70,524.99</b>	<b>\$ -</b>	<b>\$ (6,203.40)</b>	<b>\$ (6,203.40)</b>
DES-121 Misc MH Repairs	N/A	N/A	TEG	\$ 1,463.70				
DES-122 MH-13	N/A	N/A	TEG	\$ 160.10				
DES-123 Central Services	N/A	N/A	TEG	\$ 5,015.63				
<b>Sub-Total Fourth Quarter</b>				<b>\$ 6,639.43</b>	<b>\$ 23,508.33</b>	<b>\$ -</b>	<b>\$ 16,868.90</b>	<b>\$ 16,868.90</b>
<b>FY16 Year to Date</b>				<b>\$ 263,649.52</b>	<b>\$ 235,083.30</b>	<b>\$ -</b>	<b>\$ 18,318.31</b>	<b>\$ 18,318.31</b>

## B. Preventive Maintenance

Preventive maintenance, tunnel and manhole inspections and reviews of customers' mechanical rooms were performed during the quarter. The principle items for discussion are presented.



1. EDS Manhole Inspections
  - a. Some traps were found not to be functioning properly; CNE is continuing to repair or replace traps in the system.
  - b. Structural metal in the vaults and tunnels need to be cleaned and painted.
  - c. Spalled concrete needs to be repaired in some manholes.
  - d. Some minor insulation repairs are needed in some vaults.
  - e. Mud and debris needs to be removed from some manholes.
2. Other EDS Inspections
  - a. Minor items are included in the CNE monthly reports.

C. Emergencies

No emergencies were reported during the quarter.

D. EDS Walk-through

The Quarterly EDS walkthrough was conducted in two segments. The first segment was conducted on April 12, 2016 and included a review of the tunnel systems. The second segment was conducted on April 19 and 22, 2016 and included review of Manholes B2, B3, B4, B6, B7, B8, B9, B10, 12, 16A, Viridian, S4A, 22B, C and U. The following comments and observations are a result of these visits:

1. AA Birch Tunnel
  - a. There was an unusual amount of condensation (“sweating”) on the structure ceiling and most components within Manhole D3. More than likely due to the ambient conditions, but CNE should monitor this situation.
  - b. The chilled water vent valves in Manhole D3 need to be insulated to prevent “sweating.” This item should be added to the Manhole Miscellaneous Repairs list with a moderate priority.
  - c. Groundwater is seeping through the sump pump discharge piping wall penetration in Manhole D3. This link seal should be tightened to try and prevent this seepage.
  - d. The entry ladder has some minor corrosion present where two ladder sections were welded together. This corrosion should be cleaned and then the ladder should be painted with cold galvanizing paint.
  - e. The station numbering on the support columns is faded at several locations. These station numbers should be re-marked before they are no longer visible.
  - f. Water seepage exists at Stations 0+07 (?; the station marking is faded badly), 0+85, 02+38 and 03+20. CNE should monitor these locations for degradation and note any new locations.
  - g. The emergency lights at station 02+79 and in Manhole D2 are not working. CNE should repair these as soon as possible.

- h. The light at station 02+79 is not very bright. CNE should investigate and repair/replace as necessary.
- i. There is moderate corrosion present in Manhole D2 on the support members underneath the grating and on the grating. This manhole should be added to the “MH & Tunnel Structural Corrosion Prevention/Repair” with a “moderate” priority.

## 2. State Tunnel

- a. There are several locations, where the concrete tunnel structure has some minor to moderate cracking, spalling, exposed rusty rebar and/or shifting of roof structures. These problems exist at the following locations within the tunnel: W3, W27, W44, W42, W43, W44, W56, W59, W62, W75, N5, N7, N20, N31, N39, N47, N54, N61, N62 and E19, E26, E47, E51, E62, E66 and E69. In addition, the concrete roof at the southern end of the east tunnel is spalling badly and probably requires replacement. It is TEG’s understanding that CNE has met with the State and reviewed these issues and was told that the State’s engineers will review these conditions and make recommendations.
- b. There are several communications inner ducts on the floor in the southern end of the western tunnel leg as a result of work being done by the State. CNE personnel should be careful when they are reviewing the tunnel as these inner ducts could be a trip hazard.
- c. Several of the support C Channels and W shapes that have minor to moderate corrosion. This should be brought to the attention of the State for remediation.
- d. The “spider” portion of the spider guide on the high pressure condensate return piping located at N20 is outside of the guide. The spider portion should be re-positioned inside the guide.
- e. The trap at location E1 is not functioning. CNE needs to repair or replace this trap as soon as possible.
- f. There is a lot of debris at location E1 - E2 that should be removed.
- g. The concrete roof at the southern end of the east tunnel is spalling badly and probably requires replacement. CNE should bring this to the State’s attention.

## 3. 7<sup>th</sup> Avenue Tunnel

- a. Groundwater is present in the 7<sup>th</sup> Avenue entrance to Manhole 23 indicating that the drain is clogged again. CNE should attempt to clear this drain so that the accumulated water will drain.
- b. There is insulation debris on the floor in Manhole 23 from insulation repairs. This insulation debris should be removed from the manhole.
- c. The steel structural supports in Manhole 23 are corroded and need to be cleaned and re-painted and possibly replaced. This manhole should be a moderate rating on the Miscellaneous Manhole repair list.
- d. The northwest corner of the concrete pedestal base of the steam and condensate expansion joints is cracked and loose. TEG will attempt to locate design drawings on this pedestal and speak with a structural engineer regarding any repairs which may be needed.

- e. The strainer upstream of the trap does not have a blowdown valve; CNE should add a blowdown valve to this strainer.
  - f. The concrete around the manway opening is starting to spall. This should be monitored until repairs can be made.
  - g. At location 7-81, the packing on the root isolation valve upstream of the trap is leaking. CNE should repair/replace this valve as needed.
  - h. There is minor corrosion on structural steel location 7-81. This is a “Low” priority on the “MH & Tunnel Structural Corrosion Prevention/Repair”.
  - i. Lights are not working at locations 7-81, 7-30, 7-24, 7-15, 7-11 and 7-2. CNE should repair/replace these lights as soon as possible.
  - j. A steam expansion joint is leaking at location 7-62. CNE should continue to monitor this leak until it can be repaired/sealed.
  - k. At location 7-46, there is an excessive amount of water dripping down from the vertical shaft that houses the Library’s service piping. Upon further investigation inside Manhole 22 (located at the top of this vertical shaft), it was discovered that the manhole eastern concrete wall had be drilled through twice. This created a pathway for groundwater to enter this manhole and flow down the vertical shaft. It is believed that these holes in the eastern manhole wall were created by directional borings by a communications contractor. TEG and CNE are investigating the responsible party.
  - l. The strainer upstream of the trap at location 7-46 does not have a blowdown valve installed because of its position directly above a pipe. CNE should rotate this strainer at a 45 degree angle to permit the installation of a blowdown valve. The blowdown valve piping should turn downward once it is clear of the pipe underneath so that when the valve is opened, the flow is downward.
  - m. The slide/guide at location 7-44 is severely corroded and needs to be replaced. CNE should check all of the piping guides/slides to determine their condition. TEG will coordinate these repairs with CNE.
  - n. The trap is not functioning at location 7-11 (Hume Fogg). CNE needs to repair/replace this trap as soon as possible and add a blowdown valve to the strainer upstream of the trap.
  - o. There is corrosion on the structural piping supports at the Hume Fogg service connection (location 7-11). This area is a “High” priority on the “MH & Tunnel Structural Corrosion Prevention/Repair”.
  - p. The strainer upstream of the trap located at 7-1 does not have a blowdown valve. CNE needs to add a blowdown valve to this strainer.
4. 4<sup>th</sup> Avenue Tunnel
- a. The steam expansion joints at locations 4-45, 4-63 and 4-78 are leaking. CNE needs to continue to monitor these expansion joints until they can be repaired/sealed.
  - b. The emergency lights at locations 4-24 and 4-61 are not working. CNE should repair/replace these lights as soon as possible.

- c. Small portions of rock have broken loose from the tunnel sidewalls at locations 4-56 and 4-87. CNE should continue to monitor these locations for progression of this activity.
  - d. There is an anchor bolt protruding up from the tunnel floor at location 4-61 next to the ladder which accesses the Suntrust vertical shaft. CNE should cut this anchor bolt flush with the tunnel floor to prevent a trip hazard.
  - e. There is a light out in the Suntrust vertical shaft at location 4-61. CNE should repair/replace this light as soon as possible.
  - f. There is a light out at location 4-92. CNE should repair/replace this light as soon as possible.
5. Broadway Tunnel
- a. The slip joint support structure/table at location B-65 is badly corroded. TEG will coordinate with CNE to investigate a repair procedure for this support.
  - b. There are two lights not working in the Bridgestone service piping tunnel. CNE should repair these as soon as possible.
  - c. The steam expansion joint at the southern end of the Bridgestone service tunnel is leaking; TEG/CNE need to investigate if the maintenance of this expansion joint is the City's responsibility. If it is the City's responsibility then CNE needs to continue monitoring this joint until repairs can be made.
  - d. The steam expansion joints at locations B-65 and B-19 are leaking. CNE needs to continue to monitor these expansion joints until they can be repaired/sealed.
  - e. The area at location B-62/B-63 is not very well lit; a light fixture should be installed at this location.
  - f. There is hammering at the trap station at location B-49. Because of the steam main configuration, the trap piping extends from the dripleg at an upward 45 degree angle and then the piping turns horizontally for the trap station. It appears that the trap station horizontal run of piping is physically higher than the "top" of the dripleg which would explain the hammering. This trap piping should be re-routed so that the horizontal trap station piping is below the "top" of the dripleg. This will require a shutdown.
  - g. The trap strainer upstream of the southern trap in Manhole 18 does not have a blowdown valve. CNE needs to install a blowdown valve on this strainer.
  - h. The north side trap in Manhole 18 was initially not working. CNE maintenance personnel were able to get it working during the walkthrough. CNE should continue to monitor this trap and if it continues to malfunction, it should be repaired or replaced.
  - i. There is an old trap and some old piping and debris in Manhole 18. CNE needs to remove this debris, trap and piping from this manhole.
6. Manhole B2
- a. This manhole has recently had an electric sump pump installed, however there was still some standing water in the manhole floor. Per CNE personnel, this is a result of the existing sump not being deep enough to allow the float to drop lower. Therefore, a small amount of water remains in the manhole floor. The

float is positioned as low as it can be in the sump. TEG will investigate alternate level indication options to attempt to remove all water from the manhole floor.

- b. There is some corrosion on the piping supports. These supports should be cleaned and painted to prevent additional corrosion. This vault should be included in the capital project to repair and prevent structural corrosion with a “moderate” rating.
- c. There is some insulation repair needed in this vault; DES-121 is currently underway to address this.
- d. There are some hairline cracks in the walls and ceiling. CNE should monitor these cracks.

#### 7. Manhole B3

- a. There was water present in this vault and it required pumping prior to entry.
- b. There is some corrosion on the piping supports. These supports should be cleaned and painted to prevent additional corrosion. This vault should be included in the capital project to repair and prevent structural corrosion with a “moderate” rating.
- c. There is some minor insulation repair needed in this vault; this vault should be included in the capital project to repair insulation with a “moderate” rating.
- d. There is some minor spalling of a concrete wall where it appears that rebar chairs were placed during the vault’s original construction. These spalled places should be patched. TEG will coordinate with CNE to have this done.
- e. There are several hairline cracks in the ceiling of this vault; these cracks should be monitored.
- f. Recently, a contractor that was conducting directional boring, bored a hole into the eastern ceiling of this manhole. TEG has contact information on the contractor and is in the process of preparing specifications to have this contractor make repairs.
- g. The trap in this manhole was not functioning during the visit. CNE should repair or replace this trap as soon as possible.

#### 8. Manhole B4

- a. There was water present in this vault and it required pumping prior to entry.
- b. There is some corrosion of the structural components in this manhole. This vault should be included in the capital project to repair and prevent structural corrosion with a “moderate” rating.
- c. There is some minor insulation repair needed in this vault; this vault should be included in the capital project to repair insulation with a “moderate” rating.
- d. There are several hairline cracks in the ceiling of this vault; these cracks should be monitored.
- e. The blowdown valve is absent on the strainer upstream of the trap; CNE needs to add this blowdown valve.

9. Manhole B6

- a. There was not any water in this manhole.
- b. There was a lot of dirt in the floor of the manhole; CNE should clean this out using 5 gallon buckets before the accumulation significantly increases.

10. Manhole B7

- a. There was a minor amount of water in this manhole but it did not require pumping.
- b. There is a small accumulation of mud/dirt in this manhole.
- c. The insulation on the sparge tube has fallen off; it appears that it was only held in place with caulking. This insulation should be re-positioned and an aluminum strap installed to keep it in place and then re-caulked.
- d. There is some corrosion at the base of a stanchion which supports the trap piping. This corrosion should be cleaned and the stanchion painted with cold galvanizing paint.
- e. There is some corrosion on the welds on the east end of the support/anchor beam in this manhole. This weld should be cleaned and then painted with cold galvanizing paint.

11. Manhole B8

- a. There was no water in this manhole.
- b. There are some hairline cracks in the ceiling; these should be monitored.
- c. The manway frame has a large “chip” in it; per CNE personnel, C-K Masonry has been made aware of this and the frame will be replaced soon.

12. Manhole B9

- a. There was some water present in this manhole and it required pumping.
- b. There are some hairline cracks in the ceiling of this vault. These cracks should be monitored.

13. Manhole B10

- a. There was some water present in this manhole and it required pumping.
- b. There is some minor corrosion at the base of the stanchion support. This should be cleaned and painted with cold galvanizing paint as soon as possible to prevent further corrosion.
- c. There are some hairline cracks in the ceiling; CNE should monitor these cracks.

14. Viridian Manhole

- a. There was water in the manhole and it required pumping.
- b. No deficiencies to report.

15. Manhole 16A

- a. There is a small amount of corrosion on the shear lugs supporting the chilled water piping in this manhole. Before this corrosion progresses, CNE should clean these shear lugs and apply cold galvanizing paint.

- b. No other deficiencies to report.

16. Manhole 22B

- a. The end can on the steam piping to the Library has corroded and the end plate is partially detached from the can. A plate needs to be rolled to the OD of the end can and welded in place to close the end can. When this is done, a new vent needs to be added to the end can and the existing vent hole plugged. In addition, a drain needs to be added to the end can.
- b. A fiber optic contractor was doing horizontal boring in the area and bored two holes through the east wall of this manhole approximately one foot below the Library service piping. With assistance from CNE, TEG is investigating which contractor caused this damage in order to have them make repairs.
- c. There is an appreciable amount of dirt and debris in the manhole resulting from the borings through the east wall. This dirt should be removed and the manhole cleaned by the contractor that caused the damage.

17. Manhole S4A

- a. There was no water present in this manhole.
- b. There are several cracks in the concrete sidewalk above this manhole; these cracks are probably due to turning traffic driving on the concrete when making turns; the condition of this concrete was reported to Metro Public Works.
- c. There are hairline cracks in the western wall of this manhole. These cracks should be monitored.
- d. The strainer upstream of the trap does not have a blowdown valve. CNE needs to add a blowdown valve to this strainer.

18. Manhole U

- a. There was water present in this manhole.
- b. Apparently one of the manway lids was dislodged at some point and vehicular traffic rode over the open manway, hitting and damaging the access ladder. The lower portion of the ladder was corroded badly. This damaged ladder needs to be removed so there is access to this manhole with a portable ladder.

19. Manhole 12

- a. There was no water present in this manhole.
- b. There is a hairline crack in the ceiling of this manhole; this crack should be monitored.
- c. The steam anchor in this manhole consists of a vertical W shape with a baseplate anchor bolted to the manhole floor. The baseplate originally only had three anchor bolts. Because of corrosion, the baseplate now only has one anchor bolt. There is, however, a kicker welded to the anchor W shape and to the western inner steel manhole wall. While the system is energized, because of this kicker, this anchor should not move. However, if the system needs to be shut down, the anchor could shift. TEG is investigating the required repairs for this anchor.

- d. Corrosion exists at the base of both the steam and condensate anchors. TEG will address this corrosion with the needed repairs to the steam anchor base.

20. Manhole C

- a. There was water present in this manhole and it required pumping before entry.
- b. The link seals on the water line which passes through the vault are leaking slightly. These link seals should be tightened.
- c. There is a small accumulation of mud in the floor of this manhole; because of the limited access hours, and before this accumulation gets much greater, CNE should carry 5 gallon buckets during the next inspection to clean some of this accumulation.

## **VI. Customer Relations**

This section contains descriptions of the marketing efforts made by the DES Team during the quarter. The topics of interactions, meetings and training seminars with the customers are also discussed. There are currently 28 customers, comprised of 41 different buildings, connected to the EDS. Service to each of these buildings continues to prove satisfactory, and the responsiveness to customer issues is handled by CNE in an excellent and professional manner.

### **A. Marketing**

The DES has placed a temporary hold on active marketing at this time due to the uncertainty of the actual steam and chilled water loads on the MCC and due to the higher than normal system temperature differences that may be related to the chilled water chemistry. TEG will continue to monitor this issue and make recommendations to Metro regarding the availability of any additional capacity.

There have been no additional meetings or discussions with the engineers and developers of the re-development of the “old” Convention Center during the quarter. Metro General Services is in the process of redeveloping the Criminal Justice Center (CJC). Demolition of the existing building is anticipated in August 2016 and a new facility will be constructed in its place. The CJC is anticipated to remain a DES customer.

The Wells Fargo building is currently under redevelopment as a hotel. A meeting was held with the engineers and developers for this facility during the quarter. This building is anticipated to remain a DES customer.

### **B. Customer Interaction**

The CNE customer service representative (CSR) continues to respond to customer issues as they arise. Much of the communication involves minor problems with the customers’ heating and cooling systems that are unrelated to DES service. Other more significant issues are summarized herein.



- Due to an unusual increase in the EDS chilled water make-up, CNE contacted several customers and requested that they check their chilled water systems for leaks. The Renaissance Hotel reported a leak on a coil in the West Ballroom of the old Convention Center.
- CNE met with personnel from the Tennessee Tower building to review the proposed location of a new fuel oil storage tank in the Gold Parking Lot. The location is not expected to conflict with the DES lines in the area.
- Shutdowns of the chilled water system were coordinated with affected customers in efforts by CNE to find the sources of the chilled water leaks.
- Several meetings with customers were coordinated between CNE and TEG in order to assist them with trouble shooting issues within their buildings or discuss project work.
- On March 15, hardness was discovered in the condensate return system and began investigating the source. Leaking heat exchangers were discovered at the Renaissance Hotel and Bridgestone Arena. The customers isolated the bad heat exchangers and placed other units in service until repairs could be made.
- Other minor issues and customer interactions are noted in the monthly CNE reports.

## **VII. Recommendations**

Based on the review of the Third Quarter EGF and EDS operations, the following recommendations are made.

- Corroded structural steel within the vaults and tunnels should be cleaned and painted or replaced; TEG will continue to coordinate this effort with CNE.
- Insulation which is absent, or in disrepair, in the vaults should be addressed through either additional capital projects, which include work within these vaults, or through DES090.
- Steam traps which need repair or replacement should be addressed as soon as possible.
- Concrete repairs need to be made in some manholes. TEG will continue to coordinate this effort with CNE.
- Mud and debris needs to be cleaned from some manholes.