



City of Coon Rapids

# Year 1 Measurement & Verification Report

January 2012

FOR THE  
LIFE OF  
YOUR  
BUILDING

# Contents

1. EXECUTIVE SUMMARY
2. ENVIRONMENTAL IMPACT
3. FACILITY IMPROVEMENT MEASURES
  - FIM 5.01- Direct Digital Controls
  - FIM 9.01 – Interior Lighting
  - FIM 9.23 – Exterior Lighting - LED
  - FIM 9.241 – Exterior Lighting - Induction
  - FIM 29.01 – RTU Replacement
4. CONCLUSIONS & RECOMMENDATIONS
5. APPENDICES

# 1. Executive Summary

## BACKGROUND

On August 21, 2009 City of Coon Rapids signed a Detailed Engineering Study Agreement with McKinstry for the purpose of developing a performance contract. A performance contract totaling \$872,750 was signed on March 23, 2010. This report summarizes the as built savings for the implemented systems at City of Coon Rapids. The project has both electric (kW) savings and gas (Therm) savings due to the implemented Facility Improvement Measures (FIMs).

## ENERGY AND COST SAVINGS

The project is achieving utility savings through the implementation of the following FIMs:

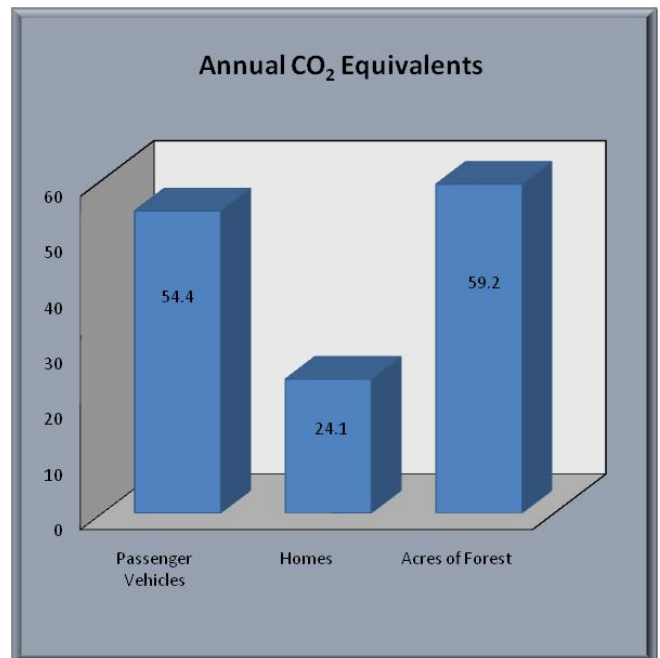
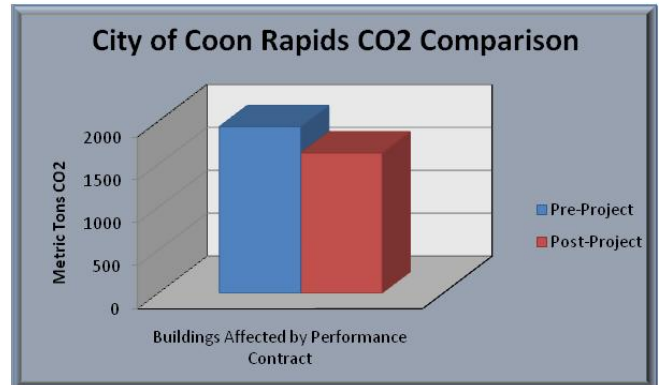
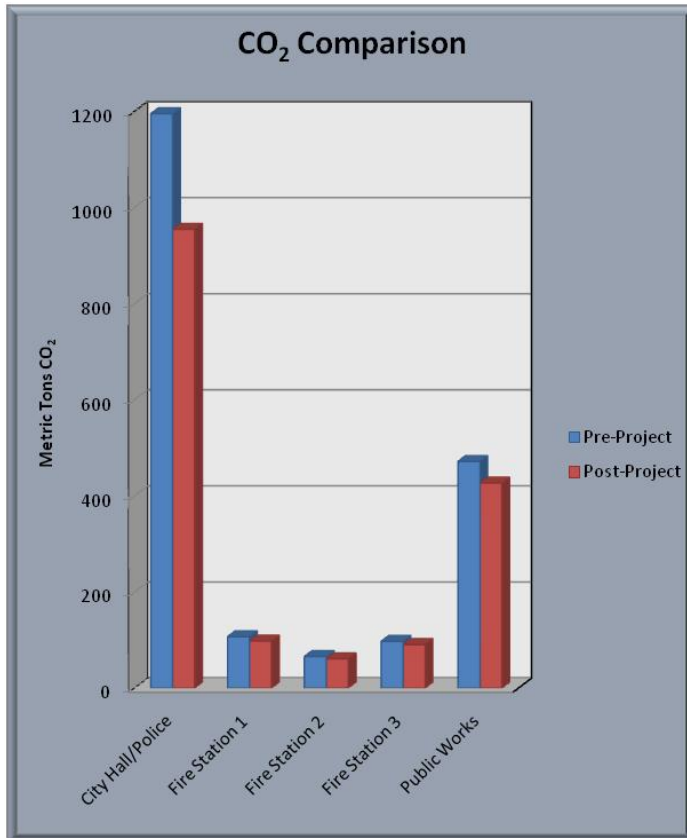
FIM No.	FIM Name	Project Locations	Performance Savings Realized
5.01	DDC Controls	City Hall/Police	\$18,678
9.01	Interior Lighting	Fire Station 1, 2, 3, Public Works	\$14,279
9.23	Exterior Lighting - LED	City Hall/Police	\$2,831
9.24	Exterior Lighting - Induction	Fire Station 1	\$1,176
29.01	RTU Replacement	City Hall/Police	\$6,354
<b>Total</b>			<b>\$43,318</b>

The guaranteed performance savings of \$43,029 was exceeded through the installation of the FIMs. The following table illustrates the performance savings realized to the guaranteed performance savings:

Guaranteed Performance Savings*	\$43,029
Performance Savings Realized	\$43,318
Difference (Excess Savings)	\$289

## 2. Environmental Impact

The first year performance savings of \$43,318 equates to the reduction of both natural gas and electric consumption. The FIMs have a total savings of 12,518 therms, and 352,287 kWh. The savings combine to a 13% reduction in total energy usage for the affected buildings.



*Environmental Impact information is for informational use only.*

By implementing the facility improvement measures, the City is not only saving money, but also helping to protect the environment.

- The City of Coon Rapids lowered its CO<sub>2</sub> production by 306 metric tons.

Please see Appendix A for Supplemental Information

# 3. Facility Improvement Measures

## FIM 5.01 – Direct Digital Controls

### FIM DESCRIPTION

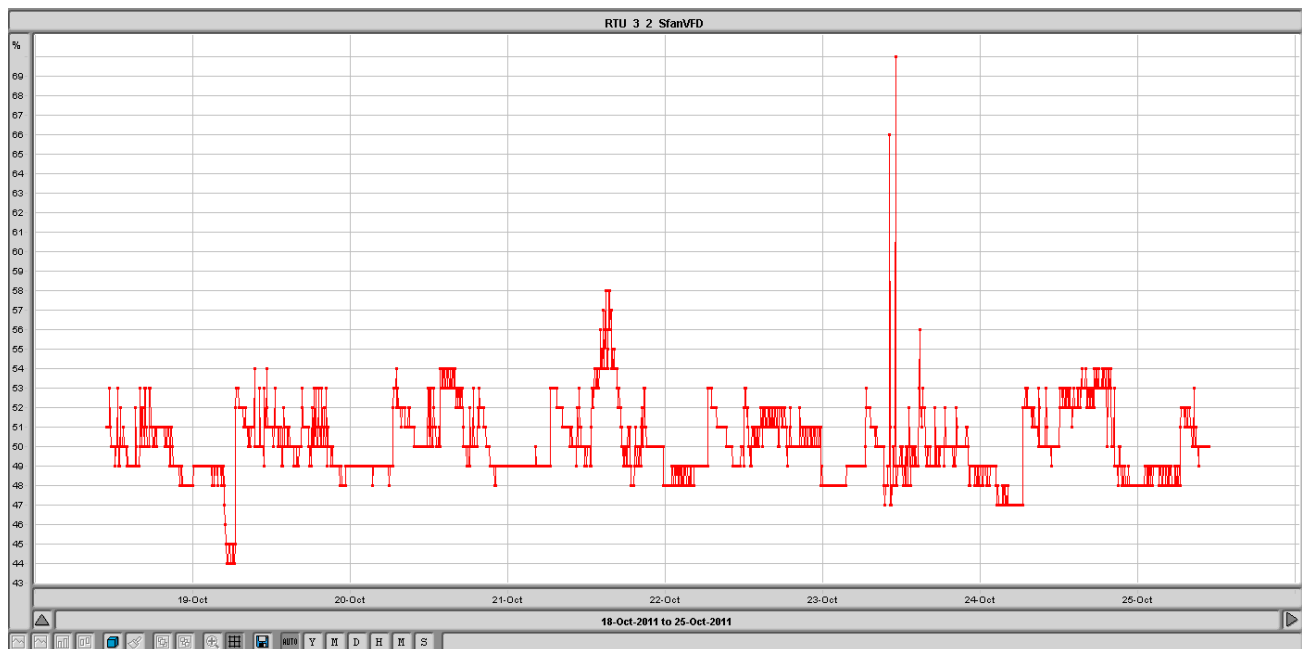
McKinstry upgraded the direct digital control system to give users the flexibility to use the system anywhere via web access. Also included in the FIM were hardware and controls to implement Demand Control Ventilation at City Hall. These implementations saved the City \$18,678, a 14% decrease in annual energy consumption.

### FIM SAVINGS VALIDATION

Annual utility savings as a result of these upgrades were achieved by:

- “Tightening” schedules and temperature set points.
- Adding Demand Control Ventilation (DCV) to the systems

The graph below depicts the variable frequency drive command to AHU 3-2. The command is hovering around 50% for much of the trend. DCV allows the systems to provide spaces with the required amount of fresh air without over ventilating, which generates utility savings.



Please see Appendix B for Additional Supporting Information.

# 3. Facility Improvement Measures

## FIM 9.01 - Interior Lighting Improvements

### FIM DESCRIPTION

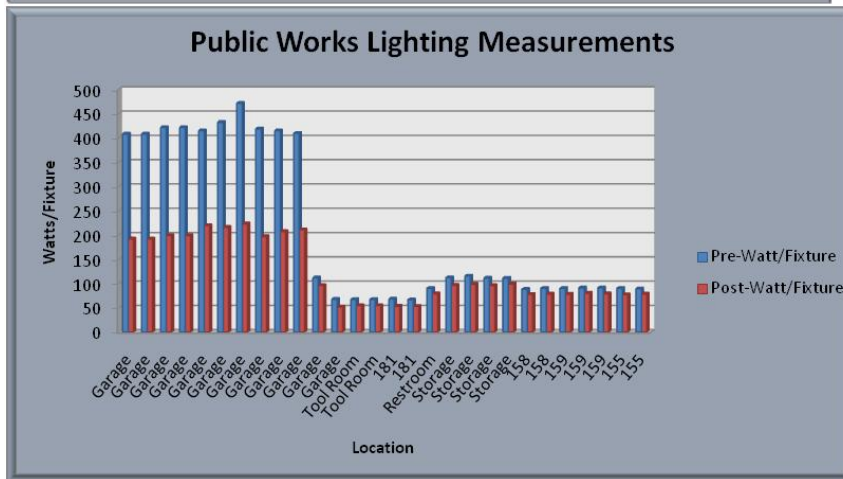
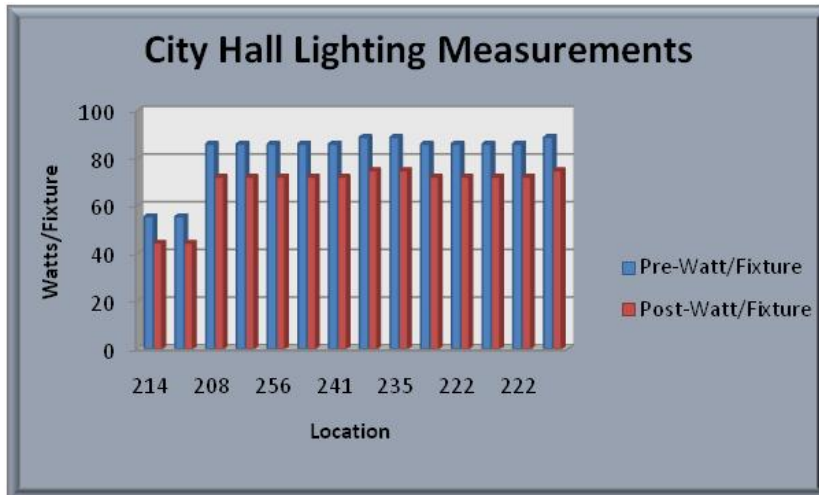
McKinstry implemented Interior Lighting Improvements at City Hall, Fire Station 1, Fire Station 2, Fire Station 3, Police Department, and the Public Works Building. By upgrading the lighting throughout the City, individual spaces have proper light levels for occupants at a lower annual cost. This FIM saves the City \$14,279, or 39% in annual lighting electrical consumption.

### FIM SAVINGS VALIDATION

Annual utility savings as a result of these upgrades were achieved by:

- Retrofitting existing T8 lamps with Sylvania FO28 (28 watt) lamps.
- Replacing 400 watt metal halide lights with 222 watt 6 lamp high bay fixtures.

The following graphs depict the actual pre- and post-watts/fixture measurements taken at City Hall and Public Works Buildings.



Please See Appendix C for Additional Supporting Information.

# 3. Facility Improvement Measures

## FIM 9.23 – Exterior Lighting - LED

### FIM DESCRIPTION

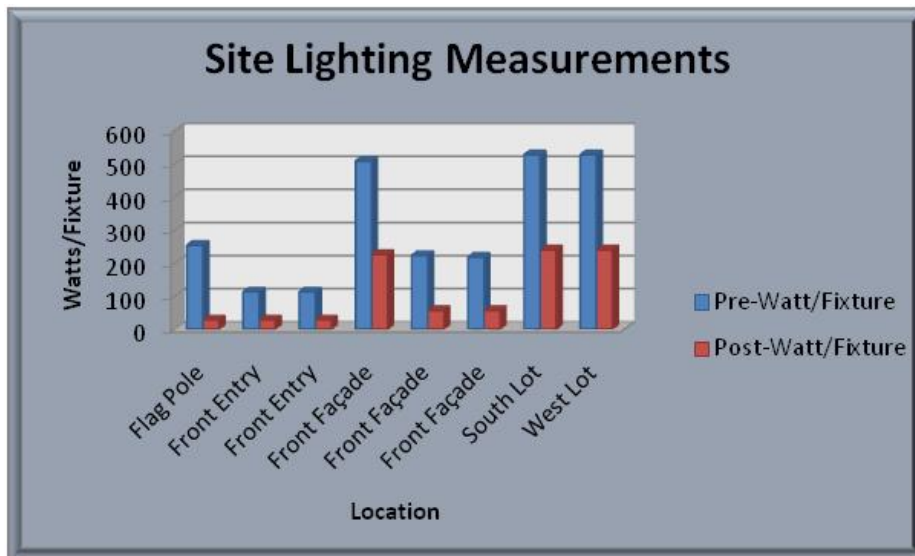
McKinstry implemented Exterior Lighting Improvements throughout the City. The implemented light fixtures provide a higher quality of light while consuming less power than the removed fixtures. Energy savings from this FIM equal \$2,831, or a 51% decrease in annual exterior lighting electrical consumption.

### FIM SAVINGS VALIDATION

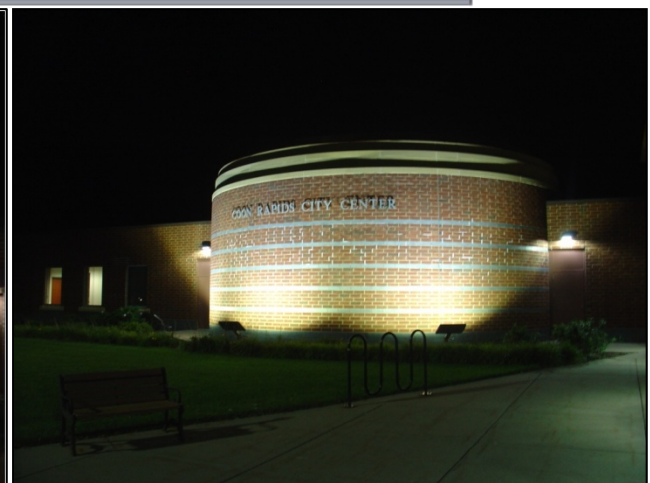
Annual utility savings as a result of these upgrades were achieved by:

- Removing existing Metal Halide light fixtures and replacing them with energy efficient LED fixtures.

The following graph depicts the actual pre- and post-project watts/fixture measurements taken at City Center.



Pre-Project City Center Photo



Post-Project City Center Photo

Please see Appendix D for Supplemental Information

# 3. Facility Improvement Measures

## FIM 9.241 – Exterior Lighting - Induction

### FIM DESCRIPTION

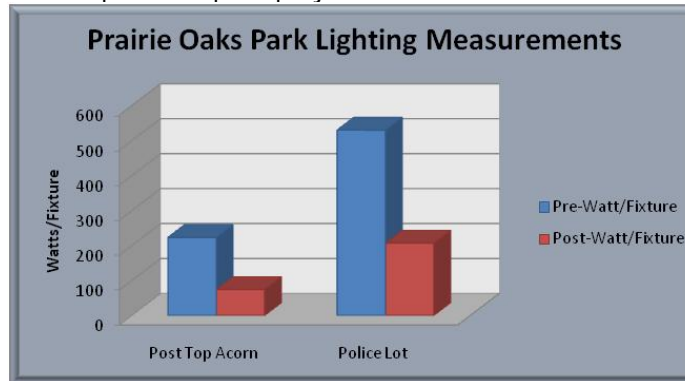
McKinstry implemented a second Exterior Lighting Improvement throughout the City with induction fixtures. The implemented induction light fixtures provide a high quality of light and consume less power than the original fixtures. Energy savings from this FIM equal \$1,176, or a 57% decrease in annual exterior lighting electrical consumption.

### FIM SAVINGS VALIDATION

Annual utility savings as a result of these upgrades were achieved by:

- Removing existing metal halide fixtures and replacing them with new induction fixtures.

The following graph depicts actual pre- and post-project watt/fixture measurements.



*Pre-Project Parking Lot Photo*

*Post-Project Parking Lot Photo*

Please see Appendix E for Additional Supporting Information.



# 3. Facility Improvement Measures

## FIM 29.01 – RTU Replacement

### FIM DESCRIPTION

McKinstry replaced existing rooftop units 3 RTU-2 and 1 RTU-1. The new units help provide a clean and safe environment for space occupants as well as save energy with more efficient components. The RTU Replacements FIM generates \$6,354 in annual energy savings.

### FIM SAVINGS VALIDATION

Annual utility savings as a result of these upgrades were achieved by:

- Replacing 2 (two) existing rooftop units with an Energy Efficiency Ratio (EER) of 8.7 with 2 (two) new rooftop units with an EER of 10.3.



*New Rooftop Unit for City Hall/Police*

Please see Appendix E for Additional Supporting Information.

# 4. Conclusions & Recommendations

## RECOMMENDATIONS

McKinstry recommends the City of Coon Rapids execute the following:

- Continue to “tighten” schedules and temperature set points to ensure spaces are only ventilated when occupied.
  - Revisit the schedules proposed by McKinstry for the DDC FIM:

AIR HANDLING UNIT SCHEDULE					PROPOSED CONDITIONS																															
Building Served	AHU	Area Served	Location	Unit Type*/Misc	WINTER SCHEDULE														SUMMER SCHEDULE																	
					M	M	T	T	W	W	T	T	F	F	S	S	S	S	M	M	T	T	W	W	T	T	F	F	S	S	S	S				
Police	1-RTU-1	Police	Roof	RTU/VAV/RH/VFD/DCV	0:00	23:59	0:00	23:59	0:00	23:59	0:00	23:59	0:00	23:59	0:00	23:59	0:00	23:59	0:00	23:59	0:00	23:59	0:00	23:59	0:00	23:59	0:00	23:59	0:00	23:59	0:00	23:59	0:00	23:59	0:00	23:59
Civic Center	3-RTU-1	Civic Center	Roof	RTU/VAV/RH/VFD/DCV	7:00	22:00	7:00	22:00	7:00	22:00	7:00	22:00	5:00	22:00	9:00	23:59	9:00	23:59	7:00	22:00	7:00	22:00	7:00	22:00	7:00	22:00	5:00	22:00	9:00	0:00	9:00	0:00	9:00	0:00	9:00	0:00
Civic Center	3-RTU-2	Civic Center	Roof	RTU/VAV/RH/VFD/DCV	7:00	22:00	7:00	22:00	7:00	22:00	7:00	22:00	5:00	22:00	9:00	23:59	9:00	23:59	7:00	22:00	7:00	22:00	7:00	22:00	7:00	22:00	5:00	22:00	9:00	0:00	9:00	0:00	9:00	0:00	9:00	0:00
City Hall	2-RTU-1	City Hall	Roof	RTU/VAV/RH/VFD/DCV	7:00	17:00	7:00	17:00	7:00	17:00	7:00	17:00	7:00	17:00	0:00	0:00	0:00	0:00	7:00	17:00	7:00	17:00	7:00	17:00	7:00	17:00	7:00	17:00	7:00	17:00	0:00	0:00	0:00	0:00	0:00	
City Hall	2-RTU-2	City Hall	Roof	RTU/VAV/RH/VFD/DCV	7:00	17:00	7:00	17:00	7:00	17:00	7:00	17:00	7:00	17:00	0:00	0:00	0:00	0:00	7:00	17:00	7:00	17:00	7:00	17:00	7:00	17:00	7:00	17:00	7:00	17:00	0:00	0:00	0:00	0:00	0:00	
City Hall	2-RTU-3	City Hall	Roof	RTU/VAV/RH/VFD/DCV	7:00	17:00	7:00	17:00	7:00	17:00	7:00	17:00	7:00	17:00	0:00	0:00	0:00	0:00	7:00	17:00	7:00	17:00	7:00	17:00	7:00	17:00	7:00	17:00	7:00	17:00	0:00	0:00	0:00	0:00	0:00	

- Continue to utilize the control sequences implemented by McKinstry staff.

The Performance Contract is exceeding the McKinstry guarantee due to the successful help from the following:

- Implemented Facility Improvement Measures.
- Initiatives taken by facility staff to operate buildings efficiently and effectively.

# 5. Appendices

## Appendix A

### ENVIRONMENTAL IMPACT

The following table depicts the actual utility savings and CO<sub>2</sub> savings associated with the performance contract.

Building	Pre Project Annual kWh	Pre Project Annual Therm	Pre CO2 (Metric Tons)	Annual kWh Saved	Annual Therms Saved	Saved CO2	Post Project CO2 (Metric Tons)	Pre Mbtu	Post Mbtu
City Hall/Police	1305960	58845	1195	248,985	12518	234	961	10341741	8240157
Fire Station 1	100160	7580	107	12,899		9	98	1099846	1055823
Fire Station 2	41920	7365	66	7,003		5	61	879573	855672
Fire Station 3	71319	9637	97	9,941		7	91	1207112	1173183
Public Works	401493	38957	472	64,761		45	427	5265996	5044966
	<b>1920852</b>	<b>122384</b>	<b>1937</b>	<b>343588</b>	<b>12518</b>	<b>300</b>	<b>1638</b>	<b>18794268</b>	<b>16369802</b>

All CO<sub>2</sub> production information is from the US Environmental Protection Agency's website located at the following address:

<http://www.epa.gov/cleanenergy/energy-resources/calculator.html>

# 5. Appendices

## Appendix B

### DIRECT DIGITAL CONTROLS IMPROVEMENTS

The following charts depict the proposed and actual schedules found in the DDC system.

AIR HANDLING UNIT SCHEDULE					PROPOSED CONDITIONS																															
Building Served	AHU	Area Served	Location	Unit Type*Misc	WINTER SCHEDULE														SUMMER SCHEDULE																	
					M	M	T	T	W	W	T	T	F	F	S	S	S	S	M	M	T	T	W	W	T	T	F	F	S	S	S	S				
Police	1-RTU-1	Police	Roof	RTU/VAV/RH/VFD/DCV	0:00	23:59	0:00	23:59	0:00	23:59	0:00	23:59	0:00	23:59	0:00	23:59	0:00	23:59	0:00	23:59	0:00	23:59	0:00	23:59	0:00	23:59	0:00	23:59	0:00	23:59	0:00	23:59	0:00	23:59	0:00	23:59
Civic Center	3-RTU-1	Civic Center	Roof	RTU/VAV/RH/VFD/DCV	7:00	22:00	7:00	22:00	7:00	22:00	7:00	22:00	5:00	22:00	9:00	23:59	9:00	23:59	7:00	22:00	7:00	22:00	7:00	22:00	7:00	22:00	7:00	22:00	5:00	22:00	9:00	0:00	9:00	0:00	9:00	0:00
Civic Center	3-RTU-2	Civic Center	Roof	RTU/VAV/RH/VFD/DCV	7:00	22:00	7:00	22:00	7:00	22:00	7:00	22:00	5:00	22:00	9:00	23:59	9:00	23:59	7:00	22:00	7:00	22:00	7:00	22:00	7:00	22:00	7:00	22:00	7:00	22:00	9:00	0:00	9:00	0:00	9:00	0:00
City Hall	2-RTU-1	City Hall	Roof	RTU/VAV/RH/VFD/DCV	7:00	17:00	7:00	17:00	7:00	17:00	7:00	17:00	7:00	17:00	0:00	0:00	0:00	0:00	7:00	17:00	7:00	17:00	7:00	17:00	7:00	17:00	7:00	17:00	7:00	17:00	0:00	0:00	0:00	0:00	0:00	
City Hall	2-RTU-2	City Hall	Roof	RTU/VAV/RH/VFD/DCV	7:00	17:00	7:00	17:00	7:00	17:00	7:00	17:00	7:00	17:00	0:00	0:00	0:00	0:00	7:00	17:00	7:00	17:00	7:00	17:00	7:00	17:00	7:00	17:00	7:00	17:00	0:00	0:00	0:00	0:00	0:00	
City Hall	2-RTU-3	City Hall	Roof	RTU/VAV/RH/VFD/DCV	7:00	17:00	7:00	17:00	7:00	17:00	7:00	17:00	7:00	17:00	0:00	0:00	0:00	0:00	7:00	17:00	7:00	17:00	7:00	17:00	7:00	17:00	7:00	17:00	7:00	17:00	0:00	0:00	0:00	0:00	0:00	

AIR HANDLING UNIT SCHEDULE					From Control System After Substantial Completion																													
Building Served	AHU	Area Served	Location	Unit Type*Misc	WINTER SCHEDULE														SUMMER SCHEDULE															
					M	M	T	T	W	W	T	T	F	F	S	S	S	S	M	M	T	T	W	W	T	T	F	F	S	S	S	S		
Police	1-RTU-1	Police	Roof	RTU/VAV/RH/VFD/DCV	0:00	23:59	0:00	23:59	0:00	23:59	0:00	23:59	0:00	23:59	0:00	23:59	0:00	23:59	0:00	23:59	0:00	23:59	0:00	23:59	0:00	23:59	0:00	23:59	0:00	23:59	0:00	23:59	0:00	23:59
Civic Center	3-RTU-1	Civic Center	Roof	RTU/VAV/RH/VFD/DCV	5:30	22:00	5:30	22:00	5:30	22:00	5:30	22:00	5:30	22:00	5:30	22:00	5:30	22:00	6:30	17:30	6:30	17:30	6:30	17:30	6:30	17:30	6:30	17:30	6:30	17:30	6:30	17:30	6:30	17:30
Civic Center	3-RTU-2	Civic Center	Roof	RTU/VAV/RH/VFD/DCV	4:00	22:15	4:00	20:30	4:00	20:30	4:00	20:30	4:00	20:30	4:00	23:59	4:00	23:59	4:00	22:15	6:30	22:15	6:30	20:30	6:30	20:30	6:30	20:30	6:30	23:59	6:30	23:45	6:30	23:45
City Hall	2-RTU-1	City Hall	Roof	RTU/VAV/RH/VFD/DCV	5:00	18:00	5:00	18:00	5:00	18:00	5:00	18:00	5:00	18:00	5:00	18:00	6:00	18:00	6:00	18:00	6:30	17:30	6:30	17:30	6:30	17:30	6:30	17:30	6:30	17:30	6:30	17:30	6:30	17:30
City Hall	2-RTU-2	City Hall	Roof	RTU/VAV/RH/VFD/DCV	5:00	18:00	5:00	18:00	5:00	18:00	5:00	18:00	5:00	18:00	5:00	18:00	6:00	18:00	6:00	18:00	6:30	17:30	6:30	17:30	6:30	17:30	6:30	17:30	6:30	17:30	6:30	17:30	6:30	17:30
City Hall	2-RTU-3	City Hall	Roof	RTU/VAV/RH/VFD/DCV	5:00	22:00	5:00	22:00	5:00	22:00	5:00	22:00	5:00	22:00	5:00	22:00	6:00	18:00	6:00	18:00	6:30	17:30	6:30	17:30	6:30	17:30	6:30	17:30	6:30	17:30	6:30	17:30	6:30	17:30



# 5. Appendices

The following table depicts the savings associated with the DDC FIM from eQuest, an industry standard building modeling software program.

	Existing (eQuest)			Proposed (eQuest)		
	kW	kWh	Therms	kW	kWh	Therms
Jan	188	80,735	9,180	177	76,177	7,545
Feb	185	72,761	7,537	176	68,532	5,880
Mar	180	78,785	5,516	169	75,714	4,558
Apr	253	95,377	3,749	251	94,218	2,982
May	324	122,916	3,212	308	117,683	2,161
Jun	341	136,496	2,503	319	126,719	1,751
Jul	354	150,691	2,312	328	137,581	1,668
Aug	362	151,453	2,375	334	139,068	1,708
Sep	290	119,681	2,802	282	114,138	1,790
Oct	180	77,161	2,290	180	76,404	2,492
Nov	180	72,462	4,673	168	69,800	3,924
Dec	187	81,173	8,560	178	76,165	6,602
<b>Total</b>	<b>3,025</b>	<b>1,239,691</b>	<b>54,709</b>	<b>2,869</b>	<b>1,172,199</b>	<b>43,061</b>

The following chart is a summary of the savings for the DDC FIM at the City Hall Complex.

## City Hall Complex

	kWh	Unit Cost	Cost	Therms	Unit Cost	Cost	Total Savings
Before	1,239,691	\$0.08	\$99,175	54,709	\$1.14	\$62,368	
After	1,172,199	\$0.08	\$93,776	43,061	\$1.14	\$49,089	
Savings	67492		\$5,399	11648		\$13,279	<b>\$18,678</b>

# 5. Appendices

## Appendix C

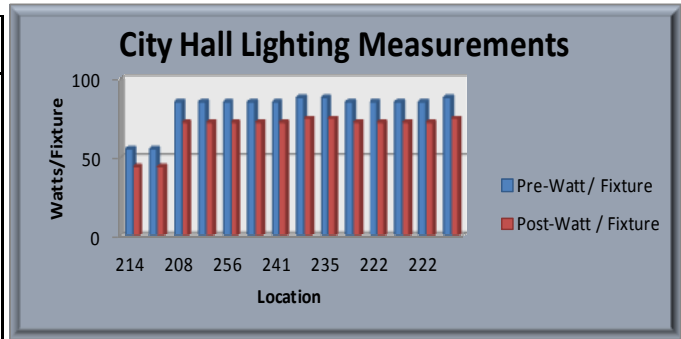
### INTERIOR LIGHTING UPGRADES

The following table depicts that as-built savings validated by the actual pre- and post-watts/fixture measurements.

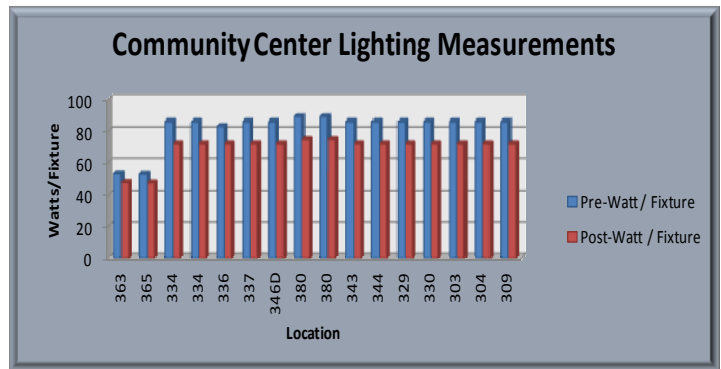
Location	Existing kWh	As-Built kWh	kWh Savings	\$/kWh	\$ Saved	% Savings	Existing kW	As-Built kW	% kW Savings	Pre & Post Measurements
City Hall	146,622.57	91,026.88	55,595.69	0.08	\$4,448	38%	58.64	47.48	19%	17%
Fire Station 1	30394.28	20973.48	9,420.80	0.09	\$848	31%	10.41	9.10	13%	19%
Fire Station 2	23246.12	16243.23	7,002.89	0.09	\$630	30%	7.96	7.09	11%	16%
Fire Station 3	28142.96	18201.97	9,940.99	0.09	\$894	35%	9.64	8.37	13%	15%
Police Dept	67389.04	47001.57	20,387.47	0.08	\$1,631	30%	26.63	23.64	11%	16%
Public Works	130155.74	65394.70	64,761.04	0.09	\$5,828	50%	58.89	36.57	38%	28%
<b>Totals</b>	<b>425,950.71</b>	<b>258,841.82</b>	<b>167,108.89</b>		<b>\$14,279</b>				<b>17%</b>	<b>19%</b>

The following charts depict the actual pre- and post watts/fixture measurements taken at the specific site locations.

Room #	Pre Voltage	Post Voltage	Pre Amp	Post Amp	Pre-Watt / Fixture	Post-Watt / Fixture	% Reduction
214	277	277	0.200	0.16	55	44	20%
214	277	277	0.200	0.16	55	44	20%
208	277	277	0.310	0.26	86	72	16%
211A	277	277	0.310	0.26	86	72	16%
256	277	277	0.310	0.26	86	72	16%
249	277	277	0.310	0.26	86	72	16%
241	277	277	0.310	0.26	86	72	16%
234	277	277	0.320	0.27	89	75	16%
235	277	277	0.320	0.27	89	75	16%
222	277	277	0.310	0.26	86	72	16%
222	277	277	0.310	0.26	86	72	16%
222	277	277	0.310	0.26	86	72	16%
222	277	277	0.310	0.26	86	72	16%
224	277	277	0.320	0.27	89	75	16%

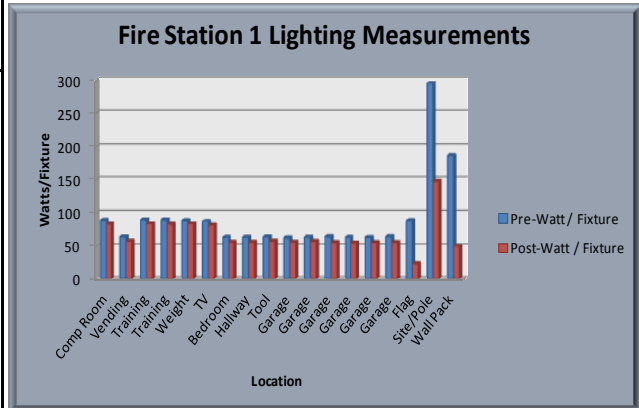


Room #	Pre Voltage	Post Voltage	Pre Amp	Post Amp	Pre-Watt / Fixture	Post-Watt / Fixture	% Reduction
363	278	278	0.190	0.17	53	47	11%
365	277	277	0.190	0.17	53	47	11%
334	277	277	0.310	0.26	86	72	16%
334	277	277	0.310	0.26	86	72	16%
336	277	277	0.300	0.26	83	72	13%
337	277	277	0.310	0.26	86	72	16%
346D	277	277	0.310	0.26	86	72	16%
380	277	277	0.320	0.27	89	75	16%
380	277	277	0.320	0.27	89	75	16%
343	277	277	0.310	0.26	86	72	16%
344	277	277	0.310	0.26	86	72	16%
329	277	277	0.310	0.26	86	72	16%
330	277	277	0.310	0.26	86	72	16%
303	277	277	0.310	0.26	86	72	16%
304	277	277	0.310	0.26	86	72	16%
309	277	277	0.31	0.3	86	72	16%

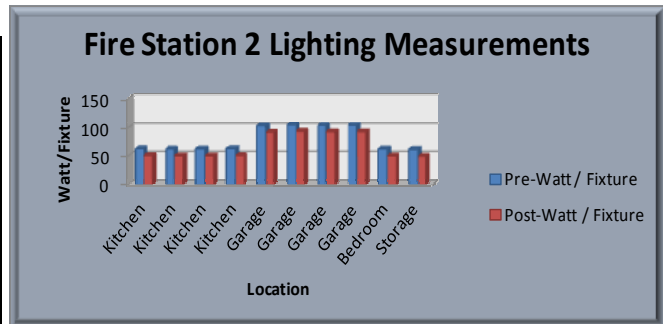


# 5. Appendices

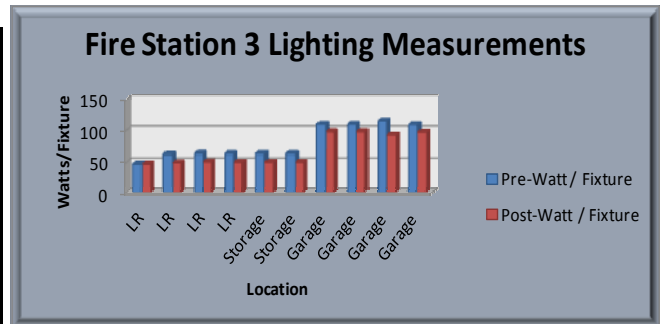
Room #	Pre Voltage	Post Voltage	Pre Amp	Post Amp	Pre-Watt / Fixture	Post-Watt / Fixture	% Reduction
Comp Room	125	125	0.720	0.67	90	84	7%
Vending	125	125	0.520	0.47	65	59	10%
Training	124	124	0.730	0.68	91	84	7%
Training	124	124	0.730	0.67	91	83	8%
Weight	124	124	0.720	0.68	89	84	6%
TV	124	124	0.710	0.66	88	82	7%
Bedroom	124	124	0.520	0.46	64	57	12%
Hallway	124	124	0.520	0.46	64	57	12%
Tool	125	125	0.520	0.47	65	59	10%
Garage	124	124	0.510	0.46	63	57	10%
Garage	124	124	0.520	0.47	64	58	10%
Garage	123	123	0.530	0.46	65	57	13%
Garage	124	124	0.520	0.45	64	56	13%
Garage	123	123	0.520	0.46	64	57	12%
Garage	123	123	0.530	0.46	65	57	13%
Flag	124	124	0.72	0.2	89	25	72%
Site/Pole	123	123	2.400	1.20	295	148	50%
Wall Pack	124	124	1.500	0.41	186	51	73%



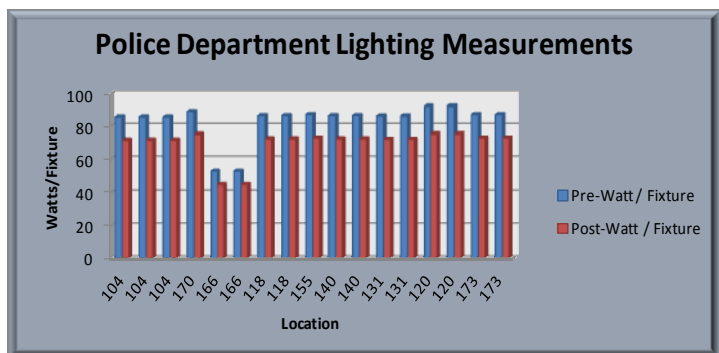
Room #	Pre Voltage	Post Voltage	Pre Amp	Post Amp	Pre-Watt / Fixture	Post-Watt / Fixture	% Reduction
Kitchen	124	124	0.500	0.40	62	50	20%
Kitchen	123	123	0.500	0.40	62	49	20%
Kitchen	123	123	0.500	0.40	62	49	20%
Kitchen	124	124	0.500	0.40	62	50	20%
Garage	114	114	0.900	0.80	103	91	11%
Garage	116	116	0.900	0.80	104	93	11%
Garage	115	115	0.900	0.80	104	92	11%
Garage	115	115	0.900	0.80	104	92	11%
Bedroom	123	123	0.500	0.40	62	49	20%
Storage	121	121	0.500	0.40	61	48	20%



Room #	Pre Voltage	Post Voltage	Pre Amp	Post Amp	Pre-Watt / Fixture	Post-Watt / Fixture	% Reduction
LR	118	118	0.400	0.40	47	47	0%
LR	123	123	0.500	0.40	62	49	20%
LR	126	126	0.500	0.40	63	50	20%
LR	125	125	0.500	0.40	63	50	20%
Storage	125	125	0.500	0.40	63	50	20%
Storage	125	125	0.500	0.40	63	50	20%
Garage	122	122	0.900	0.80	110	98	11%
Garage	122	122	0.900	0.80	110	98	11%
Garage	115	115	1.000	0.80	115	92	20%
Garage	121	121	0.900	0.80	109	97	11%

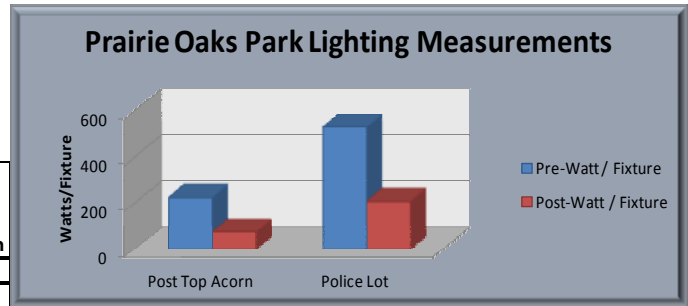


Room #	Pre Voltage	Post Voltage	Pre Amp	Post Amp	Pre-Watt / Fixture	Post-Watt / Fixture	% Reduction
104	277	277	0.310	0.26	86	72	16%
104	277	277	0.310	0.26	86	72	16%
104	277	277	0.310	0.26	86	72	16%
170	279	279	0.320	0.27	89	75	16%
166	280	280	0.190	0.16	53	45	16%
166	280	280	0.190	0.16	53	45	16%
118	280	280	0.310	0.26	87	73	16%
118	280	280	0.310	0.26	87	73	16%
155	282	282	0.310	0.26	87	73	16%
140	280	280	0.310	0.26	87	73	16%
140	280	280	0.310	0.26	87	73	16%
131	279	279	0.310	0.26	86	73	16%
131	279	279	0.310	0.26	86	73	16%
120	280	280	0.330	0.27	92	76	18%
120	280	280	0.330	0.27	92	76	18%
173	282	282	0.31	0.3	87	73	16%
173	282	282	0.310	0.26	87	73	16%

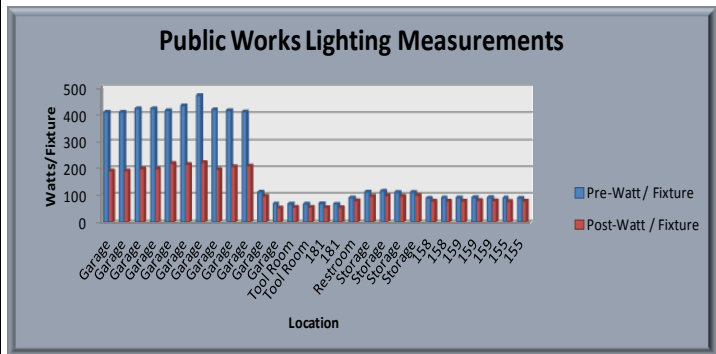


# 5. Appendices

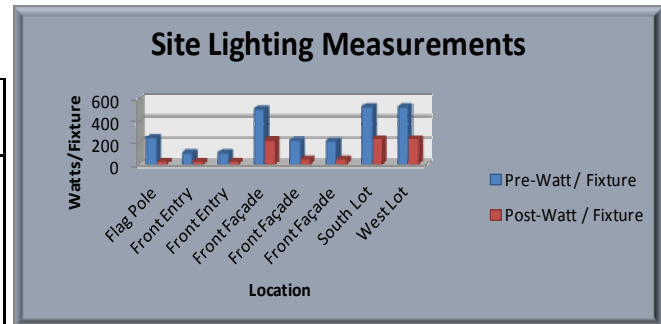
Pre Voltage	Post Voltage	Pre Amp	Post Amp	Pre-Watt / Fixture	Post-Watt / Fixture	% Reduction
124	124	1.800	0.60	223	74	67%
482	482	1.100	0.43	530	207	61%



Room #	Pre Voltage	Post Voltage	Pre Amp	Post Amp	Pre-Watt / Fixture	Post-Watt / Fixture	% Reduction
Garage	120	120	3.400	1.60	408	192	53%
Garage	120	120	3.400	1.60	408	192	53%
Garage	117	117	3.600	1.70	421	199	53%
Garage	117	117	3.600	1.70	421	199	53%
Garage	122	122	3.400	1.80	415	220	47%
Garage	120	120	3.600	1.80	432	216	50%
Garage	124	124	3.800	1.80	471	223	53%
Garage	123	123	3.400	1.60	418	197	53%
Garage	122	122	3.400	1.70	415	207	50%
Garage	124	124	3.300	1.70	409	211	48%
Garage	119	119	0.940	0.81	112	96	14%
Garage	121	121	0.560	0.43	68	52	23%
Tool Room	122	122	0.550	0.45	67	55	18%
Tool Room	122	122	0.550	0.45	67	55	18%
181	122	122	0.560	0.44	68	54	21%
181	121	121	0.55	0.44	67	53	20%
Restroom	122	122	0.740	0.65	90	79	12%
Storage	118	118	0.950	0.82	112	97	14%
Storage	119	119	0.970	0.83	115	99	14%
Storage	116	116	0.960	0.83	111	96	14%
Storage	117	117	0.950	0.85	111	99	11%
158	118	118	0.750	0.66	89	78	12%
158	119	119	0.760	0.66	90	79	13%
159	120	120	0.750	0.65	90	78	13%
159	120	120	0.760	0.67	91	80	12%
159	120	120	0.760	0.66	91	79	13%
155	119	119	0.760	0.65	90	77	14%
155	119	119	0.750	0.66	89	79	12%



Location	Pre Voltage	Post Voltage	Pre Amp	Post Amp	Pre-Watt / Fixture	Post-Watt / Fixture	% Reduction
Flag Pole	282	282	0.900	0.10	254	28	89%
Front Entry	282	282	0.400	0.10	113	28	75%
Front Entry	282	282	0.400	0.10	113	28	75%
Front Façade	282	282	1.800	0.80	508	226	56%
Front Façade	282	282	0.790	0.20	223	56	75%
Front Façade	282	282	0.770	0.20	217	56	74%
South Lot	479	479	1.100	0.50	527	240	55%
West Lot	479	479	1.100	0.50	527	240	55%
Police Lot	482	482	1.100	0.43	530	207	61%





# 5. Appendices

## Appendix D

### EXTERIOR LIGHTING UPGRADES

The following tables depict the as-built savings for the exterior lighting upgrades.

Existing Op/Hrs/Yr	Exist Qty	Existing Description	Exist			Retro Qty	Retrofit Description	Sensor	Sensor Time Off	Retro Op/Hrs/Yr	Retro Watts	Retro kWh	Retro kW	kWh Saved	kW Saved
			Watts	Exist kWh	Exist kW										
Induction Acorn															
4368	11	MH 175 Acorn Light	210	10090	2.31	11	Replacement			4368	85	4084	0.94	6006	1.38
4368	13	MH 100 Bollard	125	7098	1.63	13	22 Watt LED Bollard			4368	22	1249	0.29	5849	1.34
4368	20	MH 100 Wall Pack	125	10920	2.50	20	55 Watt LED Wall Pack			4368	50	4368	1.00	6552	1.50
4368	3	MH 400 Wall Wash	454	5949	1.36	3	257 Watt LED Area Light			4368	230	3014	0.69	2935	0.67
4368	3	MH 175 Pole/Flag Flood	210	2752	0.63	3	24 Watt LED Landscape Spot			4368	24	314	0.07	2437	0.56
4368	11	MH 150 Recessed Can	186	8937	2.05	11	Leave As Is			4368	186	8937	2.05	0	0.00
4368	14	MH 400 Pole/Flag Flood	454	27763	6.36	14	257 Watt LED Area Light			4368	230	14065	3.22	13698	3.14
4368	8	MH 400 Pole/Area Light	454	15865	3.63	8	200 Watt Induction Area Light			4369	205	7165	1.64	8699	1.99
			79284						39113			31471			

Existing Op/Hrs/Yr	Exist Qty	Existing Description	Exist			Retro Qty	Retrofit Description	Sensor	Sensor Time Off	Retro Op/Hrs/Yr	Retro Watts	Retro kWh	Retro kW	kWh Saved	kW Saved			
			Watts	Exist kWh	Exist kW													
4380	3.00	LU70 Decorative Wallpack	86.00	1130.04	0.26	3.00	1 Watt LED Wall Pack			4380	50	657	0.15	473	0.11			
4380	2.00	LU250 Parking Lot	295.00	2584.20	0.59	2.00	1 Watt LED Area Light Type III			4380	138	1209	0.28	1375	0.31			
4380	2.00	MH175 Pole/Flag Flood	210.00	1839.60	0.42	2.00	att LED Landscape Spot			4380	24	210	0.05	1629	0.37			
									212			2076			0.47		3478	

See Appendix C for pre- and post-watts/fixture measurements.

# 5. Appendices

## Appendix E

### RTU REPLACEMENTS

The following table depicts the validated EER of 10.3 from the submittals. The savings are based on improving the efficiency of the RTUs from the EER of 8.7 to EER 10.3.

**Performance Data - Packaged Rooftop, Cooling / Heating Unit**

Tags	3-RTU-2	1-RTU-1
Design airflow (cfm)	13000	12000
ESP (in H2O)	1.75	1.75
Indoor fan speed (rpm)	814	731
Indoor fan brake horsepower (bhp)	12.68	9.45
Indoor fan motor horsepower (hp)	15.00	10.00
Voltage	460/60/3	460/60/3
Cooling EDB (F)	78.00	78.00
Cooling EWB (F)	65.00	65.00
Cooling LDB (F)	58.98	59.71
Cooling LWB (F)	56.32	56.68
Sensible cooling capacity (MBh)	317.48	276.51
Total cooling capacity (MBh)	392.20	342.80
Ambient temp (F)	95.00	95.00
Heating entering air temp (F)	48.00	
Heating leaving air temp (F)	82.00	
Total heating capacity (MBh)	577.98	
Entering water temp (F)	190.00	
Leaving water temp (F)	160.00	
Fluid flow rate (gpm)	38.46	
Coil water pressure drop (in H2O)	0.27	
Ethylene glycol concentration %	0	
EER @ ARI (EER)	10.3	10.3
Minimum circuit ampacity (A)	89.48	78.45
Maximum overcurrent protection (A)	110.00	100.00
Min. unit operating weight (lb)	3820.0	3695.0
Max. unit operating weight (lb)	5480.0	5355.0

# 5. Appendices

## Appendix F

### ACKNOWLEDGEMENT (CUSTOMER COPY)

This letter acknowledges receipt of the Year 1 Measurement and Verification (M&V) Report – City of Coon Rapids for the first full year of energy savings in accordance with the provisions outlined in the ENERGY COST SAVINGS GUARANTEE Section B., 2. of the Performance Contract.

McKinstry Essention	City of Coon Rapids
Signature	Signature
Title	Title
Date	Date

### Continuation of M&V Services

In addition to the acknowledgement, it is understood that continuation of M&V Services will be provided to City of Coon Rapids annually per EXHIBIT 1 - FACILITIES SERVICES AGREEMENT which was made part of the original contract. The cost for the continuation of M&V Services for Year 2 is \$2,400.

McKinstry Essention	City of Coon Rapids
Signature	Signature
Title	Title
Date	Date

### Discontinuation of Renewal

In addition to the acknowledgement, and at the discretion of City of Coon Rapids, an authorized representative of the City may discontinue renewal of M&V Services provided per EXHIBIT 1 – FACILITIES SERVICES AGREEMENT made part of the original contract. Recognizing that per the terms of original contract, the guarantee will be terminated if the Technical Services Agreement is cancelled.

McKinstry Essention	City of Coon Rapids
Signature	Signature
Title	Title
Date	Date

McKinstry will invoice City of Coon Rapids for the continuation of measurement and verification services per EXHIBIT 1 – FACILITIES SERVICES AGREEMENT if City of Coon Rapids fails to provide McKinstry with the signed portion of either Continuation of M&V Services or Discontinuation of Renewal within 30 days of a signed acknowledgement of the receipt of the Measurement and Verification Report.



# 5. Appendices

## Appendix F

### ACKNOWLEDGEMENT (MCKINSTRY COPY)

#### Acknowledgement

This letter acknowledges receipt of the Year 1 Measurement and Verification (M&V) Report – City of Coon Rapids for the first full year of energy savings in accordance with the provisions outlined in the ENERGY COST SAVINGS GUARANTEE Section B., 2. of the Performance Contract.

McKinstry Essention	City of Coon Rapids
Signature	Signature
Title	Title
Date	Date

#### Continuation of M&V Services

In addition to the acknowledgement, it is understood that continuation of M&V Services will be provided to City of Coon Rapids annually per EXHIBIT 1 - FACILITIES SERVICES AGREEMENT (see attached) which was made part of the original contract. The cost for the continuation of M&V Services for Year 2 is \$2,400.

McKinstry Essention	City of Coon Rapids
Signature	Signature
Title	Title
Date	Date

#### Discontinuation of Renewal

In addition to the acknowledgement, and at the discretion of City of Coon Rapids, an authorized representative of the City may discontinue renewal of M&V Services provided per EXHIBIT 1 – FACILITIES SERVICES AGREEMENT made part of the original contract. Recognizing that per the terms of original contract, the guarantee will be terminated if the Technical Services Agreement is cancelled.

McKinstry Essention	City of Coon Rapids
Signature	Signature
Title	Title
Date	Date

McKinstry will invoice City of Coon Rapids for the continuation of measurement and verification services per EXHIBIT 1 – FACILITIES SERVICES AGREEMENT if City of Coon Rapids fails to provide McKinstry with the signed portion of either Continuation of M&V Services or Discontinuation of Renewal within 30 days of a signed acknowledgement of the receipt of the Measurement and Verification Report.

