LEVEL II ENERGY AUDIT

Sacramento City Unified School District
5735 47th Avenue
Sacramento, California 95824

DLR Group
1050 20th Street, Suite 250
Sacramento, California 95811

ZERO NET ENERGY ASHRAE LEVEL II AUDIT

LUTHER BURBANK HIGH SCHOOL

3500 Florin Road

Sacramento, California

PREPARED BY:
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EMG PROJECT #:

136988.19R000-061.268

DATE OF REPORT:

November 20, 2019

ONSITE DATE:

September 30 – October 3, 2019

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Certification

EMG has completed an Energy Audit of Luther Burbank High School located at 3500 Florin Road in Sacramento, California. EMG visited the site on September 30 – October 3, 2019.

The assessment was performed at the Client's request using methods and procedures consistent with ASHRAE Level II Energy Audit and using methods and procedures as outlined in EMG's Proposal.

This report has been prepared for and is exclusively for the use and benefit of the Client identified on the cover page of this report. The purpose for which this report shall be used shall be limited to the use as stated in the contract between the client and EMG.

This report, or any of the information contained therein, is not for the use or benefit of, nor may it be relied upon by any other person or entity, for any purpose without the advance written consent of EMG. Any reuse or distribution without such consent shall be at the client's or recipient's sole risk, without liability to EMG.

Estimated installation costs are based on EMG's experience on similar projects and industry standard cost estimating tools including *RS Means and Whitestone CostLab*. In developing the installed costs, EMG also considered the area correction factors for labor rates for Sacramento, California. Since actual installed costs may vary widely for particular installation based on labor & material rates at time of installation, EMG does not guarantee installed cost estimates and shall in no event be liable should actual installed costs vary from the estimated costs herein. We strongly encourage the owner to confirm these cost estimates independently. EMG does not guarantee the costs savings estimated in this report. EMG shall in no event be liable should the actual energy savings vary from the savings estimated herein.

EMG certifies that EMG has no undisclosed interest in the subject property and that EMG's employment and compensation are not contingent upon the findings or estimated costs to remedy any deficiencies due to deferred maintenance and any noted component or system replacements.

Any questions regarding this report should be directed to Kaustubh Anil Chabukswar at 800.733.0660, ext. 7512.

Prepared by: Galileo Atalig
Energy Auditor
Project Manager

Reviewed by: 

Kaustubh Anil Chabukswar, CEM CRM
Program Manager

1. Executive Summary

The purpose of this Energy Audit is to provide Sacramento City Unified School District and Luther Burbank High School with a baseline of energy usage and the relative energy efficiency of the facility and specific recommendations for Energy Conservation Measures. Information obtained from these analyses may be used to support a future application to an Energy Conservation Program, Federal & Utility grants towards energy conservation, support performance contracting, justify a municipal bond funded improvement program, or as a basis for replacement of equipment or systems.

Bldg #	Structures Assessed	Building Type	EMG Calculated Area (SF)	Estimated Occupancy
1	Building 001W: Administration, Classrooms 201-211	School Building	25,000	150 - 200
2	Building 001E: Classrooms 213-222	School Building	28,800	150 - 200
3	Building 002: Library	School Building	4,500	50 - 100
4	Building 003: Cafeteria	School Building	11,700	10 - 25
5	Building 004: Classrooms B7-10, E9-12	School Building	16,000	150 - 200
6	Building 005: Classrooms F7-12, H7-12	School Building	20,000	150 - 200
7	Building 006:Classrooms B4-6, C4-6	School Building	5,800	150 - 200
8	Building 007: Classrooms D5-7, E5-7	School Building	5,800	150 - 200
9	Building 008: Classrooms F4-6, H4-6	School Building	5,800	150 - 200
10	Building 009: Classrooms B1-3, C1-3	School Building	5,800	150 - 200
11	Building 010: Classrooms D2-4, E2-4	School Building	5,800	150 - 200
12	Building 011: Classrooms F1-3, H1-3	School Building	5,800	150 - 200
13	Building 012: Theater	School Building	23,000	50 - 100
14	Building 013: Classrooms M1-3	School Building	7,500	150 - 200
15	Building 014: Gymnasium	School Building	41,500	200 - 300
16	Building P01: Classrooms J1-5	School Building	4,800	150 - 200
17	Building P02: Farm Shed	School Building	1,900	20 - 50
18	Building P03: Classrooms J6-10	School Building	4,800	150 - 200
19	Building P04: Agriculture	School Building	960	20 - 30
20	Building P05: Classrooms K2	School Building	960	20 - 30

Bldg #	Structures Assessed	Building Type	EMG Calculated Area (SF)	Estimated Occupancy
21	Building P06: Classroom K3	School Building	960	20 - 30
22	Building P07: Classroom K4	School Building	960	20 - 30
23	Building P08: Classroom K5	School Building	960	20 - 30
24	Building P09: Classroom K6	School Building	960	20 - 30
25	Building P10: Classroom K7	School Building	960	20 - 30
26	Building P11: Classroom K8	School Building	960	20 - 30
27	Stadium Building: Concessions and Classroom for Students with Disabilities	School Building	11,200	100 - 150

The study included a review of the building's construction features, historical energy and water consumption and costs, review of the building envelope, HVAC equipment, heat distribution systems, lighting, and the building's operational and maintenance practices.

1.1. Energy Conservation Measures

EMG has identified four Energy Conservation Measures (ECMs) for this property. The savings for each measure is calculated using standard engineering methods followed in the industry, and detailed calculations for ECM are provided in Appendix for reference. A 10% discount in energy savings was applied to account for the interactive effects amongst the ECMs. In addition to the consideration of the interactive effects, EMG has applied a 15% contingency to the implementation costs to account for potential cost overruns during the implementation of the ECMs.

The following table summarizes the recommended ECMs in terms of description, investment cost, energy consumption reduction, and cost savings.

Summary of Financial Information for Recommended Non-Renewable Energy Conservation Measures

ITEM	ESTIMATE
Net Initial ECM Investment *(Current Dollars Only)*	$273,971 *(In Current Dollars)*
Estimated Annual Cost Savings *(Current Dollars Only)*	$35,681 *(In Current Dollars)*
ECM Effective Payback	7.68 years
Estimated Annual Energy Savings	8.95%
Estimated Annual Energy Utility Cost Savings *(Excluding Water)*	9.81%
Estimated Annual Water Cost Saving	2.46%

Solar Photovoltaic (PV) Screening for PROP N

SOLAR ROOFTOP PHOTOVOLTAIC ANALYSIS		
Estimated Number of Panels	947	
Estimated KW Rating	298	KW
Potential Annual kWh Produced	457,604	kWh
% of Current Electricity Uses	26.6%	
FINANCIAL SUMMARY		
Investment Cost	$1,044,400	
Estimated Energy Cost Savings	$59,489	
Payback without Incentives	17.6	Years
Incentive Payback but without SRECs	10.6	Years
Payback with All Incentives	10.6	Years

Key Metrics to Benchmark the Subject Property's Energy Usage Profile

- Building Site Energy Use Intensity - The sum of the total site energy use in thousands of Btu per unit of gross building area. Site energy accounts for all energy consumed at the building location only not the energy consumed during generation and transmission of the energy to the site.
- Building Source Energy Use Intensity – The sum of the total source energy use in thousands of Btu per unit of gross building area. Source energy is the energy consumed during generation and transmission in supplying the energy to your site.
- Building Cost Intensity - This metric is the sum of all energy use costs in dollars per unit of gross building area.
- Greenhouse Gas Emissions - Although there are numerous gases that are classified as contributors to the total for Greenhouse Emissions, the scope of this energy audit focuses on carbon dioxide (CO_2). Carbon dioxide enters the atmosphere through the burning of fossil fuels (oil, natural gas, and coal), solid waste, trees and wood products, and also as a result of other chemical reactions (e.g., manufacture of cement).

SITE ENERGY USE INTENSITY (EUI)	RATING
Current Site Energy Use Intensity (EUI)	33 kBtu/ft^2
Post ECM Site Energy Use Intensity (EUI)	30 kBtu/ft^2
SOURCE ENERGY USE INTENSITY (EUI)	**RATING**
Current Source Energy Use Intensity (EUI)	81 kBtu/ft^2
Post ECM Source Energy Use Intensity (EUI)	73 kBtu/ft^2
BUILDING COST INTENSITY (BCI)	**RATING**
Current Building Cost Intensity	$0.92/ft^2
Post ECM Building Cost Intensity	$0.83/ft^2

Summary of the Greenhouse Gas Reductions from Recommended Non-Renewable Energy Conservation Measures

The following table provides a summary of the projected Greenhouse Gas Emissions reductions as a result of the recommended Energy Conservation Measures:

GREENHOUSE GAS EMISSIONS REDUCTION	
Estimated Annual Thermal Energy Reduction	878 MMbtu
Total CO_2 Emissions Reduced	72.94 $MtCO_2$/Yr
Total Cars Off the Road (Equivalent)*	13
Total Acres of Pine Trees Planted (Equivalent)*	17

**Equivalent reductions per DOE emissions calculation algorithms*

Zero Net Energy Analysis for Renewable and Non-Renewable Recommended Measures

ZERO NET ENERGY ANALYSIS	
Building Annual Net Energy Consumption	9,805,821 kBtu
Total Annual Energy Savings for Non-Renewable Energy Measures	878,066 kBtu
Total Annual Energy Savings from Renewable Energy Measures	1,561,345 kBtu
Total Annual Energy Savings	2,439,411 kBtu
Net Energy Consumption from Grid Post Implementation	7,366,452 kBtu
% Energy Reduction (Annual Energy-Net Energy) / (Annual Energy)	25%

Energy Conservation Measures Screening:

EMG screens ECMs using two financial methodologies. ECMs which are considered financially viable must meet both criteria.

1. Simple Payback Period –The number of years required for the cumulative value of energy or water cost savings less future non-fuel or non-water costs to equal the investment costs of the building energy or water system, without consideration of discount rates. ECMs with a payback period greater than the Expected Useful Life (EUL) of the project are not typically recommended, as the cost of the project will not be recovered during the lifespan of the equipment. These ECMs are recommended for implementation during future system replacement. At that time, replacement may be evaluated based on the premium cost of installing energy efficient equipment.

$$Simple\ Payback = \frac{Initial\ Cost}{Annual\ Savings}$$

2. Savings-to-Investment Ratio (SIR) – The savings-to-investment ratio is the ratio of the present value savings to the present value costs of an energy or water conservation measure. The numerator of the ratio is the present value over the estimated useful life (EUL) of net savings in energy or water and non-fuel or non-water operation and maintenance costs attributable to the proposed energy or water conservation measure. The denominator of the ratio is the present value of the net increase in investment and replacement costs less salvage value attributable to the proposed energy or water conservation measure. It is recommended that energy efficiency recommendations should be based on a calculated SIR, with larger SIRs receiving a higher priority. A project is typically only recommended if SIR is greater than or equal to 1.0, unless other factors outweigh the financial benefit.

$$SIR = \frac{Present\ Value\ (Annual\ Savings, i\%, EUL)}{Initial\ Cost}$$

List of Recommended Energy Conservation Measures For Luther Burbank High School

ECM #	Description of ECM	Projected Initial Investment	Estimated Annual Energy Savings		Estimated Annual Water Savings	Estimated Cost Savings	Estimated Annual O&M Savings	Total Estimated Annual Cost Savings	Simple Payback	S.I.R.	Life Cycle Savings	Expected Useful Life (EUL)
			Natural Gas	Electricity								
		$	Therms	kWh	kgal	$	$	$	Years		$	Years
No/Low Cost Recommendations												
1	Install Low Flow Faucet Aerators Location: Throughout Building	$990	2,979	0	378	$4,973	$0	$4,973	0.20	42.84	$41,432	10.00
2	Insulate Hot Water Pipes Location: Utility Closets	$287	0	3,125	0	$412	$0	$412	0.70	17.13	$4,632	15.00
Totals for No/Low Cost Items		**$1,277**	**2,979**	**3,125**	**378**	**$5,385**	**$0**	**$5,385**	**0.24**			
Capital Cost Recommendations												
1	Upgrade Building Lighting to LED and Install Automatic Lighting Controls Location: Building Interior And Exterior	$235,037	0	190,432	0	$25,111	$8,480	$33,591	7.00	1.71	$165,972	15.00
2	Replace Existing Refrigerator(s) With Energy Star Certified Refrigerator(s) Location: Throughout	$1,921	0	5,072	0	$669	$0	$669	2.87	4.16	$6,063	15.00
Total For Capital Cost		**$236,958**	**0**	**195,504**	**0**	**$25,780**	**$8,480**	**$34,260**	**6.92**			
	Interactive Savings Discount @ 10%		-298	-19,863	-38	-$3,117	-$848	-$3,965				
	Total Contingency Expenses @ 15%	$35,735										
Total for Improvements		**$273,971**	**2,681**	**178,766**	**340**	**$28,049**	**$7,632**	**$35,681**	**7.68**			

In addition to the above measures, EMG has identified the following measure(s) but has not recommended as they fail to meet the above-mentioned financial criteria of SIR>1.0. Thus, EMG has classified the measure(s) as recommended for consideration.

List of Recommended For Consideration Energy Conservation Measures For Luther Burbank High School

ECM #	Description of ECM	Initial Investment	Annual Energy Savings		Annual Water Savings	Cost Savings	Estimated Annual O&M Savings	Total Estimated Annual Cost Savings	Payback	S.I.R.	Life Cycle Savings	Expected Useful Life (EUL)
		$	Natural Gas	Electricity	kgal	$	$	$	Years		$	Years
1	Install Low Flow Tankless Restroom Fixtures Location: Throughout	$91,757	0	0	1,238	$5,205	$0	$5,205	17.63	0.68	-$29,626	15.00
2	Replace Existing Water Heater With New Energy Efficient Units Location: Utility Closet J001	$24,359	-551	18,240	0	$1,779	$0	$1,779	13.69	1.00	$115	18.00
Total for Improvements		**$116,116**	**-551**	**18,240**	**1,238**	**$6,984**	**$0**	**$6,984**	**16.63**			

2. Introduction

The purpose of this Energy Audit is to provide Luther Burbank High School and Sacramento City Unified School District with a baseline of energy usage, the relative energy efficiency of the facility, and specific recommendations for Energy Conservation Measures. Information obtained from these analyses may be used to support a future application to an Energy Conservation Program, Federal and Utility grants towards energy conservation, as well as support performance contracting, justify a municipal bond-funded improvement program, or as a basis for replacement of equipment or systems.

The energy audit consisted of an onsite visual assessment to determine current conditions, itemize the energy consuming equipment (i.e. Boilers, Make-Up Air Units, DWH equipment); review lighting systems both exterior and interior; and review efficiency of all such equipment. The study also included interviews and consultation with operational and maintenance personnel. The following is a summary of the tasks and reporting that make up the Energy Audit portion of the report.

The following is a summary of the tasks and reporting that make up the Energy Audit portion of the report.

ENERGY AND WATER USING EQUIPMENT

- EMG has surveyed the common areas, office areas, rooms, maintenance facilities and mechanical rooms to document utility-related equipment, including heating systems, cooling systems, air handling systems and lighting systems.

BUILDING ENVELOPE

- EMG has reviewed the characteristics and conditions of the building envelope, checking insulation values and conditions. This review also includes an inspection of the condition of walls, windows, doors, roof areas, insulation and special use areas

RECOMMENDATIONS FOR ENERGY SAVINGS OPPORTUNITIES

- Based on the information gathered during the on site assessment, the utility rates, as well as recent consumption data and engineering analysis, EMG has identified opportunities to save energy and provide probable construction costs, projected energy/utility savings and provide a simple payback analysis.

ANALYSIS OF ENERGY CONSUMPTION

- Based on the information gathered during the on-site assessment, EMG has conducted an analysis of the energy usage of all equipment, and identified which equipment is using the most energy and what equipment upgrades may be necessary. As a result, equipment upgrades, or replacements are identified that may provide a reasonable return on the investment and improve maintenance reliability.

ENERGY AUDIT PROCESS

- Interviewing staff and review plans and past upgrades
- Performing an energy audit for each use type
- Performing a preliminary evaluation of the utility system
- Analyzing findings, utilizing ECM cost-benefit worksheets
- Making preliminary recommendations for system energy improvements and measures
- Estimating initial cost and changes in operating and maintenance costs based on implementation of energy efficiency measures
- Ranking recommended cost measures, based on the criticality of the project and the largest payback

REPORTING

The EMG Energy Audit Report includes:

- A comprehensive study identifying all applicable Energy Conservation Measures (ECMs) and priorities, based on initial cost and payback
- A narrative discussion of building systems/components considered and a discussion of energy improvement options;
- A summary of ECMs including initial costs and simple paybacks, based on current utility rates and expected annual savings.

3. Facility Overview and Existing Conditions

3.1. Building Occupancy and Point of Contact

FACILITY SCHEDULE	
Hours of Operations / Week	40
Operational Weeks / Year	38
Estimated Facility Occupancy	1835
% of Male Occupants	918

POINT OF CONTACT	
Point of Contact Name	Anthony Brown
Point of Contact Title	Plant Manager
Point of Contact – Contact Number	9165192787

3.2. Building Heating, Ventilating and Air-Conditioning (HVAC)

Description:

The school is heated and cooled by rooftop and wall-mounted package units. Buildings 001W, 001E, and 012 have additional ventilation from air handlers, fed by a boilers, chillers, and cooling tower located in building 012. The Mechanical Equipment Schedule in Appendix E contains a summary of the HVAC Equipment at the property.

BUILDING CENTRAL HEATING SYSTEM	
Primary Heating System	Heatpump System
Secondary Heating System	Boilers
Hydronic Distribution System	2
Primary Heating Fuel	Natural Gas
Heating Mode Set-point	69 °F
Heating Mode- Set-back Temperature	53 °F

BUILDING COOLING SYSTEM	
Primary Cooling System	Package Units

Secondary Cooling System	Package Units
Hydronic Distribution System	Chillers Split Systems
Cooling Mode Set-point	68°F
Cooling Mode- Set-back Temperature	93 °F

AIR DISTRIBUTION SYSTEM	
Building Ventilation	Roof Top Exhaust Fans Central AHU
On-Demand Ventilation System in Use?	No
Energy Recovery Wheel / Enthalpy Wheel Exhaust Fans	No

DOMESTIC HOT WATER SYSTEM	
Primary Domestic Water Fuel	Natural Gas

3.3. Lighting

Description:

The lighting in the school building primarily consists of T8 linear fluorescent lamp fixtures in classrooms and hallways. The fixtures were observed to be operating on bi-level mode in the classrooms. The exterior lights were primarily High Intensity Discharge (HID) fixtures.

The detailed lighting schedule and the proposed LED alternative is provided in Appendix D

4. Utility Analysis

Establishing the energy baseline begins with an analysis of the utility cost and consumption of the building. Utilizing the historical energy data and local weather information, we evaluate the existing utility consumption and assign it to the various end-uses throughout the buildings. The Historical Data Analysis breaks down utilities by consumption, cost and annual profile.

This data is analyzed, using standard engineering assumptions and practices. The analysis serves the following functions:

- Allows our engineers to benchmark the energy and water consumption of the facilities against consumption of efficient buildings of similar construction, use and occupancy.
- Generates the historical and current unit costs for energy and water
- Provides an indication of how well changes in energy consumption correlate to changes in weather.
- Reveals potential opportunities for energy consumption and/or cost reduction. For example, the analysis may indicate that there is excessive, simultaneous heating and cooling, which may mean that there is an opportunity to improve the control of the heating and cooling systems.

By performing this analysis and leveraging our experience, our engineers prioritize buildings and pinpoint systems for additional investigation during the site visit, thereby maximizing the benefit of their time spent on-site and minimizing time and effort by the customer's personnel.

Based upon the utility information provided about the Sacramento City Unified School District, the following energy rates are utilized in determining existing and proposed energy costs.

Utility Rates used for Cost Analysis

ELECTRICITY (BLENDED RATE)	NATURAL GAS	WATER / SEWER
$0.13/kWh	$1.14/therm	$4.20/kGal

The data analyzed provides the following information: 1) breakdown of utilities by consumption, 2) cost and annual profile, 3) baseline consumption in terms of energy/utility at the facility, 4) the Energy Use Index, or Btu/sq ft, and cost/sq ft. For multiple water meters, the utility data is combined to illustrate annual consumption for each utility type.

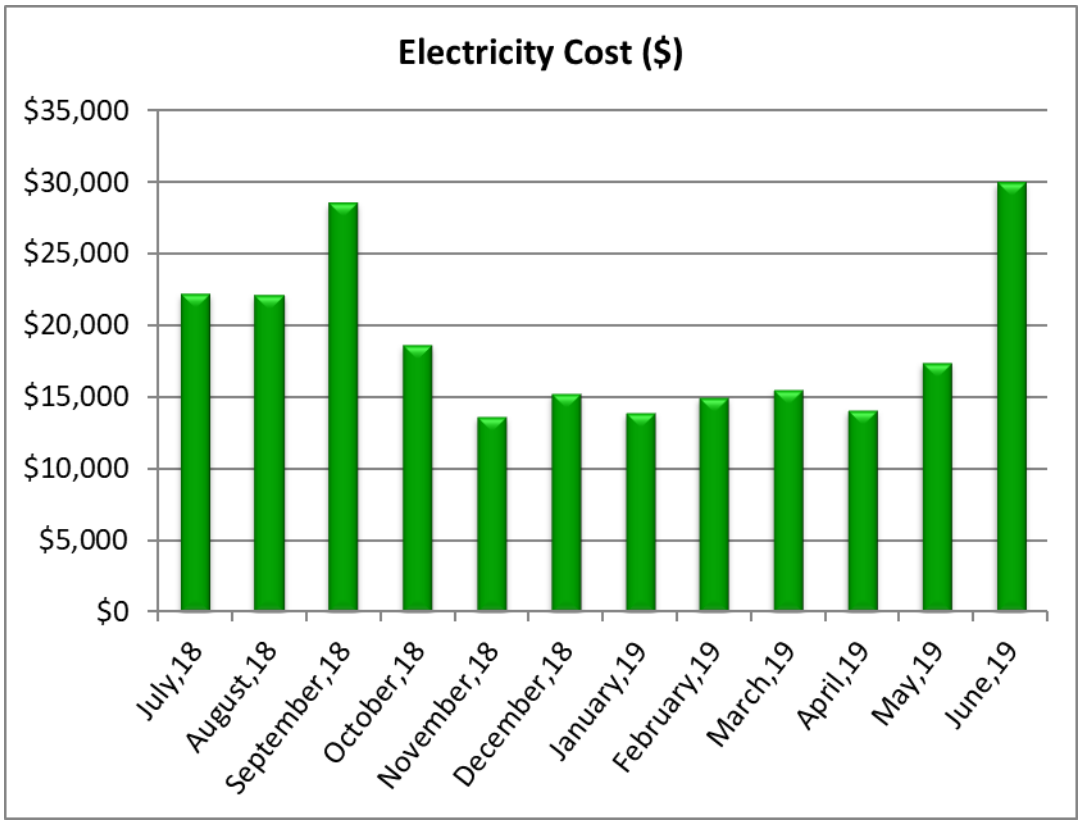
4.1. Electricity

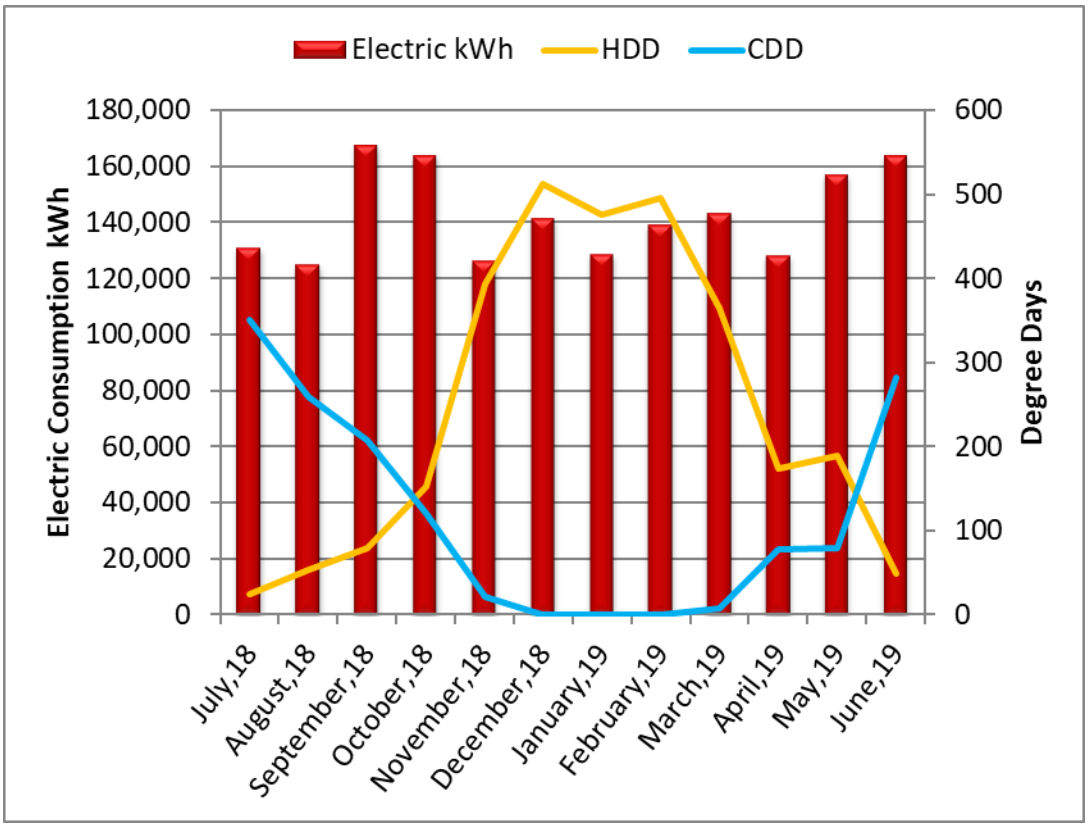
PGE satisfies the electricity requirements for the facility. The primary end uses for electric utility compromises of lighting, cooling, office/school equipment, and appliances in the break room.

The table below provides the electric use for the period of twelve continuous months.

Electric Consumption and Cost Data

BILLING MONTH	CONSUMPTION (KWH)	UNIT COST/KWH	TOTAL COST
July,18	131,215	$0.17	$22,222
August,18	125,173	$0.18	$22,176
September,18	167,620	$0.17	$28,577
October,18	164,218	$0.11	$18,688
November,18	126,687	$0.11	$13,649
December,18	141,679	$0.11	$15,267
January,19	128,565	$0.11	$13,882
February,19	139,495	$0.11	$14,946
March,19	143,458	$0.11	$15,564
April,19	128,188	$0.11	$14,067
May,19	157,175	$0.11	$17,406
June,19	164,188	$0.18	$30,054
Total/average	**1,717,662**	**$0.13**	**$226,498**


Electricity Cost ($)
$35,000
$30,000
$25,000
$20,000
$15,000
$10,000
$5,000
$0
July,18
August,18
September,18
October,18
November,18
December,18
January,19
February,19
March,19
April,19
May,19
June,19


Electric kWh
HDD
CDD
Electric Consumption kWh
180,000
160,000
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
Degree Days
600
500
400
300
200
100
0
July,18
August,18
September,18
October,18
November,18
December,18
January,19
February,19
March,19
April,19
May,19
June,19

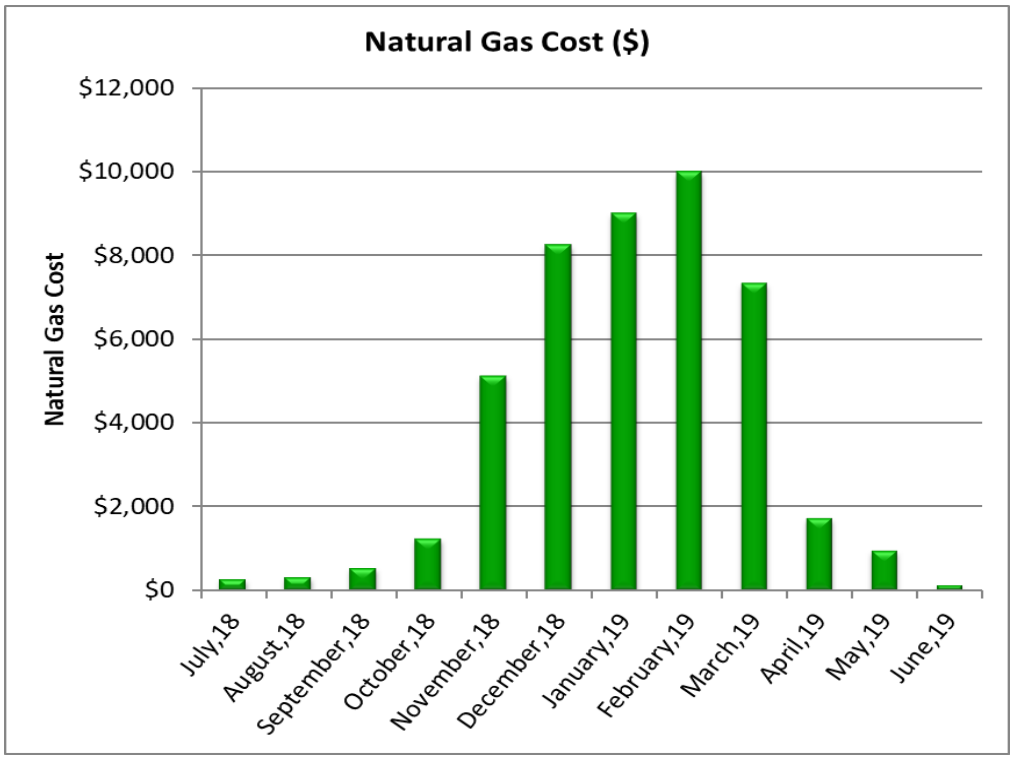
4.2. Natural Gas

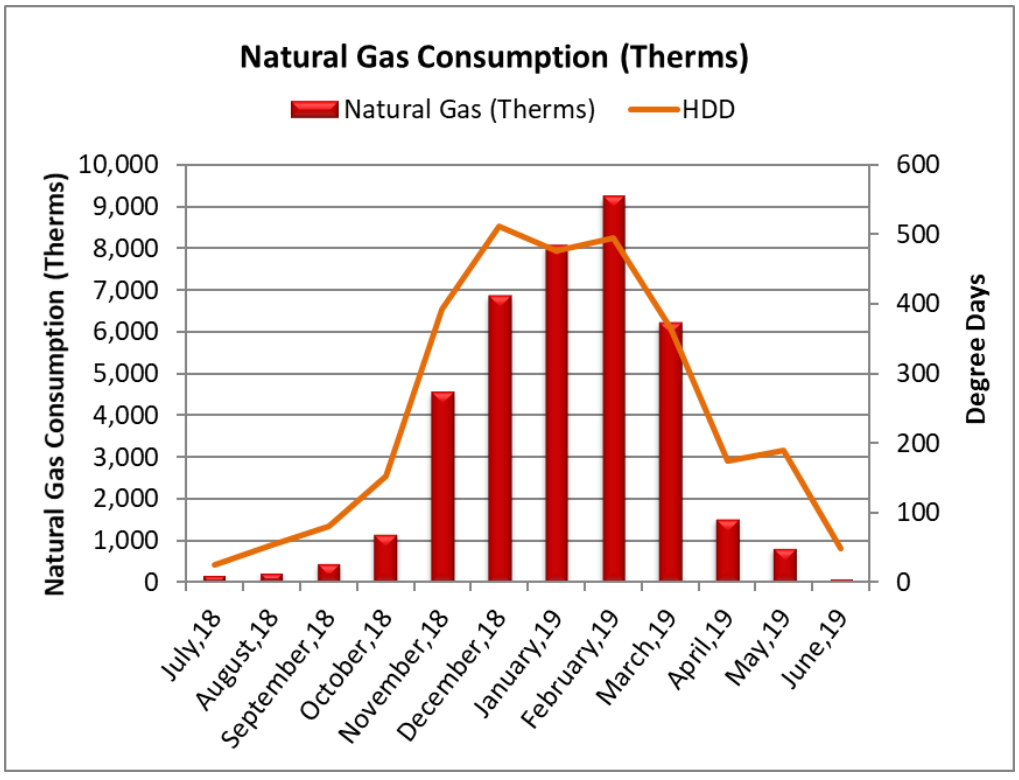
Spurr Gas satisfies the natural gas requirements of the facility. The primary end use of natural gas is for building heating, domestic water heating, and cooking in the cafeteria.

The analysis of the 12 months of consumption is provided below.

Natural Gas Consumption and Cost Data

BILLING MONTH	CONSUMPTION (THERMS)	UNIT COST/THERM	TOTAL COST
July,18	183	$1.41	$257
August,18	234	$1.33	$311
September,18	455	$1.14	$517
October,18	1,159	$1.07	$1,237
November,18	4,562	$1.12	$5,116
December,18	6,876	$1.20	$8,254
January,19	8,081	$1.11	$9,008
February,19	9,250	$1.08	$10,006
March,19	6,231	$1.18	$7,325
April,19	1,512	$1.14	$1,719
May,19	809	$1.15	$933
June,19	100	$1.17	$117
Total/average	**39,452**	**$1.14**	**$44,800**


Natural Gas Cost ($)
Natural Gas Cost
$12,000
$10,000
$8,000
$6,000
$4,000
$2,000
$0
July,18
August,18
September,18
October,18
November,18
December,18
January,19
February,19
March,19
April,19
May,19
June,19

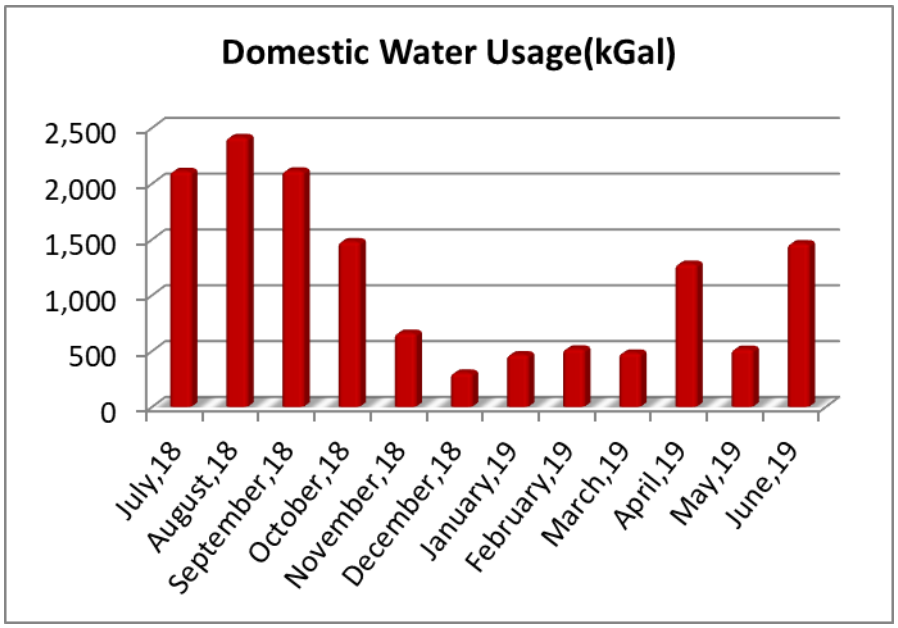

Natural Gas Consumption (Therms)
Natural Gas (Therms)
HDD
Natural Gas Consumption (Therms)
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
600
500
400
300
200
100
0
Degree Days
July,18
August,18
September,18
October,18
November,18
December,18
January,19
February,19
March,19
April,19
May,19
June,19

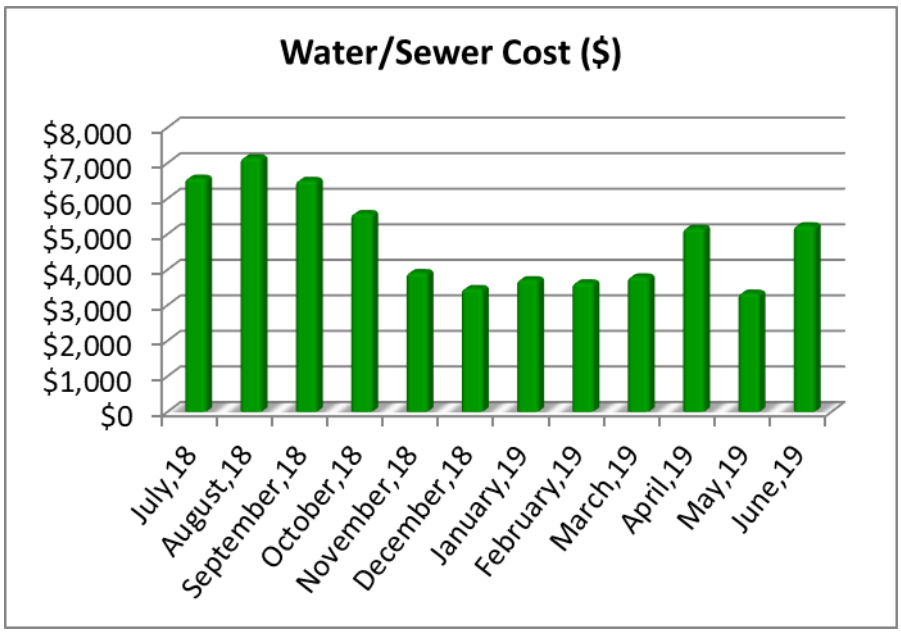
4.3. Water and Sewer

The City of Sacramento satisfies the water requirements for the facility. The primary end use of water is the plumbing fixtures such as staff showers, water closets, and lavatories. The table below provides the twelve continuous months' worth of consumption and cost for water in kGal for the facility.

Water and Sewer Consumption and Cost Data

BILLING MONTH	CONSUMPTION (KGAL)	UNIT COST/KGAL	TOTAL COST
July,18	2,111	$4.20	$6,578
August,18	2,415	$2.96	$7,151
September,18	2,115	$3.08	$6,515
October,18	1,482	$3.77	$5,583
November,18	662	$5.93	$3,922
December,18	305	$11.39	$3,474
January,19	469	$7.94	$3,723
February,19	521	$6.98	$3,635
March,19	484	$7.85	$3,800
April,19	1,281	$4.04	$5,170
May,19	519	$6.45	$3,346
June,19	1,464	$3.58	$5,240
Total/average	**13,827**	**$4.20**	**$58,137**


Domestic Water Usage(kGal)
2,500
2,000
1,500
1,000
500
0
July,18
August,18
September,18
October,18
November,18
December,18
January,19
February,19
March,19
April,19
May,19
June,19


Water/Sewer Cost ($)
$8,000
$7,000
$6,000
$5,000
$4,000
$3,000
$2,000
$1,000
$0
July,18
August,18
September,18
October,18
November,18
December,18
January,19
February,19
March,19
April,19
May,19
June,19

5. Renewable Energy Discussions

5.1. Rooftop Solar Photovoltaic Feasibility

Solar Energy Feasibility

A photovoltaic array is a linked collection of photovoltaic modules, which are in turn made of multiple interconnected solar cells. The cells convert solar energy into direct current electricity via the photovoltaic effect. The power that one module can produce is seldom enough to meet requirements of a home or a business, so the modules are linked together to form an array. Most PV arrays use an inverter to convert the DC power produced by the modules into alternating current that can plug into the existing infrastructure to power lights, motors, and other loads. The modules in a PV array are usually first connected in series to obtain the desired voltage; the individual strings are then connected in parallel to allow the system to produce more current. Solar arrays are typically measured by the peak electrical power they produce, in watts, kilowatts, or even megawatts.

When determining if a site is suitable for a solar application, two basic considerations must be evaluated:

- At minimum, the sun should shine upon the solar collectors from 9 AM to 3 PM. If less, the application may still be worthwhile, but the benefit will be less.
- The array should face south and be free of any shading from buildings, trees, rooftop equipment, etc. If the array is not facing directly south, there will be a penalty in transfer efficiency, reducing the overall efficiency of the system.

SOLAR PV QUESTIONNAIRE	RESPONSE
Does the property have a south, east, or west facing roof or available land of more than 250 square feet per required Solar Array Panel?	**Yes**
Is the area free from any shading such as trees, buildings, equipment etc throughout the whole day?	**Yes**
Can the panels be mounted at an incline of roughly 25-45 degrees? (equal to latitude of property)	**Yes**
Is the property in an area with acceptable average monthly sunlight levels?	**Yes**
Has the roofing been replaced within the past 3-5 years?	**Yes**
Is the roof structure sufficient to hold solar panels?	**Need Additional Study**
Is the property located in a state eligible for net metering?	**Yes**

A solar feasibility analysis of the XXX site has resulted in the building containing more than sufficient amount of roof area for solar electricity generation. The analysis through the use of National Renewable Energy Laboratory's solar photovoltaic software assisted in calculating the potential electricity generated from the allocated land and roof area set for solar photovoltaic installment. The allocated roof area was through looking at the roof and surrounding areas at a bird's eye view. Also detailed in the report are incentives and rebates that can potentially bring down the installation cost of the ECMs and result in a higher return on investment and quicker payback period.

The approach taken in the solar photovoltaic (PV) roof analysis begins with surveying the roof and determine areas on the roof where solar PV panels can potentially be installed.

1) Conducting a preliminary sizing of solar PV panels on the roofs and on the ground and its potential electricity production for its first year of installment using the National Renewable Energy Laboratory (NREL) PV WATTS Version 2 Software.

2) Calculate energy and cost savings for the site as a sole proprietor of the system capable of collecting state, local, and federal tax credits and incentives and interconnecting and selling the renewable energy electrical production to the building.

SOLAR ROOFTOP PHOTOVOLTAIC ANALYSIS		
Estimated Number of Panels	947	
Estimated KW Rating	298	KW
Potential Annual kWh Produced	457,604	kWh
% of Current Electricity Uses	26.6%	
FINANCIAL SUMMARY		
Investment Cost	$1,044,400	
Estimated Energy Cost Savings	$59,489	
Payback without Incentives	17.6	Years
Incentive Payback but without SRECs	10.6	Years
Payback with All Incentives	10.6	Years

A photovoltaic array is a linked collection of photovoltaic modules, which are in turn made of multiple interconnected solar cells. The cells convert solar energy into direct current. Modules of cells are linked together to form an array. Most PV arrays use an inverter to convert the DC power produced by the modules into alternating current that can connect to existing AC infrastructure to power lights, motors, and other loads.

Cost of production has fallen years with increasing demand and through production and technological advances. The cost dropped from $8–10/watt in 1996 to $4–7/watt in 2006. The market is diversifying with new types of panels suited to unique installation methods including stick on sheets and PV spray coating. The solar PV cost used in the analysis was set at $7.0/Watt which includes design, construction, administration, and installation and maintenance cost throughout the life of the solar panels.

One breakthrough for PV is “Net Metering”. When more PV electric power is generated than is consumed on site, the electric service meter reverses to “sell” the excess power directly back onto the power grid. The economics of PV for commercial industrial installations become attractive when coupled with incentives from Federal and state agencies, as well utility companies.

A kilowatt-hour costing $0.15 might be valued at $0.30 when produced by PV and sent to the grid. The economics of PV for commercial industrial installations become attractive when coupled with incentives from Federal and state agencies, as well utility companies.

The low payback period is highly dependent on the marketing potential of selling Solar Renewable Certificates to electricity generated providers who are under state regulations to contain a certain percentage of their electricity generation derived from renewable energy such as wind and solar.

Solar facilities are encouraged to sell their SRECs on the market (either spot market or through long-term contracts). Utilities may use SRECs for compliance under the state RPS for the year in which they are generated. Utilities may purchase up to 10% more SRECs than they require for compliance and "bank" those surplus SRECs for compliance during the following two years. Any SRECs pricing can range from $300 - $450/MWh and can be sold across state borders to other utility providers looking to purchase SRECs. EMG has selected to use the market value of $300/MWh minus 5% administrative fee in the analysis.

A number of states and corresponding electrical utility supplier are required under regulation to have a certain percentage of its electricity be produced by solar energy. To offset that they allow other utility companies to buy Renewable Energy Credits (REC) credit off their customers and facilities that produce their own solar energy. Typically the national market, the utility market is $400 per MWh to Utility Suppliers for not meeting this standard percentage so these REC credits are sold for $350 per MWH. (1 REC credit = 1 MWH).

State charges these utility companies to meet their state compliance of 0.2% of the entire electricity consumption from solar energy by 2022 (from.005% in 2008 aggregated up to 0.2% by 2022). The REC credits correspond to these percentages as they aggregate each year.

6. Operations and Maintenance Plan

The quality of the maintenance and the operation of the facility's energy systems have a direct effect on its overall energy efficiency. Energy-efficiency needs to be a consideration when implementing facility modifications, equipment replacements, and general corrective actions. The following is a list of activities that should be performed as part of the routine maintenance program for the property.

Building Envelope

- ✓ Ensure that the building envelope has proper caulking and weather stripping.
- ✓ Patch holes in the building envelope with foam insulation and fire rated caulk around combustion vents
- ✓ Inspect building vents semiannually for bird infestation
- ✓ Inspect windows monthly for damaged panes and failed thermal seals
- ✓ Repair and adjust automatic door closing mechanisms as needed.

Heating and Cooling

- ✗ Pilots lights on furnaces and boilers be turned off in summer
- ✓ All preventive maintenance should be performed on all furnaces and boilers, which would include cleaning of burners and heat exchanger tubes.
- ✓ Ensure that the combustion vents exhaust outside the conditioned space and the vent dampers are functional
- ✗ Ensure that the control valves are functioning properly before start of every season
- ✗ Ensure steam traps are functional before start of each heating season
- ✓ Ensure use of chemical treatment for boiler make up water
- ✓ Ensure boiler outside temperature re-set is set to 55F
- ✓ Ensure use of chemical treatment for Colling tower water to prevent corrosion
- ✓ Ensure the duct work in unconditioned space is un-compromised and well insulated
- ✓ Duct cleaning is recommended every 10 years. This should include sealing of ducts using products similar to 'aero-seal'
- ✓ Ensure use of economizer mode is functional and used
- ✓ Ensure that the outside air dampers actuators are operating correctly
- ✓ Ensure air coils in the AHU and FCA's are pressure washed annually
- ✓ Return vents should remain un-obstructed and be located centrally
- ✓ Temperature settings reduced in unoccupied areas and set points seasonally adjusted.
- ✓ Evaporator coils and condenser coils should be regularly cleaned to improve heat transfer
- ✓ Refrigerant pipes should be insulated with a minimum of ¾" thick Elastomeric Rubber Pipe Insulation
- ✓ Ensure refrigerant pressure is maintained in the condensers
- ✓ Change air filters on return vents seasonally. Use only filters with 'Minimum Efficiency Rating Value'(MERV) of 8

Central Domestic Hot Water Heater

- ✓ Never place gas fired water heaters adjacent to return vents so as to prevent flame roll outs
- ✓ Ensure the circulation system is on timer to reduce the losses through re-circulation
- ✓ Ensure all hot water pipes are insulated with fiberglass insulation at all times
- ✓ Replacement water heater should have Energy Factor (EF)>0.9
- ✓ Tank-type water heaters flushed monthly

Lighting Improvements

- ✓ Utilize bi-level lighting controls in stairwells and hallways.
- ✓ Use LED replacement lamps
- ✓ Clean lighting fixture reflective surfaces and translucent covers.
- ✓ Ensure that timers and/or photocells are operating correctly on exterior lighting
- ✓ Use occupancy sensors for offices and other rooms with infrequent occupancy

Existing Equipment and Replacements

- ✓ Ensure that refrigerator and freezer doors close and seal correctly
- ✓ Ensure kitchen and bathroom exhaust outside the building and the internal damper operates properly
- ✓ Ensure that bathroom vents exhaust out
- ✓ Office/ computer equipment either in the “sleep” or “off” mode when not used

7. Appendices

APPENDIX A: Glossary of Terms

APPENDIX B: Mechanical Equipment Inventory

APPENDIX C: Lighting System Schedule

APPENDIX D: ECM Checklist

APPENDIX E: ECM Calculations

APPENDIX F: Solar PV

APPENDIX A:
Glossary of Terms

Glossary of Terms and Acronyms

ECM – Energy Conservation Measures are projects recommended to reduce energy consumption. These can be No/Low cost items implemented as part of routine maintenance or Capital Cost items to be implemented as a capital improvement project.

Initial Investment – The estimated cost of implementing an ECM project. Estimates typically are based on R.S. Means Construction cost data and Industry Standards.

Annual Energy Savings – The reduction in energy consumption attributable to the implementation of a particular ECM. These savings values do not include the interactive effects of other ECMs.

Cost Savings – The expected reduction in utility or energy costs achieved through the corresponding reduction in energy consumption by implementation of an ECM.

Simple Payback Period –The number of years required for the cumulative value of energy or water cost savings less future non-fuel or non-water costs to equal the investment costs of the building energy or water system, without consideration of discount rates.

EUL – Expected Useful Life is the estimated lifespan of a typical piece of equipment based on industry accepted standards.

RUL – Remaining Useful Life is the EUL minus the effective age of the equipment and reflects the estimated number of operating years remaining for the item.

SIR - The savings-to-investment ratio is the ratio of the present value savings to the present value costs of an energy or water conservation measure. The numerator of the ratio is the present value of net savings in energy or water and non-fuel or non-water operation and maintenance costs attributable to the proposed energy or water conservation measure. The denominator of the ratio is the present value of the net increase in investment and replacement costs less salvage value attributable to the proposed energy or water conservation measure. It is recommended that energy-efficiency recommendations be based on a calculated SIR, with larger SIRs receiving a higher priority. A project typically is recommended only if the SIR is greater than or equal to 1.0, unless other factors outweigh the financial benefit.

Life Cycle Cost - The sum of the present values of (a) **I**nvestment costs, less salvage values at the end of the study period; (b) Non-fuel operation and maintenance costs: (c) Replacement costs less salvage costs of replaced building systems; and (d) Energy and/or water costs.

Life Cycle Savings – The sum of the estimated annual cost savings over the EUL of the recommended ECM, expressed in present value dollars.

Building Site Energy Use Intensity - The sum of the total site energy use in thousands of Btu per unit of gross building area. Site energy accounts for all energy consumed at the building location only not the energy consumed during generation and transmission of the energy to the site.

Building Source Energy Use Intensity – The sum of the total source energy use in thousands of Btu per unit of gross building area. Source energy is the energy consumed during generation and transmission in supplying the energy to your site.

Building Cost Intensity - This metric is the sum of all energy use costs in dollars per unit of gross building area.

Greenhouse Gas Emissions - Although there are numerous gases that are classified as contributors to the total for Greenhouse Emissions, the scope of this energy audit focuses on carbon dioxide (CO_2). Carbon dioxide enters the atmosphere through the burning of fossil fuels (oil, natural gas, and coal), solid waste, trees and wood products, and also as a result of other chemical reactions (e.g., manufacture of cement).

APPENDIX B:
Mechanical Equipment Inventory

Mechanical Inventory						
System	Make	Model	Serial Number	Input Capacity	Location	Location- Floor
Water Heater	No tag/plate found	No tag/plate found	No tag/plate found	30 GAL	Administration, Classrooms 201-211	Utility closet J001
Water Heater	Ruud	E10-30-G	L0811RR0709E00227A	10 GAL	Cafeteria	Kitchen
Water Heater	A. O. Smith	No tag/plate found	167098	75 GAL	Classrooms B7-10, E9-12	Mechanical room
Water Heater	A. O. Smith	DEL 30	MC93-5000677	30 GAL	Classrooms D2-4, E2-4	Utility closet J001
Water Heater	Rheem	81VP20S	RH 0998304503	20 GAL	Classrooms D5-7, E5-7	Utility closet J001
Water Heater	Rheem	81VP15S	0189C03307	15 GAL	Classrooms F4-6, H4-6	Building exterior
Water Heater	Rheem	81VP15S	RH 119930376	30 GAL	Classrooms F4-6, H4-6	Building exterior
Water Heater	A. O. Smith	DEN 30 102	MJ92-4002205-M32	30 GAL	Classrooms M1-3	Utility closet J001
Water Heater	A. O. Smith	BTH 199 100	1123M001645	100 GAL	Concessions, Classrooms for Students with Disabilities	Utility closet
Water Storage Tank	No tag/plate found	No tag/plate found	No tag/plate found	500 GAL	Gymnasium	Pool Storage Tank Room
Water Heater	Rheem	82V30-2	RH 0908R00966	30 GAL	Library	Utility closet
Water Heater	A. O. Smith	FGR 40 242	GC99-4811077-R99	40 GAL	Theater	Mechanical room M004
Water Storage Tank	No tag/plate found	No tag/plate found	No tag/plate found	150 GAL	Theater	Mechanical room M004
Air Compressor	Champion	No tag/plate found	No tag/plate found	2 HP	Gymnasium	Pool Storage Tank Room
Air Compressor	Champion	No tag/plate found	No tag/plate found	3 HP	Theater	Mechanical room M004
Pool Heater	Raypak	P-1005A	1607426807	100 MBH	Gymnasium	Pool Pump Room
Boiler	Bryan Boilers	RV450-W-FDG-LX	89496	450 MBH	Theater	Mechanical room M004
Cooling Tower	Evapco	ICT479	998917W	479 Ton	Theater	Mechanical room M004
Chiller	Carrier	30HXC076RZ-630AA	4999F67536	75 Ton	Theater	Mechanical room M004
Chiller	Carrier	30HXC076RZ-630AA	4999F67539	75 Ton	Theater	Mechanical room M004
Cooling Tower	Evapco	ICT479	998916W	479 Ton	Theater	Mechanical room M004
CRAC Drycooler/Condenser	Carrier	38AH-074---601--	3505Q06417	70 Ton	Classrooms 213-222	Roof
Ductless Split System	American Series	No tag/plate found	No tag/plate found	0.75 Ton	Classrooms D2-4, E2-4	Utility closet C001
Condensing Unit/Heat Pump	EMI	Illegible	1-05-D-6882-18	0.75 Ton	Classrooms D2-4, E2-4	Roof
Ductless Split System	American Series	No tag/plate found	No tag/plate found	0.75 Ton	Classrooms D2-4, E2-4	Utility closet C002
Condensing Unit/Heat Pump	EMI	Illegible	1-05-0-6880-18	0.75 Ton	Classrooms D2-4, E2-4	Roof
Ductless Split System	EMI	No tag/plate found	No tag/plate found	0.75 Ton	Classrooms D5-7, E5-7	Utility closet S001
Condensing Unit/Heat Pump	EMI	SHC09DA0000AA08	1-05-D-6879-18	0.75 Ton	Classrooms D5-7, E5-7	Roof
Condensing Unit/Heat Pump	EMI	SHC090A0000AA0B	1-05-D-6878-18	0.75 Ton	Classrooms D5-7, E5-7	Roof
Ductless Split System	EMI	No tag/plate found	No tag/plate found	0.75 Ton	Classrooms D5-7, E5-7	Utility closet S002
Condensing Unit/Heat Pump	Carrier	38OKC024048	150BE38065	2 Ton	Classrooms M1-3	Roof
Condensing Unit/Heat Pump	Carrier	38QRR060---3	1511X90272	5 Ton	Concessions, Classrooms for Students with Disabilities	Building exterior
Condensing Unit/Heat Pump	Carrier	38QRR060---3	1511X90266	5 Ton	Concessions, Classrooms for Students with Disabilities	Building exterior

Ductless Split System	Mitsubishi	MSZ-GE18NA	1000450	1.5 Ton	Concessions, Classrooms for Students with Disabilities	Press Box
Condensing Unit/Heat Pump	Mitsubishi	MUZ-GE18NA	1001733	1.5 Ton	Concessions, Classrooms for Students with Disabilities	Site
Condensing Unit/Heat Pump	Carrier	CR42K6-TFD-130	04G61263B	3.5 Ton	Library	Roof
Air Handler (AHU)	Temtrol	ITF-BZ35	U101544-001-00	25,000 CFM	Administration, Classrooms 201-211	Mechanical room M001
Make-Up Air Unit	Greenheck	PVF400H	05F29273	14,815 CFM	Cafeteria	Roof
Make-Up Air Unit	Greenheck	PVF100M	No tag/plate found	3,704 CFM	Gymnasium	Roof
Make-Up Air Unit	Greenheck	PVF400H	No tag/plate found	14,815 CFM	Gymnasium	Roof
Make-Up Air Unit	Greenheck	PVF400H	No tag/plate found	14,815 CFM	Gymnasium	Roof
Air Handler (AHU)	Kennard/Nelson	HH220MZ	38280404A	25,000 CFM	Theater	Attic
Air Handler (AHU)	Kennard/Nelson	No tag/plate found	No tag/plate found	25,000 CFM	Theater	Mechanical room M001
Air Handler (AHU)	Kennard/Nelson	HU225MZ	38280403A	25,000 CFM	Theater	Mechanical room M001
Exhaust Fan	Greenheck	CUBE-141-3-X	05616964	1,000 CFM	Administration, Classrooms 201-211	Roof
Exhaust Fan	Greenheck	CUBE-098-4-X	05616910	1,000 CFM	Administration, Classrooms 201-211	Roof
Exhaust Fan	Greenheck	CUBE-098-4-X	05G16912	1,000 CFM	Administration, Classrooms 201-211	Roof
Exhaust Fan	Greenheck	G8-081-4-X	05617151	1,000 CFM	Administration, Classrooms 201-211	Roof
Exhaust Fan	Greenheck	CUBE-098-4-X	056G16911	1,000 CFM	Administration, Classrooms 201-211	Roof
Exhaust Fan	Greenheck	CUBE-121-4-X	05G16932	1,000 CFM	Administration, Classrooms 201-211	Roof
Exhaust Fan	Greenheck	CUBE-121-4-X	05G16931	1,000 CFM	Administration, Classrooms 201-211	Roof
Exhaust Fan	Greenheck	CUBE-141-3-X	05G16953	1,000 CFM	Administration, Classrooms 201-211	Roof
Exhaust Fan	Greenheck	CUBE-098-4-X	05G16909	1,000 CFM	Administration, Classrooms 201-211	Roof
Exhaust Fan	Greenheck	CUBE-121-4-X	05G16930	1,000 CFM	Administration, Classrooms 201-211	Roof
Exhaust Fan	Greenheck	CUBE-121-4-X	05G16934	1,000 CFM	Administration, Classrooms 201-211	Roof
Exhaust Fan	Greenheck	CUBE-121-4-X	05G16928	1,000 CFM	Administration, Classrooms 201-211	Roof
Exhaust Fan	Greenheck	CUBE-180-4-X	05G170215	1,000 CFM	Administration, Classrooms 201-211	Roof
Exhaust Fan	Greenheck	CUBE-121-4-X	05G16926	1,000 CFM	Administration, Classrooms 201-211	Roof
Exhaust Fan	Greenheck	CUBE-121-4-X	05G16933	1,000 CFM	Administration, Classrooms 201-211	Roof
Exhaust Fan	Greenheck	CUBE-121-4-X	05G16929	1,000 CFM	Administration, Classrooms 201-211	Roof
Exhaust Fan	Greenheck	CUBE-121-4-X	05G16939	1,000 CFM	Cafeteria	Roof
Exhaust Fan	Greenheck	GRS-15-QD	05H15215	100 CFM	Cafeteria	Roof
Exhaust Fan	Greenheck	GRS-15-QD	05H15212	100 CFM	Cafeteria	Roof
Exhaust Fan	Greenheck	CUBE-240HP-30-G	05G17035	5,000 CFM	Cafeteria	Roof
Exhaust Fan	Greenheck	GRS-15-QD	05D12116	100 CFM	Cafeteria	Roof
Exhaust Fan	Greenheck	GRS-15-QD	05D33479	100 CFM	Cafeteria	Roof
Exhaust Fan	Greenheck	CUBE-240HP-30-G	05G17036	5,000 CFM	Cafeteria	Roof
Exhaust Fan	Greenheck	GRS-15-QD	05H09991	100 CFM	Cafeteria	Roof
Exhaust Fan	Greenheck	GB-101-4-X	05617201	1,000 CFM	Classrooms 213-222	Roof
Exhaust Fan	Greenheck	SFB-15-3-CW-TH-X	05113089	2,000 CFM	Classrooms 213-222	Roof
Exhaust Fan	Greenheck	CUBE-121-4-X	05616927	1,000 CFM	Classrooms 213-222	Roof

Exhaust Fan	Greenheck	CUBE-121-4-X	05616925	1,000 CFM	Classrooms 213-222	Roof
Exhaust Fan	Greenheck	CUBE-098-4-X	05616908	1,000 CFM	Classrooms 213-222	Roof
Exhaust Fan	Greenheck	GB-081-6-X	05A35706	1,000 CFM	Classrooms B1-3, C1-3	Roof
Exhaust Fan	Greenheck	GB-071-6-X	05B12246	1,000 CFM	Classrooms B1-3, C1-3	Roof
Exhaust Fan	Greenheck	GB-081-G-X	05A26314	1,000 CFM	Classrooms B1-3, C1-3	Roof
Exhaust Fan	Greenheck	GB-081-6-X	0GA26311	1,000 CFM	Classrooms B4-6, C4-6	Roof
Exhaust Fan	Greenheck	GB-081-6-X	05A26312	1,000 CFM	Classrooms B4-6, C4-6	Roof
Exhaust Fan	Greenheck	GB-071-6-X	05B12247	1,000 CFM	Classrooms B4-6, C4-6	Roof
Exhaust Fan	Greenheck	GB-121-4-X	05G17364	1,000 CFM	Classrooms B7-10, E9-12	Roof
Exhaust Fan	Greenheck	CUBE-121-4-X	05G16938	1,000 CFM	Classrooms B7-10, E9-12	Roof
Exhaust Fan	Greenheck	CUBE-121-4-X	05G16937	1,000 CFM	Classrooms B7-10, E9-12	Roof
Exhaust Fan	Greenheck	CUBE-121-4-X	05G16936	1,000 CFM	Classrooms B7-10, E9-12	Roof
Exhaust Fan	Greenheck	GB-081-4-X	05G17152	1,000 CFM	Classrooms B7-10, E9-12	Roof
Exhaust Fan	Greenheck	GB-121-4-X	05G17365	1,000 CFM	Classrooms B7-10, E9-12	Roof
Exhaust Fan	Greenheck	CUBE-121-4-X	05G16935	1,000 CFM	Classrooms B7-10, E9-12	Roof
Exhaust Fan	Greenheck	CUBE-121-4-X	05G16935	1,000 CFM	Classrooms B7-10, E9-12	Roof
Exhaust Fan	Greenheck	GB-081-4-X	05G17153	1,000 CFM	Classrooms B7-10, E9-12	Roof
Exhaust Fan	Greenheck	GB-071-6-X	05A35677	1,000 CFM	Classrooms D2-4, E2-4	Roof
Exhaust Fan	Greenheck	GB-081-6-X	05A35708	1,000 CFM	Classrooms D2-4, E2-4	Roof
Exhaust Fan	Greenheck	GB-071-6-X	05A35678	1,000 CFM	Classrooms D2-4, E2-4	Roof
Exhaust Fan	Greenheck	GB-081-6-X	05A35705	1,000 CFM	Classrooms D5-7, E5-7	Roof
Exhaust Fan	Greenheck	GB-071-6-X	05B12245	1,000 CFM	Classrooms D5-7, E5-7	Roof
Exhaust Fan	Greenheck	GB-071-6-X	05B12244	1,000 CFM	Classrooms D5-7, E5-7	Roof
Exhaust Fan	Greenheck	GB-081-6-X	05A16329	1,000 CFM	Classrooms F1-3, H1-3	Roof
Exhaust Fan	Greenheck	GB-071-6-X	05A26274	1,000 CFM	Classrooms F1-3, H1-3	Roof
Exhaust Fan	Greenheck	GB-081-6-X	06A16827	1,000 CFM	Classrooms F1-3, H1-3	Roof
Exhaust Fan	Greenheck	GB-081-6-X	05A16326	1,000 CFM	Classrooms F4-6, H4-6	Roof
Exhaust Fan	Greenheck	GB-081-6-X	05A16328	1,000 CFM	Classrooms F4-6, H4-6	Roof
Exhaust Fan	Greenheck	GB-071-6-X	05A16330	1,000 CFM	Classrooms F4-6, H4-6	Roof
Exhaust Fan	Jenn-Aire	48 KRV	No tag/plate found	2,000 CFM	Classrooms F7-12, H7-12	Roof
Exhaust Fan	Dayton	6D599	No tag/plate found	2,000 CFM	Classrooms F7-12, H7-12	Roof
Exhaust Fan	Jenn-Aire	18 KRV DF	No tag/plate found	750 CFM	Classrooms F7-12, H7-12	Roof
Exhaust Fan	Greenheck	G-120-A	01A05803	1,000 CFM	Classrooms F7-12, H7-12	Roof

Exhaust Fan	Jenn-Aire	331 CK K	No tag/plate found	3,000 CFM	Classrooms F7-12, H7-12	Roof
Exhaust Fan	Jenn-Aire	91CR-A	No tag/plate found	1,000 CFM	Classrooms F7-12, H7-12	Roof
Exhaust Fan	Jenn-Aire	271 CKA	No tag/plate found	3,000 CFM	Classrooms F7-12, H7-12	Roof
Exhaust Fan	Jenn-Aire	271 CK G	No tag/plate found	3,000 CFM	Classrooms F7-12, H7-12	Roof
Exhaust Fan	Jenn-Aire	271 CK G	No tag/plate found	3,000 CFM	Classrooms F7-12, H7-12	Roof
Exhaust Fan	Greenheck	GRS-15-QD	06A07906	100 CFM	Classrooms M1-3	Roof
Exhaust Fan	Greenheck	GRS-15-QD	06A22324	100 CFM	Classrooms M1-3	Roof
Exhaust Fan	Greenheck	GRS-15-QD	05K26136	100 CFM	Classrooms M1-3	Roof
Exhaust Fan	Greenheck	GRS-15-QD	05K26135	100 CFM	Classrooms M1-3	Roof
Exhaust Fan	Inaccessible	Inaccessible	Inaccessible	500 CFM	Concessions, Classrooms for Students with Disabilities	Roof
Exhaust Fan	Inaccessible	Inaccessible	No tag/plate found	500 CFM	Concessions, Classrooms for Students with Disabilities	Roof
Exhaust Fan	Inaccessible	Inaccessible	Inaccessible	1,000 CFM	Concessions, Classrooms for Students with Disabilities	Roof
Exhaust Fan	Inaccessible	Inaccessible	Inaccessible	500 CFM	Concessions, Classrooms for Students with Disabilities	Roof
Exhaust Fan	Inaccessible	Inaccessible	Inaccessible	500 CFM	Concessions, Classrooms for Students with Disabilities	Site
Exhaust Fan	Inaccessible	Inaccessible	Inaccessible	500 CFM	Concessions, Classrooms for Students with Disabilities	Site
Exhaust Fan	Jenn-Aire	12 KRV DF	No tag/plate found	100 CFM	Gymnasium	Roof
Exhaust Fan	Jenn-Aire	12 KRV DF	No tag/plate found	100 CFM	Gymnasium	Roof
Exhaust Fan	Jenn-Aire	12 KRV DF	No tag/plate found	100 CFM	Gymnasium	Roof
Exhaust Fan	Greenheck	GB-081-6-X	05A35707	1,000 CFM	Gymnasium	Roof
Exhaust Fan	Greenheck	GB-071-6-X	05B12249	1,000 CFM	Gymnasium	Roof
Exhaust Fan	Greenheck	GB-141-7-X	05G17396	1,000 CFM	Gymnasium	Roof
Exhaust Fan	Greenheck	GB-141-7-X	05G17397	1,000 CFM	Gymnasium	Roof
Exhaust Fan	Jenn-Aire	12 KRV DF	No tag/plate found	100 CFM	Gymnasium	Roof
Exhaust Fan	Jenn-Aire	12 KRV DF	No tag/plate found	100 CFM	Gymnasium	Roof
Exhaust Fan	Greenheck	GB-071-6-X	05G17126	1,000 CFM	Gymnasium	Roof
Exhaust Fan	Greenheck	GB-141-7-X	05G17393	1,000 CFM	Gymnasium	Roof
Exhaust Fan	Greenheck	GB-141-7-X	05G17395	1,000 CFM	Gymnasium	Roof
Exhaust Fan	Greenheck	GB-081-6-X	05A26313	1,000 CFM	Gymnasium	Roof
Exhaust Fan	Greenheck	GB-141-7-X	05G17392	1,000 CFM	Gymnasium	Roof
Exhaust Fan	Jenn-Aire	12 KRV DF	No tag/plate found	100 CFM	Gymnasium	Roof
Exhaust Fan	Greenheck	GB-081-6-X	05G17154	1,000 CFM	Gymnasium	Roof
Exhaust Fan	Greenheck	GB-071-6-X	05B12243	1,000 CFM	Gymnasium	Roof
Exhaust Fan	Jenn-Aire	12 KRV DF	No tag/plate found	100 CFM	Gymnasium	Roof
Exhaust Fan	Greenheck	GB-071-6-X	05G17128	1,000 CFM	Gymnasium	Roof
Exhaust Fan	Greenheck	GB-141-7-X	05G17390	1,000 CFM	Gymnasium	Roof
Exhaust Fan	Greenheck	GB-071-6-X	06A26275	1,000 CFM	Gymnasium	Roof
Exhaust Fan	Greenheck	GB-141-7-X	05G17394	1,000 CFM	Gymnasium	Roof
Exhaust Fan	Greenheck	GB-141-7-X	05G17391	1,000 CFM	Gymnasium	Roof
Exhaust Fan	Jenn-Aire	12 KRV DF	No tag/plate found	100 CFM	Gymnasium	Roof
Exhaust Fan	Greenheck	GB-121-4-X	05G17366	1,000 CFM	Gymnasium	Roof
Exhaust Fan	Jenn-Aire	12 KRV DF	No tag/plate found	100 CFM	Library	Roof

Exhaust Fan	Westinghouse	SFY 4659-5	No tag/plate found	20,000 CFM	Theater	Mechanical room M001
Exhaust Fan	Westinghouse	SFY 4659	No tag/plate found	20,000 CFM	Theater	Attic
Exhaust Fan	Westinghouse	SFY 4659	No tag/plate found	20,000 CFM	Theater	Mechanical room M001
Exhaust Fan	Greenheck	BCF-108-4-TH-Q	02J04789	1,000 CFM	Theater	Mechanical room M004
Exhaust Fan	Westinghouse	SFY 4659	No tag/plate found	20,000 CFM	Theater	Mechanical room M001
Distribution Pump	Barret	BOWL-2-4/VFD/WHIP	59926 A	30 HP	Site	Site
Distribution Pump	No tag/plate found	No tag/plate found	No tag/plate found	7.5 HP	Site	Site
Distribution Pump	Holloshaft	No tag/plate found	VTP-10440	50 HP	Site	Site
Distribution Pump	Barrett	IBCR15-2-2/VFD/WHM2	59927 B	7.5 HP	Site	Site
Distribution Pump	Bell & Gossett	CN4006-01 J20	No tag/plate found	7.5 HP	Theater	Mechanical room M004
Distribution Pump	Bell & Gossett	Illegible	Illegible	5 HP	Theater	Mechanical room M004
Distribution Pump	Totaline	6E275TL-360-TR	3911PE4304	10 HP	Classrooms 213-222	Roof
Distribution Pump	Trainerd	06EF299660	64663	10 HP	Classrooms 213-222	Roof
Distribution Pump	Bell & Gossett	1531 5BC 81/2BF	980784	2 HP	Theater	Mechanical room M004
Distribution Pump	Bell & Gossett	Illegible	Illegible	2 HP	Theater	Mechanical room M004
Distribution Pump	Bell & Gossett	Illegible	Illegible	2 HP	Theater	Mechanical room M004
Furnace	Carrier	58MXB040-12	2405AB1874	38 MBH	Administration, Classrooms 201-211	Utility closet Z006
Furnace	Carrier	58MVP060	0405A13112	60 MBH	Classrooms M1-3	Roof
Furnace	Carrier	58MVC080-20	0611A08114	80 MBH	Concessions, Classrooms for Students with Disabilities	Mechanical room 1505
Furnace	Carrier	58MVC080-20	0611A08111	80 MBH	Concessions, Classrooms for Students with Disabilities	Mechanical room 1510
Furnace	Carrier	58MVP080-F-1-20	0403A11664	75 MBH	Library	Utility Closet M001
Packaged Unit (RTU)	Aaon	RM-005-3-0-AA01-222	200508-AMGE	5 Ton	Administration, Classrooms 201-211	Roof
Packaged Unit (RTU)	Aaon	RM-006-3-0-AA01-222	200508-AMGF18119	6 Ton	Administration, Classrooms 201-211	Roof
Packaged Unit (RTU)	Aaon	RM-006-3-0-AA01-222	200508-AMGF18120	6 Ton	Administration, Classrooms 201-211	Roof
Packaged Unit (RTU)	Aaon	RM-006-3-0-AA01-222	200508-AMGF18117	6 Ton	Administration, Classrooms 201-211	Roof
Packaged Unit (RTU)	Aaon	RM-005-3-0-AA01-222	200508-AMGE18109	5 Ton	Administration, Classrooms 201-211	Roof
Packaged Unit (RTU)	Aaon	Illegible	Illegible	2 Ton	Administration, Classrooms 201-211	Roof
Packaged Unit (RTU)	Aaon	RM-007-3-0-AA01-222	200508-AMGG18113	7 Ton	Administration, Classrooms 201-211	Roof
Packaged Unit (RTU)	Aaon	RM-005-3-0-AA01-222	200508-AMGE18108	5 Ton	Administration, Classrooms 201-211	Roof
Packaged Unit (RTU)	Aaon	RM-006-3-0-AA01-222	200508-AMGF18118	6 Ton	Administration, Classrooms 201-211	Roof
Package Unit	MarvAir	HVPSA42HP2A050NBU-A5-100	HG-F152640-0-1	3.5 Ton	Agriculture	Building exterior
Packaged Unit (RTU)	Aaon	Illegible	Illegible	7 Ton	Cafeteria	Roof
Packaged Unit (RTU)	Aaon	RM-005-3-0-AA01-222	200508-AMGD18127	5 Ton	Cafeteria	Roof
Packaged Unit (RTU)	Aaon	RM-004-3-0-AA01-222	200508-AMGD12128	4 Ton	Cafeteria	Roof
Packaged Unit (RTU)	Aaon	RM-007-3-0-AA01-222	200508-AMGG18124	7 Ton	Cafeteria	Roof
Packaged Unit (RTU)	Aaon	RM-002-3-0-AA01-212	200508-AMGB18129	2 Ton	Cafeteria	Roof
Packaged Unit (RTU)	Aaon	RM-007-3-0-AA01-222	200508-AMGG18126	7 Ton	Cafeteria	Roof
Packaged Unit (RTU)	Aaon	Illegible	Illegible	7 Ton	Cafeteria	Roof

Package Unit	MarvAir	HVPSA42HP2A050NBU-A5-10	HG-F153665-0-4	3.5 Ton	Classroom K2	Building exterior
Package Unit	MarvAir	HVPSA42HP2A050NBU-A5-100	HG-F152640-0-2	3.5 Ton	Classroom K3	Building exterior
Package Unit	MarvAir	HVPSA42HP2A050NBU-A5-100	hg-F153665-0-6	3.5 Ton	Classroom K4	Building exterior
Package Unit	MarvAir	HVPSA42HP2A050NBU-A5-100	HG-F153665-0-5	3.5 Ton	Classroom K5	Building exterior
Package Unit	MarvAir	HVPSA42HP2A050NBU-A5-100	HG-F153665-0-1	3.5 Ton	Classroom K6	Building exterior
Package Unit	MarvAir	HVPSA42HP2A050NBU-A5-100	HG-F153665-0-2	3.5 Ton	Classroom K7	Building exterior
Package Unit	MarvAir	HVPSA42HP2A050NBU-A5-100	HG-F153665-0-3	3.5 Ton	Classroom K8	Building exterior
Packaged Unit (RTU)	Aaon	RM-007-3-0-AA01-222	200508-AMG18112	7 Ton	Classrooms 213-222	Roof
Packaged Unit (RTU)	Aaon	RM-004-3-0-AA01-222	200508-AMGD18101	4 Ton	Classrooms 213-222	Roof
Packaged Unit (RTU)	Aaon	RM-002-3-0-AA01-212	200508-AMG18110	2 Ton	Classrooms 213-222	Roof
Packaged Unit (RTU)	Aaon	Illegible	Illegible	7 Ton	Classrooms 213-222	Roof
Packaged Unit (RTU)	Aaon	RM-005-3-0-AA01-222	200508-AMGE18104	5 Ton	Classrooms 213-222	Roof
Packaged Unit (RTU)	Aaon	RM-004-3-0-AA01-222	200508-AMGD18102	4 Ton	Classrooms 213-222	Roof
Packaged Unit (RTU)	Aaon	RM-005-3-0-AA01-222	200508-AMGE18105	5 Ton	Classrooms 213-222	Roof
Packaged Unit (RTU)	Aaon	RM-005-3-0-AA01-222	200508-AMGE18105	5 Ton	Classrooms 213-222	Roof
Packaged Unit (RTU)	Aaon	RM-004-3-0-AA01-222	200508-AMGD18103	4 Ton	Classrooms 213-222	Roof
Packaged Unit (RTU)	Aaon	RM-005-3-0-AA01-222	200508-AMGE18106	5 Ton	Classrooms 213-222	Roof
Packaged Unit (RTU)	Aaon	RM-006-3-0-AA01-222	200508-AMGF18116	6 Ton	Classrooms 213-222	Roof
Packaged Unit (RTU)	Aaon	RM-003-3-0-AA01-212	200508-AMGC18121	3 Ton	Classrooms 213-222	Roof
Packaged Unit (RTU)	Aaon	RM-006-3-0-AA01-222	200508-AMGF18115	6 Ton	Classrooms 213-222	Roof
Packaged Unit (RTU)	Aaon	RM-005-3-0-AA01-222	200501-AMGE15660	5 Ton	Classrooms B1-3, C1-3	Roof
Packaged Unit (RTU)	Aaon	RM-005-3-0-AA01-222	200501-AMGE15659	5 Ton	Classrooms B1-3, C1-3	Roof
Packaged Unit (RTU)	Aaon	RM-005-3-0-AA01-222	200501-AMGE15665	5 Ton	Classrooms B1-3, C1-3	Roof
Packaged Unit (RTU)	Aaon	RM-005-3-0-AA01-222	200501-AMGE15666	5 Ton	Classrooms B1-3, C1-3	Roof
Packaged Unit (RTU)	Aaon	RM-005-3-0-AA01-222	200501-AMGE15658	5 Ton	Classrooms B1-3, C1-3	Roof
Packaged Unit (RTU)	Aaon	RM-005-3-0-AA01-222	200501-AMGE15664	5 Ton	Classrooms B1-3, C1-3	Roof
Packaged Unit (RTU)	Aaon	RM-005-3-0-AA01-222	200501-AMGF15657	5 Ton	Classrooms B4-6, C4-6	Roof
Packaged Unit (RTU)	Aaon	RM-005-3-0-AA01-222	200501-AMGE15663	5 Ton	Classrooms B4-6, C4-6	Roof
Packaged Unit (RTU)	Aaon	RM-005-3-0-AA01-222	200501-AMGE15655	5 Ton	Classrooms B4-6, C4-6	Roof
Packaged Unit (RTU)	Aaon	RM-005-3-0-AA01-222	200501-AMGE15662	5 Ton	Classrooms B4-6, C4-6	Roof
Packaged Unit (RTU)	Aaon	RM-005-3-0-AA01-222	200501-AMGE15656	5 Ton	Classrooms B4-6, C4-6	Roof
Packaged Unit (RTU)	Aaon	RM-005-3-0-AA01-222	200501-AMGE15661	5 Ton	Classrooms B4-6, C4-6	Roof
Packaged Unit (RTU)	Aaon	RM-005-3-0-AA01-222	200508-AMGF18431	5 Ton	Classrooms B7-10, E9-12	Roof
Packaged Unit (RTU)	Aaon	RM-002-3-0-AA01-212	200508-AMGB18137	2 Ton	Classrooms B7-10, E9-12	Roof
Packaged Unit (RTU)	Aaon	RK-02-3-E0-000	200303-AKCA07080	2 Ton	Classrooms B7-10, E9-12	Roof
Packaged Unit (RTU)	Aaon	RM-006-3-0-AA01	200508-AMGF18134	6 Ton	Classrooms B7-10, E9-12	Roof
Packaged Unit (RTU)	Aaon	RM-006-3-0-AA01	200508-AMGF18132	6 Ton	Classrooms B7-10, E9-12	Roof
Packaged Unit (RTU)	Aaon	RM-006-3-0-AA01-222	200508-AMGF18130	6 Ton	Classrooms B7-10, E9-12	Roof
Packaged Unit (RTU)	Aaon	RM-006-3-0-AA01-222	200508-AMGF18136	6 Ton	Classrooms B7-10, E9-12	Roof

Packaged Unit (RTU)	Aaon	RM-006-3-0-AA01-222	200508-AMGF18133	6 Ton	Classrooms B7-10, E9-12	Roof
Packaged Unit (RTU)	Aaon	RM-006-3-0-AA01-222	200508-AMGF18135	6 Ton	Classrooms B7-10, E9-12	Roof
Packaged Unit (RTU)	Greenheck	RM-005-3-0-AA01-222	200509-AMGE20791	5 Ton	Classrooms D2-4, E2-4	Roof
Packaged Unit (RTU)	Aaon	RM-005-3-0-AA01-222	200509-AMGE20790	5 Ton	Classrooms D2-4, E2-4	Roof
Packaged Unit (RTU)	Aaon	RM-005-3-0-AA01-222	200509-AMGE20793	5 Ton	Classrooms D2-4, E2-4	Roof
Packaged Unit (RTU)	Aaon	RM-005-3-0-AA01-222	200509-AMGE20794	5 Ton	Classrooms D2-4, E2-4	Roof
Packaged Unit (RTU)	Aaon	RM-005-3-0-AA01-222	200509-AMGE20795	5 Ton	Classrooms D2-4, E2-4	Roof
Packaged Unit (RTU)	Aaon	RM-005-3-0-AA01-222	200509-AMGE20792	5 Ton	Classrooms D2-4, E2-4	Roof
Packaged Unit (RTU)	Aaon	RM-005-3-0-AA01-222	200509-AMGE20788	5 Ton	Classrooms D5-7, E5-7	Roof
Packaged Unit (RTU)	Aaon	RM-005-3-0-AA01-222	200509-AMGE20789	5 Ton	Classrooms D5-7, E5-7	Roof
Packaged Unit (RTU)	Aaon	RM-005-3-0-AA01-222	200509-AMGE20787	5 Ton	Classrooms D5-7, E5-7	Roof
Packaged Unit (RTU)	Aaon	RM-005-3-0-AA01-222	200509-AMGE20788	5 Ton	Classrooms D5-7, E5-7	Roof
Packaged Unit (RTU)	Aaon	RM-005-3-0-AA01-222	200509-AMGE20785	5 Ton	Classrooms D5-7, E5-7	Roof
Packaged Unit (RTU)	Aaon	RM-005-3-0-AA01-222	200509-AMGE20784	5 Ton	Classrooms D5-7, E5-7	Roof
Packaged Unit (RTU)	Aaon	Illegible	Illegible	5 Ton	Classrooms F1-3, H1-3	Roof
Packaged Unit (RTU)	Aaon	RM-005-3-0-AA01-222	200411-AMGE13025	5 Ton	Classrooms F1-3, H1-3	Roof
Packaged Unit (RTU)	Aaon	RM-005-3-0-AA01-222	Illegible	5 Ton	Classrooms F1-3, H1-3	Roof
Packaged Unit (RTU)	Aaon	Illegible	Illegible	5 Ton	Classrooms F1-3, H1-3	Roof
Packaged Unit (RTU)	Aaon	RM-005-3-0-AA01-222	200411-AMGE13026	5 Ton	Classrooms F1-3, H1-3	Roof
Packaged Unit (RTU)	Aaon	RM-005-3-0-AA01-222	200411-AMGE13024	5 Ton	Classrooms F1-3, H1-3	Roof
Packaged Unit (RTU)5 Ton	Aaon	RM-005-3-0-AA01-222	200411-AMGE13018	5 Ton	Classrooms F4-6, H4-6	Roof
Packaged Unit (RTU)	Aaon	RM-005-3-0-AA01-222	200411-AMGE13020	5 Ton	Classrooms F4-6, H4-6	Roof
Packaged Unit (RTU)	Aaon	RM-005-3-0-AA01-222	200411-AMGE13019	5 Ton	Classrooms F4-6, H4-6	Roof
Packaged Unit (RTU)	Aaon	Illegible	Illegible	5 Ton	Classrooms F4-6, H4-6	Roof
Packaged Unit (RTU)	Aaon	Illegible	Illegible	5 Ton	Classrooms F4-6, H4-6	Roof
Packaged Unit (RTU)	Aaon	Illegible	Illegible	5 Ton	Classrooms F4-6, H4-6	Roof
Packaged Unit (RTU)	Aaon	Illegible	Illegible	5 Ton	Classrooms F7-12, H7-12	Roof
Packaged Unit (RTU)	Aaon	RM-006-3-0-AA01-222	200707-AMGF35701	6 Ton	Classrooms F7-12, H7-12	Roof
Packaged Unit (RTU)	Trane	YSC060E3ELA	10441095L	5 Ton	Classrooms F7-12, H7-12	Roof
Packaged Unit (RTU)	Trane	YSC060ESC	164914541	5 Ton	Classrooms F7-12, H7-12	Roof
Packaged Unit (RTU)	Aaon	RM-002-3-0-AA01-212	200707-AMGB35457	2 Ton	Classrooms F7-12, H7-12	Roof
Packaged Unit (RTU)	Aaon	RM-006-3-0-AA01-222	200707-AMGF35450	6 Ton	Classrooms F7-12, H7-12	Roof

Packaged Unit (RTU)	Aaon	No tag/plate found	No tag/plate found	6 Ton	Classrooms F7-12, H7-12	Roof
Packaged Unit (RTU)	Aaon	Illegible	Illegible	6 Ton	Classrooms F7-12, H7-12	Roof
Packaged Unit (RTU)	Aaon	RM-006-3-0-AA01-222	200707-AMGF35451	6 Ton	Classrooms F7-12, H7-12	Roof
Packaged Unit (RTU)	Aaon	Illegible	Illegible	2 Ton	Classrooms F7-12, H7-12	Roof
Packaged Unit (RTU)	Trane	YSC090E3FLA0B0C	103910597L	7.5 Ton	Classrooms F7-12, H7-12	Roof
Packaged Unit (RTU)	Trane	YSC060E3ELA18	10491155L	5 Ton	Classrooms F7-12, H7-12	Roof
Packaged Unit (RTU)	Aaon	Illegible	Illegible	5 Ton	Classrooms F7-12, H7-12	Roof
Package Unit	MarvAir	HVPSA36HP2A050NBU-A5-100	HG-F153664-0-3	3 Ton	Classrooms J1-5	Building exterior
Package Unit	MarvAir	HVPSA36HP2A050CU-A5-200	KH-F164114-0-1	3 Ton	Classrooms J1-5	Building exterior
Package Unit	MarvAir	HVPSA36HP2A050NBU-A5-100	HG-F153664-0-1	3 Ton	Classrooms J1-5	Building exterior
Package Unit	MarvAir	HVPSA36HP2A050NBU-A5	HG-F153664-0-5	3 Ton	Classrooms J1-5	Building exterior
Package Unit	MarvAir	HVPSA36HP2A050CU-A5-200	KH-F164114-0-4	3 Ton	Classrooms J1-5	Building exterior
Package Unit	Bard	WH421-AXVXX4XXX	1264911864972-1	3.5 Ton	Classrooms J6-10	Building exterior
Heat Pump	Bard	W0421-AN8VX4XXX	126L011664992	3.5 Ton	Classrooms J6-10	Building exterior
Heat Pump	Bard	W0421-ANBVX4XXX	126K011664995-1	3.5 Ton	Classrooms J6-10	Building exterior
Heat Pump	Bard	W0421-ANBVX4XXX	126J011681904-1	3.5 Ton	Classrooms J6-10	Building exterior
Heat Pump	Bard	W0421-ANGVX4XXX	126K011684986-1	3.5 Ton	Classrooms J6-10	Building exterior
Packaged Unit (RTU)	Aaon	RM005-3-0-AA01-222	200503-AMGE16323	5 Ton	Classrooms M1-3	Roof
Packaged Unit (RTU)	Aaon	RM-010-3-0-AA02-232	200503-AMGJ16301	10 Ton	Classrooms M1-3	Roof
Packaged Unit (RTU)	Aaon	RM-008-3-0-AA02-232	200503-AGMH16302	8 Ton	Classrooms M1-3	Roof
Packaged Unit (RTU)	Aaon	RM-005-3-0-AA01-222	200503-AMGE16322	5 Ton	Classrooms M1-3	Roof
Packaged Unit (RTU)	Aaon	RM-008-3-0-AA02-232	200508-AMGB18084	10 Ton	Gymnasium	Roof
Packaged Unit (RTU)	Aaon	RM-020-3-0-AA02-242	200508-AMGP18149	20 Ton	Gymnasium	Roof
Packaged Unit (RTU)	Aaon	RM-002-3-0-AA01-212	200508-AMGB18140	2 Ton	Gymnasium	Roof
Packaged Unit (RTU)	Aaon	RM-008-3-0-AA02-232	Illegible	8 Ton	Gymnasium	Roof
Packaged Unit (RTU)	Aaon	RM-003-3-0-AA01-212	200508-AMGC18138	3 Ton	Gymnasium	Roof
Packaged Unit (RTU)	Aaon	RM-020-3-0-AA02-242	200508-AMGP18151	20 Ton	Gymnasium	Roof
Packaged Unit (RTU)	Aaon	RM-008-3-0-AA02-232	200503-AMGH18082	8 Ton	Gymnasium	Roof
Packaged Unit (RTU)	Aaon	RM-003-3-0-AA01-212	200508-AMGC18139	3 Ton	Gymnasium	Roof
Packaged Unit (RTU)	Aaon	RM-020-3-0-AA02-242	200508-AMGP18152	20 Ton	Gymnasium	Roof
Packaged Unit (RTU)	Aaon	RM-010-3-0-AA02-232	200508-AMGH18085	10 Ton	Gymnasium	Roof
Packaged Unit (RTU)	Aaon	RM-002-3-0-AA01-212	200508-AMGB18141	2 Ton	Gymnasium	Roof
Packaged Unit (RTU)	AAON, Inc.	RM-008-3-0-AA02-232	200508-AMGH18083	8 Ton	Gymnasium	Roof
Packaged Unit (RTU)	Aaon	RM-020-3-0-AA02-242	200508-AMGP18150	20 Ton	Gymnasium	Roof
Packaged Unit (RTU)	Aaon	RM-008-3-0-AA02-232	Illegible	10 Ton	Gymnasium	Roof
Packaged Unit (RTU)	Aaon	RM-015-3-0-AA02-232	200503-AMGL16300	15 Ton	Library	Roof
Air Curtain	Mars Air Systems	Standard 36	A9004SE36-L	1,000 CFM	Cafeteria	Kitchen
Air Curtain	Mars Air Systems	Standard 36	A9006SE36-L	1,000 CFM	Cafeteria	Kitchen
Circulation Pump	Bell & Gossett	A3	2506-862	1 HP	Gymnasium	Pool Storage Tank Room
Gas Heater	Bryan Boilers	315 WT	7524	840 MBH	Gymnasium	Pool Storage Tank Room
Gas Heater	Ray	NB 3309	150EP B5087-4	750 MBH	Gymnasium	Pool Storage Tank Room
Circulation Pump	No tag/plate found	No tag/plate found	No tag/plate found	1 HP	Gymnasium	Pool Storage Tank Room
Circulation Pump	Goulds pumps	NSF-50	C221280-01C61	15 HP	Gymnasium	Pool Pump Room

APPENDIX C:
Lighting System Schedule

										Lamp Details				Fixture Details				Existing Consumption	
Line No.	Building Name	Interior/ Exterior	Floor	Space Type	Room No.	Additional Area Description	LUX	Control Quantity	Existing Control	Technology	Sub-Technology	Lamp Type	Total Lamps	Fixture Type	Fixture Quantity	24x7 Fixture Count	Fixture Height	Annual Hours	Existing Annual kWh
1	004	Interior		MECHANICAL	M001		-	1	Light Switch	Linear Fluorescent	T8	4' 32W T8	8	Industrial	4	0	8	1,520	389
2	004	Interior		MECHANICAL	B001		-	1	Light Switch	Linear Fluorescent	T8	4' 32W T8	24	Industrial	12	0	8	1,520	1,167
3	004	Interior		CLASSROOM	O001		-	12	Light Switch	Linear Fluorescent	T8	4' 32W T8	288	Industrial	144	0	8	1,520	14,008
4	004	Interior		CLASSROOM	C002		-	3	Wall-Mounted Sensor	Linear Fluorescent	T8	4' 32W T8	6	2x4 Prism Troffer	3	0	8	1,520	292
5	004	Interior		CLASSROOM	C001		-	1	Wall-Mounted Sensor	Linear Fluorescent	T8	4' 32W T8	8	Industrial	4	0	8	1,520	389
6	004	Interior		CLASSROOM	S003		-	4	Light Switch	Linear Fluorescent	T8	4' 32W T8	12	Industrial	6	0	8	1,520	584
7	004	Exterior		HALLWAY	Exterior		-	1	Timer	Linear Fluorescent	T8	4' 32W T8	60	2x4 Parabolic Troffer	30	0	8	1,520	2,918
8	004	Interior		CLASSROOM	O007		-	3	Light Switch	Linear Fluorescent	T8	4' 32W T8	64	Industrial	32	0	8	1,520	3,113
9	004	Interior		CLASSROOM	O006		-	8	Light Switch	Linear Fluorescent	T8	4' 32W T8	48	Industrial	24	0	8	1,520	2,335
10	004	Interior		CLASSROOM	O006		-	8	Light Switch	Linear Fluorescent	T8	4' 32W T8	8	2x4 Prism Troffer	2	0	8	1,520	389
11	004	Interior		CLASSROOM	O006		-	8	Light Switch	Linear Fluorescent	T8	4' 32W T8	12	2x4 Prism Troffer	6	0	8	1,520	584
12	004	Interior		OFFICE	C003		-	3	Light Switch	Linear Fluorescent	T8	4' 32W T8	3	2x4 Prism Troffer	1	0	8	1,520	146
13	004	Interior		OFFICE	J002		-	3	Light Switch	Linear Fluorescent	T8	4' 32W T8	12	Industrial	6	0	8	1,520	584
14	004	Interior		OFFICE	J002		-	3	Light Switch	Linear Fluorescent	T8	4' 32W T8	12	Industrial	6	0	8	1,520	584
15	004	Interior		OFFICE	J002		-	3	Light Switch	Linear Fluorescent	T8	4' 32W T8	16	Industrial	8	0	8	1,520	778
16	005	Interior		MeCHANICAL	H12		-	2	Wall-Mounted Sensor	Linear Fluorescent	T8	4' 32W T8	2	2x4 Prism Troffer	2	0	8	1,520	97
17	005	Interior		MeCHANICAL	H12		-	2	Ceiling-Mounted Sensor	Linear Fluorescent	T8	4' 32W T8	54	2x4 Prism Troffer	18	0	8	1,520	2,627
18	005	Interior		MECHANICAL	C007		-	3	Wall-Mounted Sensor	Linear Fluorescent	T8	4' 32W T8	12	2x4 Prism Troffer	6	0	8	1,520	584
19	005	Interior		ClASSROOM	N004		-	4	Wall-Mounted Sensor	Linear Fluorescent	T8	4' 32W T8	50	Industrial	25	0	8	1,520	2,432
20	005	Interior		ClASSROOM	O003		-	1	Wall-Mounted Sensor	Linear Fluorescent	T8	4' 32W T8	4	Industrial	2	0	8	1,520	195
21	005	Interior		ClASSROOM	F9		-	6	Light Switch	Linear Fluorescent	T8	4' 32W T8	360	Industrial	180	0	8	1,520	17,510
22	005	Interior		STORAGE	Tool storage		-	10	Wall-Mounted Sensor	Linear Fluorescent	T8	4' 32W T8	40	Industrial	20	0	8	760	973
23	005	Exterior		HALLWAY	Exterior		-	1	Timer	Linear Fluorescent	T8	4' 32W T8	22	2x4 Prism Troffer	11	0	8	1,520	1,070
24	005	Exterior		HALLWAY	Exterior		-	1	Timer	HID	MH	MH250	2	Wallpack-Horizontal	2	0	8	1,520	760
25	005	Interior		ClASSROOM	O001		-	6	Wall-Mounted Sensor	Linear Fluorescent	T8	4' 32W T8	72	Industrial	36	0	8	1,520	3,502
26	005	Interior		OFFICE	Office		-	7	Wall-Mounted Sensor	Linear Fluorescent	T8	4' 32W T8	28	Industrial	14	0	8	1,520	1,362
27	005	Interior		OFFICE	N008		-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	9	2x4 Prism Troffer	3	0	8	1,520	438
28	005	Interior		OFFICE	H8		-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	27	2x4 Prism Troffer	9	0	8	1,520	1,313
29	005	Interior		CLASSROOM	H-9		-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	48	2x4 Prism Troffer	16	0	8	1,520	2,335
30	005	Interior		CLASSROOM	H-10		-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	39	2x4 Prism Troffer	13	0	8	1,520	1,897
31	005	Interior		CLASSROOM	H11		-	2	Ceiling-Mounted Sensor	Linear Fluorescent	T8	4' 32W T8	36	2x4 Prism Troffer	12	0	8	1,520	1,751
32	003	Interior		CAFETERIA	L001		-	4	Light Switch	Linear Fluorescent	T8	4' 32W T8	154	Industrial	77	0	8	1,520	7,491
33	003	Interior		OPEN OFFICE	S001		-	6	Wall-Mounted Sensor	Linear Fluorescent	T8	4' 32W T8	24	Industrial	12	0	8	1,520	1,167
34	003	Interior		KITCHEN	Kitchen		-	10	Light Switch	Linear Fluorescent	T8	4' 32W T8	24	2x4 Prism Troffer	12	0	8	1,520	1,167
35	003	Interior		KITCHEN	Kitchen		-	10	Light Switch	Linear Fluorescent	T8	4' 32W T8	24	2x4 Prism Troffer	12	0	8	1,520	1,167
36	003	Interior		KITCHEN	Kitchen		-	10	Light Switch	Linear Fluorescent	T8	4' 32W T8	24	2x4 Prism Troffer	12	0	8	1,520	1,167
37	003	Exterior		HALLWAY	Exterior		-	1	Timer	Linear Fluorescent	T8	4' 32W T8	12	2x4 Prism Troffer	6	0	8	1,520	584
38	003	Exterior		HALLWAY	Exterior		-	1	Timer	HID	MH	MH250	2	Wallpack-Horizontal	2	0	8	1,520	760
39	003	Exterior		CAFETERIA	D001		-	1	Timer	Linear Fluorescent	T8	4' 32W T8	36	2x4 Prism Troffer	9	0	8	1,520	1,751
40	003	Interior		OPEN OFFICE	T001		-	4	Wall-Mounted Sensor	Linear Fluorescent	T8	4' 32W T8	8	Industrial	4	0	8	1,520	389
41	003	Interior		KITCHEN	Kitchen		-	10	Light Switch	Linear Fluorescent	T8	4' 32W T8	8	2x4 Prism Troffer	4	0	8	1,520	389
42	014	Interior		GYMNASIUM	G4		-	6	Light Switch	Linear Fluorescent	T8	4' 32W T8	120	2x4 Prism Troffer	30	0	8	1,520	5,837
43	014	Interior		GYMNASIUM	G003		-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	24	2x4 Prism Troffer	6	0	8	1,520	1,167
44	014	Interior		GYMNASIUM	G1		-	6	Light Switch	Linear Fluorescent	T8	4' 32W T8	176	2x4 Prism Troffer	44	0	8	1,520	8,561
45	014	Interior		GYMNASIUM	G1		-	6	Light Switch	Linear Fluorescent	T8	4' 32W T8	18	2x4 Prism Troffer	9	0	8	1,520	876
46	014	Exterior		GYMNASIUM	Exterior		-	1	Light Switch	Linear Fluorescent	T8	4' 32W T8	26	2x4 Prism Troffer	13	0	8	1,520	1,265
47	014	Exterior		GYMNASIUM	Exterior		-	1	Timer	HID	MH	MH250	8	Wallpack-Horizontal	8	0	8	1,520	3,040
48	014	Exterior		GYMNASIUM	Exterior		-	1	Light Switch	CFL	CFL - 4 Pin	CFL42	1	Surface Mount Can	1	0	8	1,520	64
49	014	Exterior		CLASSROOM	G9		-	4	Light Switch	Linear Fluorescent	T8	4' 32W T8	36	2x4 Prism Troffer	18	0	8	1,520	1,751
50	014	Exterior		JANITORIAL	J001		-	3	Light Switch	Linear Fluorescent	T8	4' 32W T8	6	2x4 Prism Troffer	3	0	8	1,520	292
51	014	Exterior		OFFICE	C008		-	5	Wall-Mounted Sensor	Linear Fluorescent	T8	4' 32W T8	30	2x4 Prism Troffer	15	0	8	1,520	1,459
52	014	Exterior		MECHANICAL	Mechanical		-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	18	2x4 Prism Troffer	9	0	8	1,520	876
53	014	Exterior		MECHANICAL	Pool room		-	2	Wall-Mounted Sensor	Linear Fluorescent	T8	4' 32W T8	6	2x4 Prism Troffer	3	0	8	1,520	292
54	014	Exterior		MECHANICAL	Pool room		-	2	Light Switch	Incan/H/MR	Incan	I100-A19	2	High hat	2	0	8	1,520	304
55	014	Exterior		LOCKER ROOM	Boys locker room		-	1	Wall-Mounted Sensor	Linear Fluorescent	T8	4' 32W T8	4	2x4 Prism Troffer	2	0	8	1,520	195
56	014	Exterior		LOCKER ROOM	Boys locker room		-	1	Wall-Mounted Sensor	Linear Fluorescent	T8	4' 32W T8	8	2x4 Prism Troffer	4	0	8	1,520	389
57	014	Exterior		LOCKER ROOM	Boys locker room		-	1	Wall-Mounted Sensor	Linear Fluorescent	T8	4' 32W T8	8	2x4 Prism Troffer	4	0	8	1,520	389
58	014	Exterior		LOCKER ROOM	Boys locker room		-	1	Wall-Mounted Sensor	Linear Fluorescent	T8	4' 32W T8	16	2x4 Prism Troffer	8	0	8	1,520	778
59	014	Interior		RESTROOM	Girls shower room		-	6	Light Switch	Linear Fluorescent	T8	4' 32W T8	240	2x4 Prism Troffer	120	0	8	1,520	11,674
60	014	Interior		RESTROOM	G7		-	2	Wall-Mounted Sensor	Linear Fluorescent	T8	4' 32W T8	20	2x4 Prism Troffer	10	0	8	1,520	973
61	014	Exterior		RESTROOM	Boys restroom		-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	12	2x4 Prism Troffer	6	0	8	1,520	584
62	013	Interior		AUDITORIUM	H001		-	1	Light Switch	Linear Fluorescent	T8	4' 32W T8	14	2x4 Prism Troffer	7	0	8	760	340
63	013	Interior		MECHANICAL	Mech		-	1	Light Switch	Linear Fluorescent	T8	4' 32W T8	2	2x4 Prism Troffer	1	0	8	760	49
64	013	Exterior		HALLWAY	Exterior		-	1	Timer	Linear Fluorescent	T8	4' 32W T8	16	2x4 Prism Troffer	8	0	8	1,520	778
65	013	Exterior		HALLWAY	Exterior		-	1	Timer	HID	MH	MH250	4	Wallpack-Horizontal	4	0	8	1,520	1,520

66	013	Exterior		CLASSROOM	M1		-	3	Timer	Linear Fluorescent	T8	4' 32W T8	102	Industrial	34	0	8	1,520	4,961
67	013	Exterior		CLASSROOM	W002		-	4	Light Switch	Linear Fluorescent	T8	4' 32W T8	114	Industrial	38	0	8	1,520	5,545
68	013	Exterior		StAIRWELL	W006		-	3	Wall-Mounted Sensor	Linear Fluorescent	T8	4' 32W T8	12	2x4 Prism Troffer	6	0	8	1,520	584
69	013	Interior		CLASSROOM	M3		-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	87	Industrial	29	0	8	1,520	4,232
70	013	Interior		CLASSROOM	M3		-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	15	2x4 Prism Troffer	5	0	8	1,520	730
71	012	Interior		MECHANICAL	M004		-	1	Light Switch	Linear Fluorescent	T8	4' 32W T8	12	2x4 Prism Troffer	6	0	8	1,520	584
72	012	Exterior		HALLWAY	Exterior		-	1	Timer	Linear Fluorescent	T8	4' 32W T8	16	2x4 Prism Troffer	8	0	8	1,520	778
73	012	Exterior		HALLWAY	Exterior		-	1	Timer	HID	MH	MH250	5	Wallpack-Horizontal	5	0	8	1,520	1,900
74	012	Exterior		HALLWAY	H002		-	4	Light Switch	Linear Fluorescent	T8	4' 32W T8	8	2x4 Prism Troffer	4	0	8	1,520	389
75	012	Exterior		AuDITORIUM	Auditorium		-	6	Building Management System	Incan/H/MR	Incan	I100-Globe	88	2x4 Prism Troffer	44	0	8	1,520	13,376
76	012	Exterior		AuDITORIUM	T001		-	2	Building Management System	Incan/H/MR	Incan	I100-Globe	12	2x4 Prism Troffer	6	0	8	760	912
77	012	Exterior		AuDITORIUM	Auditorium		-	6	Light Switch	CFL	CFL - 4 Pin	CFL42	14	High hat	14	0	8	1,520	894
78	012	Exterior		HALLWAY	Exterior		-	1	Light Switch	Linear Fluorescent	T8	4' 32W T8	16	2x4 Prism Troffer	4	0	8	1,520	778
79	002	Interior		MECHANICAL	M001		-	1	Light Switch	Linear Fluorescent	T8	4' 32W T8	4	2x4 Prism Troffer	2	0	8	1,520	195
80	002	Interior		LIBRARY	L1		-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	16	2x4 Prism Troffer	4	0	8	1,520	778
81	002	Interior		LIBRARY	L1		-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	72	Industrial	36	0	8	1,520	3,502
82	002	Interior		LIBRARY	S002		-	8	Light Switch	Linear Fluorescent	T8	4' 32W T8	16	2x4 Prism Troffer	8	0	8	1,520	778
83	002	Exterior		HALLWAY	Exterior		-	0	Timer	Linear Fluorescent	T8	4' 32W T8	4	2x4 Prism Troffer	2	0	8	1,520	195
84	006	Exterior		HALLWAY	Exterior		-	1	Light Switch	Linear Fluorescent	T8	4' 32W T8	28	2x4 Prism Troffer	14	0	8	1,520	1,362
85	007	Exterior		HALLWAY	Exterior		-	1	Timer	Linear Fluorescent	T8	4' 32W T8	28	2x4 Prism Troffer	14	0	8	1,520	1,362
86	008	Interior		HALLWAY	Exterior		-	1	Light Switch	Linear Fluorescent	T8	4' 32W T8	28	2x4 Prism Troffer	14	0	8	1,520	1,362
87	009	Exterior		HALLWAY	Exterior		-	1	Timer	Linear Fluorescent	T8	4' 32W T8	30	2x4 Prism Troffer	15	0	8	1,520	1,459
88	010	Interior		HALLWAY	Exterior		-	1	Timer	Linear Fluorescent	T8	4' 32W T8	28	2x4 Prism Troffer	14	0	8	1,520	1,362
89	011	Exterior		HALLWAY	Exterior		-	1	Timer	Linear Fluorescent	T8	4' 32W T8	32	2x4 Prism Troffer	16	0	8	1,520	1,556
90	006	Exterior		CLASSROOM	B6		-	12	Light Switch	Linear Fluorescent	T8	4' 32W T8	288	2x4 Prism Troffer	144	0	8	1,520	14,008
91	006	Exterior		RESTROOM	Men's		-	2	Wall-Mounted Sensor	Linear Fluorescent	T8	4' 32W T8	12	2x4 Prism Troffer	6	0	8	1,520	584
92	006	Exterior		RESTROOM	All gender		-	1	Wall-Mounted Sensor	Linear Fluorescent	T8	4' 32W T8	2	2x4 Prism Troffer	1	0	8	1,520	97
93	007	Exterior		CLASSROOM	D-8		-	4	Wall-Mounted Sensor	Linear Fluorescent	T8	4' 32W T8	8	2x4 Prism Troffer	4	0	8	1,520	389
94	007	Exterior		CLASSROOM	D-8		-	4	Wall-Mounted Sensor	Linear Fluorescent	T8	4' 32W T8	16	2x4 Prism Troffer	8	0	8	1,520	778
95	007	Exterior		CLASSROOM	D-7		-	12	Wall-Mounted Sensor	Linear Fluorescent	T8	4' 32W T8	288	2x4 Prism Troffer	144	0	8	1,520	14,008
96	007	Exterior		JANITORIAL	J001		-	1	Wall-Mounted Sensor	Linear Fluorescent	T8	4' 32W T8	2	2x4 Prism Troffer	1	0	8	1,520	97
97	008	Interior		RESTROOM	T001		-	1	Wall-Mounted Sensor	Linear Fluorescent	T8	4' 32W T8	2	2x4 Prism Troffer	1	0	8	1,520	97
98	008	Interior		CLASSROOM	F-6		-	12	Wall-Mounted Sensor	Linear Fluorescent	T8	4' 32W T8	288	2x4 Prism Troffer	144	0	8	1,520	14,008
99	008	Interior		RESTROOM	T003		-	2	Wall-Mounted Sensor	Linear Fluorescent	T8	4' 32W T8	12	2x4 Prism Troffer	6	0	8	1,520	584
100	011	Exterior		CLASSROOM	F-3		-	12	Light Switch	Linear Fluorescent	T8	4' 32W T8	288	2x4 Prism Troffer	144	0	8	1,520	14,008
101	011	Exterior		CLASSROOM	T002		-	0	Ceiling-Mounted Sensor	Linear Fluorescent	T8	4' 32W T8	12	2x4 Prism Troffer	6	0	8	1,520	584
102	010	Interior		CLASSROOM	E-4		-	12	Light Switch	Linear Fluorescent	T8	4' 32W T8	12	2x4 Prism Troffer	6	24	8	1,520	584
103	010	Interior		CLASSROOM	E-1		-	4	Wall-Mounted Sensor	Linear Fluorescent	T8	4' 32W T8	8	2x4 Prism Troffer	4	0	8	1,520	389
104	010	Interior		CLASSROOM	E-1		-	4	Wall-Mounted Sensor	Linear Fluorescent	T8	4' 32W T8	16	2x4 Prism Troffer	8	0	8	1,520	778
105	009	Exterior		CLASSROOM	C-3		-	12	Light Switch	Linear Fluorescent	T8	4' 32W T8	288	2x4 Prism Troffer	144	0	8	1,520	14,008
106	009	Exterior		RESTROOM	T003		-	1	Wall-Mounted Sensor	Linear Fluorescent	T8	4' 32W T8	2	2x4 Prism Troffer	1	0	8	1,520	97
107	009	Exterior		RESTROOM	T002		-		Wall-Mounted Sensor	Linear Fluorescent	T8	4' 32W T8	12	2x4 Prism Troffer	6	0	8	1,520	584
108	P005 to P011	Exterior		CLASSROOM	K-1		-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	30	2x4 Prism Troffer	15	0	8	1,520	1,459
109	P005 to P011	Exterior		CLASSROOM	K-2		-	10	Light Switch	Linear Fluorescent	T8	4' 32W T8	120	2x4 Prism Troffer	60	0	8	1,520	5,837
110	P003	Interior		HALLWAY	Exterior		-	1	Light Switch	CFL	CFL - 2 Pin	CFL13	8	Wallpack-Vertical	4	0	8	1,520	158
111	P003	Interior		CLASSROOM	P-5		-	10	Light Switch	Linear Fluorescent	T8	4' 32W T8	180	2x4 Prism Troffer	60	0	8	1,520	8,755
112	P002	Interior		CLASSROOM	P004		-	1	Light Switch	Linear Fluorescent	T8	8' 86W T8	12	Strip Fixture	6	0	8	1,520	1,569
113	P004	Interior		CLASSROOM	P004		-	1	Light Switch	Linear Fluorescent	T8	4' 32W T8	48	2x4 Prism Troffer	12	0	8	1,520	2,335
114	P001	Interior		CLASSROOM	J-4		-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	45	2x4 Prism Troffer	15	0	8	1,520	2,189
115	P001	Exterior		HALLWAY	Exterior		-	1	Timer	HID	MH	MH250	1	Wallpack-Horizontal	1	0	8	1,520	380
116	005	Interior		OFFICE	Teacher office		-	1	Wall-Mounted Sensor	Linear Fluorescent	T8	4' 32W T8	4	Industrial	2	0	8	1,520	195
117	001	Interior		HALLWAY	Exterior		-	1	Light Switch	Linear Fluorescent	T8	4' 32W T8	36	2x4 Prism Troffer	18	0	8	1,520	1,751
118	001	Interior		HALLWAY	F004		-	4	Light Switch	Linear Fluorescent	T8	4' 32W T8	18	2x4 Prism Troffer	9	0	8	1,520	876
119	001	Interior		HALLWAY	F004		-	4	Light Switch	Linear Fluorescent	T8	4' 32W T8	24	2x4 Prism Troffer	12	0	8	1,520	1,167
120	001	Interior	1	CLASSROOM	A-20		-	3	Light Switch	Linear Fluorescent	T8	4' 32W T8	90	2x4 Prism Troffer	45	0	8	1,520	4,378
121	001	Interior		OffICE	A-14		-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	24	2x4 Prism Troffer	12	0	8	1,520	1,167
122	001	Interior		CLASSROOM	A-18		-	1	Light Switch	Linear Fluorescent	T8	4' 32W T8	40	2x4 Prism Troffer	20	0	8	1,520	1,946
123	001	Interior		CLASSROOM	A-16		-	3	Light Switch	Linear Fluorescent	T8	4' 32W T8	54	2x4 Prism Troffer	27	0	8	1,520	2,627
124	001	Interior		CLASSROOM	A14B		-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	2	2x4 Prism Troffer	1	0	8	1,520	97
125	001	Interior		CLASSROOM	A14B		-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	14	2x4 Prism Troffer	7	0	8	1,520	681
126	001	Interior		OFFICE	S005		-	4	Light Switch	Linear Fluorescent	T8	4' 32W T8	16	2x4 Prism Troffer	8	0	8	1,520	778
127	001	Interior		RESTROOM	T008		-	3	Light Switch	Linear Fluorescent	T8	4' 32W T8	6	2x4 Prism Troffer	3	0	8	1,520	292
128	001	Interior		OFFICE	A-10		-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	40	2x4 Prism Troffer	20	0	8	1,520	1,946
129	001	Interior		MECHANICAL	M003		-	1	Light Switch	Linear Fluorescent	T8	4' 32W T8	4	2x4 Prism Troffer	2	0	8	1,520	195
130	001	Interior		OFFICE	A-9		-	3	Light Switch	Linear Fluorescent	T8	4' 32W T8	24	2x4 Prism Troffer	12	0	8	1,520	1,167
131	001	Interior		RESTROOM	T004		-	0	Ceiling-Mounted Sensor	Linear Fluorescent	T8	4' 32W T8	16	2x4 Prism Troffer	8	0	8	1,520	778
132	001	Interior		STORAGE	J003		-	3	Light Switch	Linear Fluorescent	T8	4' 32W T8	6	Strip Fixture	3	0	8	1,520	292
133	001	Interior	2	HALLWAY	Hallway		-	1	Light Switch	Linear Fluorescent	T8	4' 32W T8	38	2x4 Prism Troffer	19	0	8	1,520	1,848
134	001	Interior	2	CLASSROOM	A201		-	34	Light Switch	Linear Fluorescent	T8	4' 32W T8	816	2x4 Prism Troffer	408	0	8	1,520	39,690
135	001	Interior	2	STORAGE	S204		-	1	Light Switch	Linear Fluorescent	T8	4' 32W T8	6	2x4 Prism Troffer	2	0	8	760	146
136	001	Interior	2	STORAGE	S203		-	5	Light Switch	Linear Fluorescent	T8	4' 32W T8	45	2x4 Prism Troffer	15	0	8	722	1,040
137	001	Interior	2	STORAGE	J201		-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	4	Strip Fixture	2	0	8	722	92

138	001	Interior		STORAGE	A212		-	1	Light Switch	Linear Fluorescent	T8	4' 32W T8	16	Strip Fixture	8	0	8	722	370
139	001	Interior	2	RESTROOM	T201		-	2	Ceiling-Mounted Sensor	Linear Fluorescent	T8	4' 32W T8	16	2x4 Prism Troffer	8	0	8	1,520	778
140	001	Interior		OFFICE	C007		-	1	Light Switch	Linear Fluorescent	T8	4' 32W T8	4	2x4 Prism Troffer	2	0	8	1,520	195
141	001	Interior		OFFICE	C008		-	10	Light Switch	Linear Fluorescent	T8	4' 32W T8	80	2x4 Prism Troffer	40	0	8	1,520	3,891
142	001	Interior		OFFICE	C016		-	3	Light Switch	Linear Fluorescent	T8	4' 32W T8	36	2x4 Prism Troffer	18	0	8	1,520	1,751
143	001	Interior		STORAGE	S002		-	1	Wall-Mounted Sensor	Linear Fluorescent	T8	4' 32W T8	4	2x4 Prism Troffer	2	0	8	722	92
144	001	Interior		OFFICE	A5		-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	64	2x4 Prism Troffer	32	0	8	1,520	3,113
145	001	Interior		RESTROOM	J001		-	2	Wall-Mounted Sensor	Linear Fluorescent	T8	4' 32W T8	8	2x4 Prism Troffer	4	0	8	1,520	389
146	001	Interior		HALLWAY	Office hallway		-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	26	2x4 Prism Troffer	13	0	8	1,520	1,265
147	001	Interior		HALLWAY	Reception		-	3	Light Switch	Linear Fluorescent	T8	4' 32W T8	134	2x4 Prism Troffer	67	0	8	1,520	6,518
148	001	Interior		HALLWAY	Entrance		-	1	Light Switch	Linear Fluorescent	T8	4' 32W T8	16	2x4 Prism Troffer	8	0	8	1,520	778
149	001	Interior		OFFICE	Office		-	1	Light Switch	Linear Fluorescent	T8	4' 32W T8	4	2x4 Prism Troffer	1	0	8	1,520	195
150	001	Interior		OFFICE	A-13		-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	40	2x4 Prism Troffer	20	0	8	1,520	1,946
151	001	Interior		OFFICE	S004		-	1	Light Switch	Linear Fluorescent	T8	4' 32W T8	16	2x4 Prism Troffer	8	0	8	1,520	778
152	Stadium building	Exterior		HALLWAY	Exterior		-	1	Timer	CFL	CFL - 4 Pin	CFL42	29	Wallpack-Horizontal	29	0	8	1,520	1,851
153	Stadium building	Exterior		CLASSROOM	1506		-	2	Timer	Linear Fluorescent	T8	4' 32W T8	56	2x4 Prism Troffer	28	0	8	1,520	2,724
154	Stadium building	Exterior		RESTROOM	Men		-	5	Timer	Linear Fluorescent	T8	4' 32W T8	60	2x4 Prism Troffer	30	0	8	1,520	2,918
155	Stadium building	Exterior		STORAGE	1608		-	2	Timer	Linear Fluorescent	T8	4' 32W T8	24	2x4 Prism Troffer	12	0	8	1,520	1,167
156	Stadium building	Exterior		STORAGE	Storage		-	2	Timer	Linear Fluorescent	T8	4' 32W T8	16	2x4 Prism Troffer	8	0	8	722	370
157	Stadium building	Exterior		OFFICE	Commentators area		-	1	Light Switch	Linear Fluorescent	T8	4' 32W T8	10	2x4 Prism Troffer	5	0	8	722	231
158	Stadium building	Exterior		RESTROOM	All gender in 1504		-	1	Wall-Mounted Sensor	Linear Fluorescent	T8	4' 32W T8	2	2x4 Prism Troffer	1	0	8	1,520	97
159	Stadium building	Exterior		OFFICE	1502		-	4	Light Switch	Linear Fluorescent	T8	4' 32W T8	16	2x4 Prism Troffer	8	0	8	1,520	778
	Totals												7,308		3,442				369,871

									Fixture Details						Existing Consumption					Proposed- Post Retrofit			
Line No.	Building Name	Interior/ Exterior	Floor	Space Type	Room No.	Additional Area Description	Existing Control	Control Quantity	Technology	Sub-Technology	Lamp- Fixture	Fixture Quantity	Total Lamps	Fixture Height	Annual Hours	Existing Annual kWh	ECM	ECM Type	Recommended Sensor	LED Lamp Retrofit	Annual Hours of Operation	Proposed Annual kWh	Annual Savings From LED Retrofit
																							kWh
1	004	Interior		MECHANICAL	M001		Light Switch	1	Linear Fluorescent	T8	4' 32W T8; Industrial	4	8	8	1,520	389	ECM	RB - Replace Bulb	Ceiling Mounted	4' 17W LED T8	1,292	176	213
2	004	Interior		MECHANICAL	B001		Light Switch	1	Linear Fluorescent	T8	4' 32W T8; Industrial	12	24	8	1,520	1,167	ECM	RB - Replace Bulb	Ceiling Mounted	4' 17W LED T8	1,292	527	640
3	004	Interior		CLASSROOM	O001		Light Switch	12	Linear Fluorescent	T8	4' 32W T8; Industrial	144	288	8	1,520	14,008	ECM	RB - Replace Bulb	Ceiling Mounted	4' 17W LED T8	1,292	6,326	7,683
4	004	Interior		CLASSROOM	C002		Wall-Mounted Sensor	3	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	3	6	8	1,520	292	ECM	RB - Replace Bulb	Retain Existing Controls	4' 17W LED T8	1,520	155	137
5	004	Interior		CLASSROOM	C001		Wall-Mounted Sensor	1	Linear Fluorescent	T8	4' 32W T8; Industrial	4	8	8	1,520	389	ECM	RB - Replace Bulb	Retain Existing Controls	4' 17W LED T8	1,520	207	182
6	004	Interior		CLASSROOM	S003		Light Switch	4	Linear Fluorescent	T8	4' 32W T8; Industrial	6	12	8	1,520	584	ECM	RB - Replace Bulb	Wall Mounted	4' 17W LED T8	1,292	264	320
7	004	Exterior		HALLWAY	Exterior		Timer	1	Linear Fluorescent	T8	4' 32W T8; 2x4 Parabolic Troffer	30	60	8	1,520	2,918	ECM	RB - Replace Bulb	Ceiling Mounted	4' 17W LED T8	1,292	1,318	1,601
8	004	Interior		CLASSROOM	O007		Light Switch	3	Linear Fluorescent	T8	4' 32W T8; Industrial	32	64	8	1,520	3,113	ECM	RB - Replace Bulb	Ceiling Mounted	4' 17W LED T8	1,292	1,406	1,707
9	004	Interior		CLASSROOM	O006		Light Switch	8	Linear Fluorescent	T8	4' 32W T8; Industrial	24	48	8	1,520	2,335	ECM	RB - Replace Bulb	Ceiling Mounted	4' 17W LED T8	1,292	1,054	1,280
10	004	Interior		CLASSROOM	O006		Light Switch	8	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	2	8	8	1,520	389	ECM	RB - Replace Bulb	Ceiling Mounted	4' 17W LED T8	1,292	176	213
11	004	Interior		CLASSROOM	O006		Light Switch	8	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	6	12	8	1,520	584	ECM	RB - Replace Bulb	Ceiling Mounted	4' 17W LED T8	1,292	264	320
13	004	Interior		OFFICE	J002		Light Switch	3	Linear Fluorescent	T8	4' 32W T8; Industrial	6	12	8	1,520	584	ECM	RB - Replace Bulb	Wall Mounted	4' 17W LED T8	1,292	264	320
15	004	Interior		OFFICE	J002		Light Switch	3	Linear Fluorescent	T8	4' 32W T8; Industrial	8	16	8	1,520	778	ECM	RB - Replace Bulb	Wall Mounted	4' 17W LED T8	1,292	351	427
17	005	Interior		MeCHANICAL	H12		Ceiling-Mounted Sensor	2	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	18	54	8	1,520	2,627	ECM	RB - Replace Bulb	Retain Existing Controls	4' 17W LED T8	1,520	1,395	1,231
19	005	Interior		CIASSROOM	N004		Wall-Mounted Sensor	4	Linear Fluorescent	T8	4' 32W T8; Industrial	25	50	8	1,520	2,432	ECM	RB - Replace Bulb	Retain Existing Controls	4' 17W LED T8	1,520	1,292	1,140
21	005	Interior		CIASSROOM	F9		Light Switch	6	Linear Fluorescent	T8	4' 32W T8; Industrial	180	360	8	1,520	17,510	ECM	RB - Replace Bulb	Ceiling Mounted	4' 17W LED T8	1,292	7,907	9,603
22	005	Interior		STORAGE	Tool storage		Wall-Mounted Sensor	10	Linear Fluorescent	T8	4' 32W T8; Industrial	20	40	8	760	973	ECM	RB - Replace Bulb	Retain Existing Controls	4' 17W LED T8	760	517	456
24	005	Exterior		HALLWAY	Exterior		Timer	1	HID	MH	MH250; Wallpack-Horizontal	2	2	8	1,520	760	ECM	RF - Replace Entire Fixture	Photo Sensor	70W LED Wallpack	1,292	181	579
25	005	Interior		CIASSROOM	O001		Wall-Mounted Sensor	6	Linear Fluorescent	T8	4' 32W T8; Industrial	36	72	8	1,520	3,502	ECM	RB - Replace Bulb	Ceiling Mounted	4' 17W LED T8	1,292	1,581	1,921
26	005	Interior		OFFICE	Office		Wall-Mounted Sensor	7	Linear Fluorescent	T8	4' 32W T8; Industrial	14	28	8	1,520	1,362	ECM	RB - Replace Bulb	Retain Existing Controls	4' 17W LED T8	1,520	724	638
27	005	Interior		OFFICE	N008		Light Switch	2	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	3	9	8	1,520	438	ECM	RB - Replace Bulb	Wall Mounted	4' 17W LED T8	1,292	198	240
28	005	Interior		OFFICE	H8		Light Switch	2	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	9	27	8	1,520	1,313	ECM	RB - Replace Bulb	Wall Mounted	4' 17W LED T8	1,292	593	720
32	003	Interior		CAFETERIA	L001		Light Switch	4	Linear Fluorescent	T8	4' 32W T8; Industrial	77	154	8	1,520	7,491	ECM	RB - Replace Bulb	Ceiling Mounted	4' 17W LED T8	1,292	3,382	4,108
33	003	Interior		OPEN OFFICE	S001		Wall-Mounted Sensor	6	Linear Fluorescent	T8	4' 32W T8; Industrial	12	24	8	1,520	1,167	ECM	RB - Replace Bulb	Retain Existing Controls	4' 17W LED T8	1,520	620	547
34	003	Interior		KITCHEN	Kitchen		Light Switch	10	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	12	24	8	1,520	1,167	ECM	RB - Replace Bulb	Ceiling Mounted	4' 17W LED T8	1,292	527	640
35	003	Interior		KITCHEN	Kitchen		Light Switch	10	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	12	24	8	1,520	1,167	ECM	RB - Replace Bulb	Ceiling Mounted	4' 17W LED T8	1,292	527	640
36	003	Interior		KITCHEN	Kitchen		Light Switch	10	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	12	24	8	1,520	1,167	ECM	RB - Replace Bulb	Ceiling Mounted	4' 17W LED T8	1,292	527	640
37	003	Exterior		HALLWAY	Exterior		Timer	1	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	6	12	8	1,520	584	ECM	RB - Replace Bulb	Ceiling Mounted	4' 17W LED T8	1,292	264	320
38	003	Exterior		HALLWAY	Exterior		Timer	1	HID	MH	MH250; Wallpack-Horizontal	2	2	8	1,520	760	ECM	RF - Replace Entire Fixture	Ceiling Mounted	70W LED Wallpack	1,292	181	579
39	003	Exterior		CAFETERIA	D001		Timer	1	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	9	36	8	1,520	1,751	ECM	RB - Replace Bulb	Ceiling Mounted	4' 17W LED T8	1,292	791	960
40	003	Interior		OPEN OFFICE	T001		Wall-Mounted Sensor	4	Linear Fluorescent	T8	4' 32W T8; Industrial	4	8	8	1,520	389	ECM	RB - Replace Bulb	Retain Existing Controls	4' 17W LED T8	1,520	207	182
41	003	Interior		KITCHEN	Kitchen		Light Switch	10	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	4	8	8	1,520	389	ECM	RB - Replace Bulb	Ceiling Mounted	4' 17W LED T8	1,292	176	213
42	014	Interior		GYMNASIUM	G4		Light Switch	6	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	30	120	8	1,520	5,837	ECM	RB - Replace Bulb	Ceiling Mounted	4' 17W LED T8	1,292	2,636	3,201
45	014	Interior		GYMNASIUM	G1		Light Switch	6	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	9	18	8	1,520	876	ECM	RB - Replace Bulb	Ceiling Mounted	4' 17W LED T8	1,292	395	480
48	014	Exterior		GYMNASIUM	Exterior		Light Switch	1	CFL	CFL - 4 Pin	CFL42; Surface Mount Can	1	1	8	1,520	64			Ceiling Mounted				
49	014	Exterior		CLASSROOM	G9		Light Switch	4	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	18	36	8	1,520	1,751	ECM	RB - Replace Bulb	Ceiling Mounted	4' 17W LED T8	1,292	791	960
50	014	Exterior		JANITORIAL	J001		Light Switch	3	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	3	6	8	1,520	292	ECM	RB - Replace Bulb	Wall Mounted	4' 17W LED T8	1,292	132	160
51	014	Exterior		OFFICE	C008		Wall-Mounted Sensor	5	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	15	30	8	1,520	1,459	ECM	RB - Replace Bulb	Retain Existing Controls	4' 17W LED T8	1,520	775	684
52	014	Exterior		MECHANICAL	Mechanical		Light Switch	2	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	9	18	8	1,520	876	ECM	RB - Replace Bulb	Ceiling Mounted	4' 17W LED T8	1,292	395	480
53	014	Exterior		MECHANICAL	Pool room		Wall-Mounted Sensor	2	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	3	6	8	1,520	292	ECM	RB - Replace Bulb	Ceiling Mounted	4' 17W LED T8	1,292	132	160
54	014	Exterior		MECHANICAL	Pool room		Light Switch	2	Incan/H/MR	Incan	I100-A19; High hat	2	2	8	1,520	304	ECM		Ceiling Mounted	16W LED A19	1,292	41	263
55	014	Exterior		LOCKER ROOM	Boys locker room		Wall-Mounted Sensor	1	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	2	4	8	1,520	195	ECM	RB - Replace Bulb	Ceiling Mounted	4' 17W LED T8	1,292	88	107
56	014	Exterior		LOCKER ROOM	Boys locker room		Wall-Mounted Sensor	1	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	4	8	8	1,520	389	ECM	RB - Replace Bulb	Ceiling Mounted	4' 17W LED T8	1,292	176	213
58	014	Exterior		LOCKER ROOM	Boys locker room		Wall-Mounted Sensor	1	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	8	16	8	1,520	778	ECM	RB - Replace Bulb	Ceiling Mounted	4' 17W LED T8	1,292	351	427
60	014	Interior		RESTROOM	G7		Wall-Mounted Sensor	2	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	10	20	8	1,520	973	ECM	RB - Replace Bulb	Retain Existing Controls	4' 17W LED T8	1,520	517	456
62	013	Interior		AUDITORIUM	H001		Light Switch	1	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	7	14	8	760	340	ECM	RB - Replace Bulb	Wall Mounted	4' 17W LED T8	646	154	187
64	013	Exterior		HALLWAY	Exterior		Timer	1	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	8	16	8	1,520	778	ECM	RB - Replace Bulb	Photo Sensor	4' 17W LED T8	1,292	351	427
65	013	Exterior		HALLWAY	Exterior		Timer	1	HID	MH	MH250; Wallpack-Horizontal	4	4	8	1,520	1,520	ECM	RF - Replace Entire Fixture	Photo Sensor	70W LED Wallpack	1,292	362	1,158
66	013	Exterior		CLASSROOM	M1		Timer	3	Linear Fluorescent	T8	4' 32W T8; Industrial	34	102	8	1,520	4,961	ECM	RB - Replace Bulb	Photo Sensor	4' 17W LED T8	1,292	2,240	2,721
67	013	Exterior		CLASSROOM	W002		Light Switch	4	Linear Fluorescent	T8	4' 32W T8; Industrial	38	114	8	1,520	5,545	ECM	RB - Replace Bulb	Photo Sensor	4' 17W LED T8	1,292	2,504	3,041
68	013	Exterior		SIAIRWELL	W006		Wall-Mounted Sensor	3	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	6	12	8	1,520	584	ECM	RB - Replace Bulb	Retain Existing Controls	4' 17W LED T8	1,520	310	274
69	013	Interior		CLASSROOM	M3		Light Switch	2	Linear Fluorescent	T8	4' 32W T8; Industrial	29	87	8	1,520	4,232	ECM	RB - Replace Bulb	Ceiling Mounted	4' 17W LED T8	1,292	1,911	2,321
70	013	Interior		CLASSROOM	M3		Light Switch	2	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	5	15	8	1,520	730	ECM	RB - Replace Bulb	Ceiling Mounted	4' 17W LED T8	1,292	329	400
72	012	Exterior		HALLWAY	Exterior		Timer	1	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	8	16	8	1,520	778	ECM	RB - Replace Bulb	Photo Sensor	4' 17W LED T8	1,292	351	427
73	012	Exterior		HALLWAY	Exterior		Timer	1	HID	MH	MH250; Wallpack-Horizontal	5	5	8	1,520	1,900	ECM	RF - Replace Entire Fixture	Photo Sensor	70W LED Wallpack	1,292	452	1,448
74	012	Exterior		HALLWAY	H002		Light Switch	4	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	4	8	8	1,520	389	ECM	RB - Replace Bulb	Photo Sensor	4' 17W LED T8	1,292	176	213
76	012	Exterior		AuDITORIUM	T001		Building Management System	2	Incan/H/MR	Incan	I100-Globe; 2x4 Prism Troffer	6	12	8	760	912			Ceiling Mounted				
78	012	Exterior		HALLWAY	Exterior		Light Switch	1	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	4	16	8	1,520	778	ECM	RB - Replace Bulb	Photo Sensor	4' 17W LED T8	1,292	351	427
79	002	Interior		MECHANICAL	M001		Light Switch	1	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	2	4	8	1,520	195	ECM	RB - Replace Bulb	Ceiling Mounted	4' 17W LED T8	1,292	88	107
80	002	Interior		LIBRARY	L1		Light Switch	2	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	4	16	8	1,520	778	ECM	RB - Replace Bulb	Ceiling Mounted	4' 17W LED T8	1,292	351	427
81	002	Interior		LIBRARY	L1		Light Switch	2	Linear Fluorescent	T8	4' 32W T8; Industrial	36	72	8	1,520	3,502	ECM	RB - Replace Bulb	Ceiling Mounted	4' 17W LED T8	1,292	1,581	1,921
82	002	Interior		LIBRARY	S002		Light Switch	8	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	8	16	8	1,520	778	ECM	RB - Replace Bulb	Ceiling Mounted	4' 17W LED T8	1,292	351	427
85	007	Exterior		HALLWAY	Exterior		Timer	1	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	14	28	8	1,520	1,362	ECM	RB - Replace Bulb	Photo Sensor	4' 17W LED T8	1,292	615	747
87	009	Exterior		HALLWAY	Exterior		Timer	1	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	15	30	8	1,520	1,459	ECM	RB - Replace Bulb	Photo Sensor	4' 17W LED T8	1,292	659	800
91	006	Exterior		RESTROOM	Men's		Wall-Mounted Sensor	2	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	6	12	8	1,520	584	ECM	RB - Replace Bulb	Retain Existing Controls	4' 17W LED T8	1,520	310	274
92	006	Exterior		RESTROOM	All gender		Wall-Mounted Sensor	1	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	1	2	8	1,520	97	ECM	RB - Replace Bulb	Retain Existing Controls	4' 17W LED T8	1,520	52	46
93	007	Exterior		CLASSROOM	D-8		Wall-Mounted Sensor	4	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	4	8	8	1,520	389	ECM	RB - Replace Bulb	Retain Existing Controls	4' 17W LED T8	1,520	207	182
94	007	Exterior		CLASSROOM	D-8		Wall-Mounted Sensor	4	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	8	16	8	1,520	778	ECM	RB - Replace Bulb	Retain Existing Controls	4' 17W LED T8	1,520	413	365
95	007	Exterior		CLASSROOM	D-7		Wall-Mounted Sensor	12	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	144	288	8	1,520	14,008	ECM	RB - Replace Bulb	Retain Existing Controls	4' 17W LED T8	1,520	7,442	6,566
97	008	Interior		RESTROOM	T001		Wall-Mounted Sensor	1	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	1	2	8	1,520	97	ECM	RB - Replace Bulb	Retain Existing Controls	4' 17W LED T8	1,520	52	46
98	008	Interior		CLASSROOM	F-6		Wall-Mounted Sensor	12	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	144	288	8	1,520	14,008	ECM	RB - Replace Bulb	Retain Existing Controls	4' 17W LED T8	1,520	7,442	6,566
99	008	Interior		RESTROOM	T003		Wall-Mounted Sensor	2	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	6	12	8	1,520	584	ECM	RB - Replace Bulb	Retain Existing Controls	4' 17W LED T8	1,520	310	274
104	010	Interior		CLASSROOM	E-1		Wall-Mounted Sensor	4	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	8	16	8	1,520	778	ECM	RB - Replace Bulb	Retain Existing Controls	4' 17W LED T8	1,520	413	365
106	009	Exterior		RESTROOM	T003		Wall-Mounted Sensor	1	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	1	2	8	1,520	97	ECM	RB - Replace Bulb	Retain Existing Controls	4' 17W LED T8	1,520	52	46
109	P005 to P011	Exterior		CLASSROOM	K-2		Light Switch	10	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	60	120	8	1,520	5,837	ECM	RB - Replace Bulb	Wall Mounted	4' 17W LED T8	1,292	2,636	3,201
	Totals												7,308									160,728	190,477

APPENDIX D:
ECM Checklist

NA	In Place	Evaluate	ECM Description
✓			Add Reflective Coating To Exterior Windows
✓			Replace External Windows
	✓		Upgrade Insulation
✓			Control External Air Leakage In Commercial Buildings
	✓		Install Reflective Insulation Between Radiators And External Wall
✓			Replace Existing Motors With High Efficiency Motors
	✓		Install On-Demand Ventilation on Air Handlers
	✓		Reduce HVAC Hours of Operation
✓			Install Variable Frequency Drives (VFD)
✓			Install Outside Air Temperature Reset Controls For Hot Water Boilers
✓			Install Chilled Water Reset Control
	✓		Install Timers On Exhaust Fans
✓			Install Energy Savers on Vending, Snack Machines
	✓		Install Building Energy Management System and Replace Terminal Units
	✓		Re-Commission The Building & Its Control Systems
	✓		Replace Inefficient Heating Plant
	✓		Replace Inefficient Cooling Plant
	✓		Replace Existing Air Conditioners with Energy Star Air Conditioners
✓			Replace Unit Electric Heaters with Natural Gas Fired Unit Heaters
✓			Convert From Gas Pilot to Electronic Ignition for Boilers
		✓	Insulate Hot Water Pipes
	✓		Insulate Refrigerant Lines
	✓		Insulate Hot Surfaces And Tanks
	✓		Insulate Air Ducts
✓			Replace Defective Steam Traps
✓			Upgrade Electric Heating System To Heat Pumps
✓			Replace Inefficient Furnace System
✓			Replace Rooftop Package Unit
✓			Install Energy Recovery Wheel on Air Handling Unit
		✓	Replace Existing Water Heater With New Energy Efficient Units
		✓	Replace Incandescent/Halogen Lamps With Energy Efficient Lamps
		✓	Upgrade Inefficient Linear Fluorescent Lamps And Fixtures
	✓		Upgrade EXIT SIGNS With LED EXIT Signs
		✓	Bilevel and Tandem Linear Fluorescent Lighting ECM
		✓	Replace High Intensity Discharge (HID) Lamps With Energy Efficienct Lamps
		✓	Replace Existing Refrigerator(s) With Energy Star Certified Refrigerator(s)
✓			Replace Existing Freezers With High Efficiency Freezers
✓			Install Low Flow Shower Heads
		✓	Install Low Flow Faucet Aerators
		✓	Install Low Flow Restroom Flush Tank Toilets
		✓	Install Low Flow Tankless Restroom Fixtures

APPENDIX E:
ECM Calculations

UIC	**Install Low Flow Faucet Aerators**
EAP2-b	**Location**: Throughout Building

Property Type:	**Commercial**	Estimated No. of Operational Weeks	38
		Number of Occupied Days/Week (Max 7)	5

KITCHEN FAUCETS			**BATHROOM FAUCETS**		
Number of Occupants Affected By Retrofit	1,835		Number of Occupants Affected by Retrofit	1,835	
Do You Want To Replace Kitchen Faucets Aerators	Yes	*(Select)*	Do You Want To Replace Bathroom Faucets Aerators	Yes	*(Select)*
Total Number of Faucet Aerators To Be Replaced	27		Total Number of Faucet Aerators To Be Replaced	38	
Total Number of Faucets To Be Replaced:	0		Total Number of Faucets To Be Replaced:	0	
GPM of Existing Faucet Aerators	2.2	GPM	GPM of Existing Faucet Aerators	2.2	GPM
GPM of Proposed Faucet Aerator	1.5	GPM	GPM of Proposed Faucet Aerator	0.5	GPM
Estimated Number of Uses Per Day	4		Estimated Number of Uses Per Day	5	

Annual Water Savings From Installing Low Flow Aerators: 378.22 kGal

WATER & ENERGY SAVING CALCULATION			**COST SAVING CALCULATION**		
Select Type of Water Heater Fuel:	Natural Gas	(Select)	Property Location in United States	North Central Localities	
Energy Factor of Domestic Hot Water Heater:	0.54	EF	Heating Fuel Tariff	$1.14	$/Therm
Hot Water Discharge Temperature at Faucet	110.00	°F	Water Tariff ($/1000 Gal)	$4.20	$/kGal
Equivalent Heating Fuel Savings:	2,979	Therms	Annual Cost Savings In Form of Water	$1,590	$
Savings Discounted by 15% to Account For Cold Water Use					
Annual Water Savings	378.22	kGal	Annual Energy Savings From Water Heater	$3,383	$

COST BENEFIT ANALYSIS				
Estimated Total Annual Cost Savings	$4,973	$$	Estimated Total Installation Cost	$990	$$
Simple Payback Period	0.20	Years	*Type of Recommendation*	No/Low Cost ECM Recommendation	

ECM EXPLANATION:

By reducing the flow of water coming from the restroom faucets, aerators can generate energy savings at low cost and with easy installation. The savings generated would be in the form of reduced water and sewer costs and at the same time aerators would save energy by reducing the demand for hot water. The average faucet has a flow rate of about 2 to 4 GPM. Adding a screw-in faucet aerator reduces the flow to 0.5 to 1.5 GPM in the bathroom and 2.2 GPM in the kitchen. In addition to saving energy and water, the "foamier" water that comes from faucet aerators wets objects better than water from a faucet with no aerator, which tends to bounce off the object rather than thoroughly wetting it.

EMG recommends replacing the proposed faucet aerators with new low flow aerators as mentioned above. The proposed ECM shall also result in an annual energy saving in form of reduction in water heating bills.

Summary:

Initial Investment: $990 Estimated Annual Cost Savings: $4,973 Simple Payback Period (Yrs): 0.20

UIC	Insulate Hot Water Pipes
EAH6A	Location: Utility Closets

ENTER EXISTING CONDITION

Type of Heating Fuel	Electric (Select)	System Under Consideration:	Domestic Water Heaters
Enter Estimated Length of Exposed Pipe (Ft)	15.00	Average Diameter of the Exposed Pipe	0.33 (Ft)
Average Ambient Space Temperature Around The Exposed Pipe (˚F)	75.00 ◦F	Average Temperature of Fluid In The Pipe (◦F)	120.00 ◦F
Estimated Annual Heating Plant Efficiency (%):	84%	Estimated Annual Heating Hours of Operation (Hrs)	8,760 Hrs

EXISTING STATE		PROPOSED	
Enter The Existing Net Effective R-Value of The Return Pipe	0.62 Sq.Ft deg F.hr/btu	Enter The Proposed Net Effective R-Value of The Return Pipe	6.00 Sq.Ft deg F.hr/btu
Annual Conduction Losses From Existing Insulation	9,989 kBtu/Yr	Annual Conduction Losses From Proposed Insulation	1,032 kBtu/Yr

ENERGY SAVINGS

Estimated Energy Savings	8,956 kBtu	Estimated Total Annual Input Heating Energy Savings	10,662 kBtu
Cost of Heating Fuel/Unit:	$0.13 $/kWh	Estimated Total Annual Input Heating Energy Savings	3,125 kWh

COST ANALYSIS

Estimated Cost For Adding Insulation	$287 $$	Total Annual Estimated Cost Savings	$412 $$
Simple Pay Back Period	0.70 Years	*Type of Recommendation*	No/Low Cost ECM Recommendation

ECM DESCRIPTION:

EMG recommends insulating hot water pipes with cylindrical half-sections of insulation or with flexible cell material. Large pipes should be insulated with flexible material. If access to the pipes for servicing is required, rigid insulation (curved or flat segments or cylindrical half-, third-, or quarter-sections) offers an advantage. Fittings such as elbows, valves, and tees may be insulated with preformed insulation, fabricated fitting insulation, individual pieces cut from sectional straight pipe insulation, or insulating cements. Fitting insulation should be cemented with pipe insulation (ASHRAE 1985). In marginally heated spaces, the heat loss from the pipe might be used to maintain temperatures above freezing. In that case, it might be desirable to leave a portion of the pipe un-insulated.

SUMMARY:

Initial Investment: $287 Simple Payback: 0.70 Years

Energy Cost Savings: $412

UIC	**Upgrade Building Lighting to LED and Install Automatic Lighting Controls**
EAL10	**Location: Building Interior and Exterior**

	No. of ECMs	No. of Fixtures	No. of Lamps	KWh Saved	Energy Cost Saving	O & M Savings
Upgrade Lighting to LED	296	3,338	7,144	190,432	$24,756.20	$8,480.02

Existing Technology	**Sub-Technology**	**No. of ECMs**	**No. of Fixtures**	**No. of Lamps**	**KWh Saved**	**Energy Cost Saving**	**O & M Savings**
CFL	CFL - 2 Pin	0	0	0	0	$0	$0
CFL	CFL - 4 Pin	0	0	0	0	$0	$0
CFL	CFL - Screw-in	0	0	0	0	$0	$0
Circiline	T9	0	0	0	0	$0	$0
Incan/H/MR	H	0	0	0	0	$0	$0
Incan/H/MR	Incan	1	2	2	263	$34	$313
Incan/H/MR	MR	0	0	0	0	$0	$0
HID	HPS	0	0	0	0	$0	$0
HID	MH	6	22	22	6,370	$828	$357
HID	MV	0	0	0	0	$0	$0
HID	QL	0	0	0	0	$0	$0
Linear Fluorescent	T8	145	3,314	3,314	183,799	$23,894	$7,810
Linear Fluorescent	T12	0	0	0	0	$0	$0
Linear Fluorescent	T8 U	0	0	0	0	$0	$0
Linear Fluorescent	T12 U	0	0	0	0	$0	$0
Linear Fluorescent	T5	0	0	0	0	$0	$0
Linear Fluorescent	T6	0	0	0	0	$0	$0
Linear Fluorescent	T10	0	0	0	0	$0	$0

Proposed Controls	**No. of Controls**		**No. of Controls**
Photo Sensor	26	Ceiling Mounted	326
Wall Mounted	64		

Initial Investment			**Equipment Rentals**	
Material Cost	$84,978.42		Scissor Lift 26' - Interior Spaces	$0.00
Labor Cost	$150,059.00		Bucket Truck - Exterior Spaces	$0.00
Local Electric Rate:	$0.16	$/kWh	Estimated Annual Energy Savings:	190,432
Hourly Labor Rate For Electrician:	$72.40		Estimated Annual Energy Cost Savings:	$24,756
Budgeted Initial Investment:	$235,037		Estimated Annual O&M Cost Savings:	$8,480
Estimated Return on Investment: *(Including O&M Savings)*	7.07	Years	Estimated Annual Cost Savings:	$33,236

UIC	**Replace Existing Refrigerator(s) With Energy Star Certified Refrigerator(s)**
EAA1	**Location: Throughout**

Number of Refrigerators To Be Replaced	3	Qty
Details of Existing Refrigerator:	1980-1989 Top Freezer 18.5-18.9 CuFt-1987.5 kWh	
Estimated Annual Energy Consumption By The Existing Refrigerator:	1,988	kWh/Year
Proposed New Refrigerator:	Top Freezer 10.1 CuFt -297 kWh/Yr	
Estimated Proposed Annual Energy Consumption of The New Refrigerator:	297	kWh/Year
Annual Kwh Savings Per Unit (Kwh/year)	1,691	kWh
Total Annual Kwh Savings (Kwh/year)	5,072	kWh
Current Electrical Tariff ($/Kwh)	$0.13	$/kWh
Annual Cost Savings From All Refrigerators ($$)	$669	$$

Total Installation Cost Including, Eco Friendly Disposal Of Existing Refrigerator ($$)

No. of Units	Disposal Tax	Unit Cost	Total Cost	
3	$50	$379	$1,921	$$

Simple Return on Investment: 2.87 Yrs

Note- *Average Life of a Refrigerator is 15 Years*

Type of Recommendation: Capital Cost ECM Recommendation

ECM DESCRIPTION:

One of the highest 'silent' energy consuming devices in any home/office is the refrigerator, which runs all year long. Having a low energy consuming refrigerator thus results in a considerable reduction in the annual energy costs. On an average a useful life of any refrigerator is approximately 19 years and hence EMG recommends replacing the current refrigerator at the end of its useful life with a new energy star certified low energy consuming refrigerator.

EMG strongly recommends replacing the existing older non energy star refrigerators with new energy efficient Energy Star Certified refrigerators of the appropriate type.

The expected useful life of new refrigerators is approximately 15 years.

Summary:

Initial Investment:	$1,921	Simple Payback:	2.87	Yrs
Annual Cost Savings:	$669			

UIC	Install Low Flow Tankless Restroom Fixtures
EAP4	Location: Throughout

ECM FOR DETERMINING WATER SAVINGS IN COMMERCIAL PROPERTIES

Number of Males	917	
Number of Females	918	
Number of Occupied Days Per Week (Max 7)	5	
Number of Occupied Weeks/Year (Max 52)	38	
Number of Urinals To Be Retrofitted	42	
Number of Water Closets To Be Retrofitted	60	
No. of Water Closets With Separate Flush Tank *(Typical Residential Type)*	0	
Estimated Restroom Usage/Individual/Day *Default is 4 Uses/Day For Residential/Office*	4	(Select)

Urinal Water Savings

Do you Want To Make Any Changes To The Urinals?	Yes	
Estimated Existing Use of Urinal/Day/Man	80%	
Existing Gallons Per Flush Ratings For Urinal Flushes	1.00	GPF
Proposed Urinal	0.125 GPF -Wall Mount	
GPF of Proposed Urinal Flush Valve**	0.125	GPF
Estimated Annual Water Savings From Urinal	487.84	kGal

***(1992 EpACT Energy Act Mandates 1.0GPF Max on Urinals)*

Water Closet Water Savings

Tankless Water Closets

Do The Water Closet Need To Be Retrofitted?	*(Select)*	Yes	
Existing Gallons Per Flush Ratings For Water Closet Flushes		1.60	GPF
Are The Existing Water Closet Being Replaced? *(If No; Then Only The Flush Valve Would Be Replaced With Dual Flush Retrofit Kit)*	*(Select)*	No	
No. of Tankless Water Closets		60	
GPF of Proposed Dual Flush- Water Closet Valve*	*Solid Waste (20%)*	1.60	GPF
**(Federal Law Requires All Flushes Not To Exceed 1.6 GPF)*	*Liquid Waste (80%)*	0.48	GPF
Estimated Annual Water Savings From Male Users		124.89	kGal
Estimated Annual Water Savings From Female Users		625.12	kGal
Total Water Savings From Water Closets		750.01	kGal

Water & Cost Saving Calculations

Water Savings Calculation

Water Savings By The Use of Low Flow Water Closet Flush Valves/Yr	750.01	kgal
Water Savings By The Use of Low Flow Urinal Flush Valves/ Yr	487.84	kgal
Total Annual Water Savings in kgal	1237.85	kgal

Cost Savings Calculations

Enter Water Tariff Rate ($/1000Gal)	$4.20	$$
Estimated Cost Savings From Water	$5,205	$$

Estimated Cost of Retrofit

Cost For Replacing Existing Urinal Fixture With A Low Flow Fixture *(Includes Labor)*	$54,615	$$
Cost For Replacing Existing Flush Valves With Low Flow - Dual Flush Valves ($80 Per Unit) *(Up For Liquid Waste And Down For Solid Waste)* *(Includes Labor)*	$37,143	$$
Estimated Total Cost For Retrofit	$91,757	$$
Simple Pay Back Period	17.63	Yrs
Type of Recommendation	Capital Cost ECM Recommendation	

ECM EXPLANATION:

The highest water utilization at any home/office occurs in the restrooms. It is estimated that on an average a normal human being uses the restroom at least four times a day. Keeping with the global water conservation objectives, federal law prohibits use of any new water closet flushes over 1.6 GPF. At the same time the '1992 EpACT' mandates all new Urinals to have a maximum 1.0 GPF flush valves on urinals.

EMG recommends replacing all urinals above 1.0 GPF with a new 0.5 GPF or lesser urinals. At the same time EMG also recommends replacing all the water closets having a GPF rating of 1.6 and over with low flow water closet fixtures equipped with dual flush valves.

In case the property doesn't wish to replace the entire water closet fixtures, EMG recommends retrofitting all the tankless water closet flush fixtures with new dual flush fixtures that would result in a 30% water savings per flush for liquid wastes, while retaining the same flush rate for solid wastes.

SUMMARY:

Initial Investment:	$91,757	Simple Payback Period:	17.63 Yrs
Annual Cost Savings:	$5,205		

UIC	**Replace Existing Water Heater With New Energy Efficient Units**
EAD3	**Location: Utility Closet J001**

Step 1	**Existing Water Heater Details**	*Utility Closet J001*						
	Number of Water Heaters Being Replaced:	2						
	Select Existing Hot Water Heater Fuel	Electric		Natural Gas		Natural Gas		Electric
	Insert Energy Factor of Existing Water Heater	0.85	EF		EF		EF	EF
	Input Existing Water Heater Input Rating	6.00	kW		kBtus		kBtus	kW
	Select One Method For Calculation	Annual Heating Hours		Annual Heating Hours		Annual DWH Load		Annual DWH Load
	Insert Average Annual Hours of Operation	1,520	hrs		hrs		Therms	kWh
	Annual Water Heater Energy Consumption/Heater	9,120	kWh	0	Therms	#DIV/0!	hrs	#DIV/0! hrs
	Total Estimated Annual Energy Consumption For all Heaters	18,240	kWh	0	Therms	0	Therms	0 kWh
	Total Estimated Annual Operating Energy Costs For all Heaters	$2,405	$	$0	$	$0	$	$0 $
Step 2	**Proposed New Water Heater**							
	Proposed Hot Water Heater Fuel	Natural Gas		Heat Pump		Electric		Natural Gas
	Capacity of the Proposed New Water Heater	285MBH- Boiler						
	Energy Factor of Proposed Water Heater	0.96	EF	0.00	EF	0.00	EF	0.00 EF
	Proposed Water Heater Input Rating	285.00	kBtuh	0.00	kW	0.00	kW	0.00 kBtuh
	Annual kBtuh Consumption For All The Proposed Water Heaters	55,104	kBtuh	#DIV/0!	kBtuh	#DIV/0!	kBtuh	#DIV/0! kBtuh
	Estimated Annual Water Heater Fuel Consumption (All Heaters)	551	Therms	0	kWh	0	kWh	0 Therms
	Estimated Total Annual Energy Costs	$626	$	$0		$0		$0
Step 3	**Energy & Cost Saving Calculation**							
	Estimated Cost of New Water Heater/Unit	$8,160	$	$0	$	$0	$	$0 $
	Total Estimated Installation Cost	$24,359	$	$0	$	$0	$	$0 $
	Total Estimated Annual Cost Savings	$1,779	$	$0	$	$0	$	$0 $
	Total Annual Cost Savings:	$1,779		Total Initial Investment::		$24,359		
	Simple Pay Back Period	13.69						
	Type of Recommendation	Capital Cost ECM Recommendation						

ECM SUMMARY:

Electric resistance is the most expensive method for heating domestic hot water. A natural gas or propane fired water system provide more units of heat with direct burning of fuel while high wattage draw is required for electric water heaters to create resistance heat. This electric usage can be seen with the increase power demand for the site and the additional kWh consumption. The installation process of the gas/propane fired water heater requires additional measures with tying a gas line or fuel tank to the system along with installing an exhaust gas vent. This process is not a costly retrofit if a current gas line or tank is at the site. The hot water exhaust duct can be tied to the existing gas fired furnaces or boilers for an easy retrofit.

SUMMARY:

Initial Investment: $24,359 Simple Payback: 13.69 yrs
Annual Cost Savings: $1,779

APPENDIX F:
Solar PV

UIC	Install Fixed Tilt Solar Photovoltaic System
EAR-2	Details:Rooftop Solar PV

Select State: Northern California **Electric Rate:** $0.13 $/KWH Annual Electric Consumption: 1,717,662 KWh

Roof No.	Description	Number of Roofs	DC System Size Per Roof	PV System Sizing For All Roofs	Estimated Number of 315 Watt PV Panels:	Total Estimated Annual Electricity Generated/ Roof	Total Estimated Electricity Generated (All Roofs)	Total Cost Savings	Installation Cost: ($3.5/Watt)	Simple Pay Back Period without Incentives	One Time Potential Utility or State Incentives	One Time Potential Federal Incentives	Annual Potential Incentives and Rebates		Simple Pay Back Period with All Incentives
			kW	kW		kWh	kWh			Yrs		Dept. of Treasury Renewable Grant (30%)	Federal REPI Incentive	Solar Renewable Certificates (SRECS)-(~$0/MWH)	Years
												30%	$0.02	$0	
1	Building 1	1	40.70	41	129	62,415	62,415	$8,114	$142,450	17.6	$0	$42,735	$1,373	$0	10.6
2	Building 2	1	24	24	77	37,111	37,111	$4,824	$84,700	17.6	$0	$25,410	$816	$0	10.6
3	Building 3	1	27	27	86	41,712	41,712	$5,423	$95,200	17.6	$0	$28,560	$918	$0	10.6
4	Building 4	1	33	33	105	50,760	50,760	$6,599	$115,850	17.6	$0	$34,755	$1,117	$0	10.6
5	Building 5	1	54	54	171	82,657	82,657	$10,745	$188,650	17.6	$0	$56,595	$1,818	$0	10.6
6	Building 6	1	53	53	169	81,430	81,430	$10,586	$185,850	17.6	$0	$55,755	$1,791	$0	10.6
7	Building 7	1	22	22	71	34,351	34,351	$4,466	$78,400	17.6	$0	$23,520	$756	$0	10.6
8	Building 8	1	44	44	139	67,168	67,168	$8,732	$153,300	17.6	$0	$45,990	$1,478	$0	10.6
		8		**298**	**947**	**457,604.0**	**457,604**	**$59,489**	**$1,044,400**	**17.56**	**$0**	**$313,320**	**$10,067**	**$0**	**10.60**

Solar Rooftop Photovoltaic Analysis		
Total Number of Roofs	8	
Estimated Number of Panels	947	
Estimated KW Rating	298	KW
Potential Annual KWh Produced	457,604	KWh
% of Current Electricity Load	26.6%	

Financial Analysis		
Investment Cost	$1,044,400	
Estimated Energy Cost Savings	$59,489	
Potential Rebates	$313,320	
Potential Annual Incentives	$10,067	
Payback without Incentives	17.6	years
Incentive Payback but without SRECS	10.6	years
Payback with All Incentives	10.6	years