STAFF REPORT

Report To: Board of Supervisors **Meeting Date:** December 1, 2016

Staff Contact: Laura Tadman and Darren Schulz

Agenda Title: For Possible Action: To award Contract No. 1415-123B Performance Based Contract to Ameresco, Inc. for a total not to exceed amount of $4,170,786 to be funded from the Construction – Energy Performance Contract Fund as provided in fiscal year 16/17. (Laura Tadman; LTadman@carson.org and Darren Schulz; DSchulz@carson.org)

Staff Summary: This contract is for the Implementation and Construction Phase of the Energy Performance Contract Project, allowing for the construction of the energy and maintenance cost saving improvements developed during the design phase.

Agenda Action: Formal Action/Motion **Time Requested:** 5 minutes

---

Proposed Motion

I move to award Contract No. 1415-123B Performance Based Contract to Ameresco, Inc. for a total not to exceed amount of $4,170,786 to be funded from the Construction – Energy Performance Contract Fund as provided in fiscal year 16/17.

Board's Strategic Goal

Sustainable Infrastructure

Previous Action

October 1, 2015 - Contract 1415-123 for financial grade auditing services was awarded to Ameresco, Inc. for an amount not to exceed $76,000.

Background/Issues & Analysis

Pursuant to NRS 332.300-332.440 local governments may enter into a performance contract with a qualified service company for the purchase and installation of an operating cost-savings measure to reduce costs related to energy, water and the disposal of waste, and related labor costs. Such a performance contract may be in the form of an installment payment contract or a lease-purchase contract.

Applicable Statute, Code, Policy, Rule or Regulation

NRS 332.300-332.440

Financial Information

Is there a fiscal impact? ☒ Yes ☐ No

If yes, account name/number: Construction – Energy Performance Contract / 210-0000-430.70-40

Is it currently budgeted? ☐ Yes ☒ No

Explanation of Fiscal Impact: If approved this project will be funded by the issuance of two installment purchase agreements for a combined total of $4,276,538. The project costs, proceeds from the issuance of the installments purchase agreements and other related costs will be added to the City's FY17 Budget upon confirmation of the final amounts.

Alternatives

Not award contract and provide other direction.

Board Action Taken:

Motion: _____ 1) _____ Aye/Nay

2) _____ _____

_____

_____

_____

_____

(Vote Recorded By)

CONTRACT # 1415-123B

PERFORMANCE-BASED CONTRACT

This Performance-Based Contract is entered into by and between:

Carson City, a consolidated municipality
and political subdivision of the State of Nevada
Contact Person: Tom Grundy
3505 Butti Way
Carson City, NV 89701

and

Ameresco, Inc.
Contact Person: Robert Georgeoff
480.499.9122
rgeorgeoff@ameresco.com

PERFORMANCE-BASED CONTRACT

TERMS AND CONDITIONS

Table of Contents

1 Incorporated Documents

This Contract incorporates the following attachments in descending order of constructive precedence; a Contractor's Attachment shall not contradict or supersede any specifications, terms or conditions without written evidence of mutual assent to such change appearing in this Contract:

ATTACHMENT AA:
Financial Grade Operational Audit (Dated: November 2, 2016)

2 Contract Term

This Contract shall be effective upon the approval of Carson City through the Twenty (20) Year Anniversary Date of the Project Acceptance completion date, unless sooner terminated by either party as specified in this Contract.

3 Definitions

A. Accumulated Energy Savings ("**Accumulated Energy Savings**") means the City's total energy savings as outlined in Schedule C – Installment Purchase Cash Flow Analysis entitled 'Total Annual Savings' and shall include electric energy savings, gas energy savings, operational savings, maintenance savings, water consumption savings, and any other savings for the Project installed by the Contractor.

B. Accumulated Realized Savings ("**Accumulated Realized Savings**") means the sum of the savings derived from the sum of M&V Savings plus any Stipulated Savings.

C. Base Utility Rates ("**Base Utility Rates**") means the utility rates as described in the Financial-Grade Operational Audit (Attachment AA), used by Contractor, to calculate the ECM/OC Savings for the various ECM/OCS Measures.

D. Capitalized Interest ("**Capitalized Interest")** means interest, if any, on the cost of money from the time the Project loan funds into escrow and the City making the first payment to the Contractor.

E. Carson City ("**City**") means Carson City, Nevada, a consolidated municipality and political subdivision of the State of Nevada.

F. Change Order ("**Change Order**") means a written agreement, issued after execution of this Contract, signed by the City and the Contractor, changing the terms hereof or adding to, deducting from, or otherwise modifying the Project, or extending or modifying the date for Substantial Completion or Final Completion, adjusting the Contract Sum, or the Project Term.

G. Construction Interest ("**Construction Interest")** means interest on cost incurred by the Contractor on the Project from the beginning of the Project through the time the Contractor begins to receive progress payments. A bank (or other financing entity) 'construction interest' certification will be provided as part of the Project's 'open book pricing' summary and recapitulation at the end of the Project.

H. Commissioning Plan (**"Commissioning Plan"**) is the Contractor's plan, as described in Section 9 of Attachment AA (Financial-Grade Operational Audit), to start-up and check out equipment/systems installed under this Contract.

I. Independent Contractor/Energy Services Company ("**Contractor**") means Ameresco, Inc., the contractor that will perform services and/or provide goods for the City under the terms and conditions set forth in this Contract.

J. Department ("**Department**") means the Department of Public Works of the City.

K. Direct Project Costs ("**Direct Project Costs**") consist of labor, equipment and material required to perform the defined scope of work. It also includes the job site costs, permits, temporary services and utilities, disposal of materials, subcontracted design engineering, safety and security measures, subcontracted field supervision, subcontractor quality control, subcontractor bond cost, construction contingency, subcontractor administrative submittals for the Project and subcontractor overhead and profit for the project.

L. Energy Cost Savings Measures ("**ECMs**") / Operating Cost Savings Measures ("**OCS Measures**") mean those measures, as defined in NRS 332.330, included in the Project that result in savings of energy, water, or operating and maintenance costs set forth in Attachment AA.

M. Equipment ("**Equipment**") means all items of equipment provided to the City pursuant to this Contract.

N. Facilities ("**Facilities**") mean any buildings and/or grounds at which the Scope of Work of this Contract is to be performed.

O. Final Commissioning Report (**"Final Commissioning Report**") shall be provided to the City by the Contractor within 35 days of receiving the City's comments and responses to the Contractor's Initial Commissioning Report. The City's comments and responses shall be provided to the Contractor within 30 days of receipt of Contractor's Initial Commissioning Report. The Final Report will reflect what equipment/systems were commissioned, what occurred, any problems that were encountered and steps taken to resolve the problem, all completed pre- and post- measurements and/or tests; and, will address any issues, questions or concerns previously raised by the City.

P. Final Completion for each OCS Measure/ECM ("**Final Completion**") shall be achieved when all the punch list items, identified at the Substantial Completion date have been satisfactorily completed, and the City's Representative has signed the Project Acceptance Letter.

Q. Fiscal Year ("**Fiscal Year**") means the period beginning July 1st and ending June 30th of the following year.

R. Guaranteed Maximum Price ("**GMP**") is that series of specified prices and total price of the Project, as set forth in Section 16C, that the Contractor guarantees not to exceed without agreement by the parties hereto

S. Guaranteed Energy Savings ("**Guaranteed Energy Savings**") means the savings Contractor guarantees as part of this Contract as outlined in Schedule C; and shall include electric energy savings, gas energy savings, operational savings, maintenance savings, water consumption savings, and any other savings for the Project installed by the Contractor.

T. Indirect Project Costs ("**Indirect Project Costs**") include Contractor's design and engineering, design oversight, construction management, project administration, contract administration, commissioning, initial M&V at construction, travel, overhead and profit. These costs are calculated as an overall percentage, as specified in Section 16C, of the Direct Project Costs.

U. Initial Commissioning Report (**"Initial Commissioning Report"**) shall be provided to the City by the Contractor at the completion of Project commissioning. The report will reflect what equipment/systems were commissioned, what occurred, if any problems were encountered and steps taken to resolve, and if any equipment/system commissioning had to be postponed, the reasons for, and the expected date the commissioning will occur.

V. International Performance Measurement and Verification Protocol 2007or IPMVP ("**IPMVP**") and the appropriate Federal Energy Management Program guidelines are a means by which one can establish reasonable assurance of equipment savings through stipulated values, measurements, and engineering calculations and/or modeling.

W. Measurement and Verification Plan ("**M&V Plan**") is defined in Section 8 of Attachment AA.

X. Measured and Verified Savings ("**M&V Savings**") mean the savings measured and verified according to the M&V Plan.

Y. Open Book Pricing ("**Open Book Pricing**"), as defined in RFP No.1415-123 and further detailed below is the full disclosure of all costs by the Contractor, including all costs of subcontractors and vendors. The Contractor will maintain cost accounting records on authorized work performed, showing actual costs for labor and materials, or other basis requiring accounting records. Contractor will provide all documentation as prescribed in this Contract in two packages. The first package will reflect all design related costs (including all outsourced work); and will be provided at the end of the Design Phase of the Project. The second package will include a summary of the earlier provided Design Phase costs as well as all documented Construction Phase related costs.

Z. O&M ("**O&M**") means Operations and Maintenance.

AA. Operating Cost Savings ("**OC Savings**") means any expenses that are eliminated or avoided on a long-term basis as a result of the installation or modification of equipment, or services performed by the Contractor. The term does not include any savings that are realized solely because of a shift in the cost of personnel or other similar short-term cost savings. (NRS 332.320).

BB. Pass Through Costs ("**Pass Through Costs**") shall include bond premiums, taxes, Capitalized Interest, third party consulting fees and permit costs. Pass Through costs are not subject to Contractor's overhead and profit.

CC. Project ("**Project**") means the work as outlined in ATTACHMENT AA Financial-Grade Operational Audit (dated November 2, 2016and the specific work outlined in this Contract.

DD. Project Acceptance ("**Project Acceptance**") means the date the City approves all items included in the OCS Measures/ECMs at Substantial Completion of the last OCS Measure/ECM. Final Project Acceptance will not be made until the Contractor has successfully demonstrated, through approved Commissioning protocols described in the M&V portion of the Proposal, that all OCS Measures/ECMs have shown immediately after commissioning the potential to achieve all of the stated savings in the Financial Grade Operational Audit.

EE. Scope of Work ("**Scope of Work**") means the goods and services to be provided or performed by Contractor under this Contract; as well as any Change Orders to this Contract, the Request for Proposal No. 1415-123, and the Financial Grade Operational Audit (dated November 2, 2016).

FF. Standards ("**Standards**"): Standards shall mean all applicable Federal, state and local laws, codes, statutes, regulations, zoning ordinances, land use development restrictions, building codes and governmental requirements of all kinds;

1. Standards will maintain consistency with all applicable state and local codes. Designs must comply with the City's building codes.

2. If two or more Standards are in conflict, the more stringent will apply, and if any provision of this Contract is more stringent than the applicable Standards, this Contract will govern.

GG. State of Nevada ("**State**") means the State of Nevada and its Agencies identified herein.

HH. Stipulated Savings ("**Stipulated Savings**") mean the savings that have been mutually agreed upon and stipulated to by the Contractor and the City prior to or upon implementation of the OCS Measures/ECMs in accordance with the M&V Plan.

II. Substantial Completion ("**Substantial Completion**") means the time when the Work for each OCS Measure/ECM, or the individual buildings or installation thereunder, is sufficiently complete in accordance with the Contract so that the City can occupy or utilize the space and/or equipment for its intended use. The date of Substantial Completion shall be documented by a written Certificate of Substantial Completion signed by the City and the Contractor. The Certificate of Substantial Completion shall specifically identify any items of Work to be completed or corrected, the estimated costs of completion or correction of such Work, and shall establish the time for such completion and correction. Payments for Substantially Completed Work will only be made upon successful demonstration by the Contractor that stated savings have shown, immediately after commissioning, the potential to be achieved for all OCS Measures/ECMs that constituted the work accepted as Substantially Complete.

JJ. Utility Rate Reduction (URR) Savings ("**Utility Rate Reduction (URR) Savings**") mean those savings achieved through a reduction in fuel, refuse and water rates by one of the following means:

1. Reduced rate from local electric utility company, natural gas company, water, trash collection company, or fuel company;

2. Direct purchase of natural gas or electricity;

3. Bulk purchase of fuel; or,

4. Putting the City on alternative rates.

KK. Work ("**Work**") means all services, labor, materials, and equipment required to plan, design, develop, construct, install and commission each individual ECM/OCS Measure in accordance with this Contract.

4 ECMs/OCS Measures

A. The City authorizes the Contractor to design, implement, construct, install, commission and monitor the Project as further described in Attachment AA. The Contractor shall supply all labor, materials, equipment, management, and supervision necessary to design, install, and commission all ECM/OCS Measures described in Attachment AA. The Contractor's responsibilities for the City's facilities, as described in the OCS MEASURES/ECMs Matrix of Attachment AA(Financial-Grade Operational Audit), to accomplish the approved Scope of Work (on a Facility-by-Facility basis and not necessarily on a simultaneous basis), shall include:

1. Providing all necessary designs, plans, and specifications;

2. Selecting subcontractors (with final selection approval by the City, which shall be given no later than fourteen days after submission by Contractor);

3. Awarding subcontracts;

4. Obtaining and evaluating submitted drawings on all equipment to be provided;

5. Progress inspections during installation;

6. Training up to eight City personnel, on proper operation of the newly-installed equipment;

7. Final inspection and savings verification using the M&V Plan;

8. Commissioning or start-up of each item of equipment;

9. Undertaking any other responsibility necessary to fully perform the approved Scope of Work pursuant to the terms of this Contract, other than any work which is the City's responsibility under the terms hereof, which includes any work that the City may be required to perform under the terms of Section 28 hereof; and

10. Not later than one hundred and eighty (180) days after Project Acceptance the Contractor will provide a minimum of two (2) days of competency based training to the City's personnel on the proper operation of the equipment.

B. The City will provide the Contractor (including its employees, agents and Subcontractors) with reasonable access to all of the Facilities, as well as available information requested by the Contractor about the Facilities described in the ECM/OCS Measures Matrix in Attachment AA, and will cooperate with Contractor at all stages of the installation of the OCS Measures/ECMs and require employees of the City to complete training with the Contractor. The City represents that it is the owner of the Facilities, and that it will be the owner at all times Work or services provided post-installation are performed under this Contract, and that it will obtain and provide evidence of the consent of any mortgagee, owner, or other party who may have the right to disapprove any Work to be done on the Facilities.

5 Operation

The City will operate and maintain those OCS Measures/ECMs installed under this Contract, not specified as Contractor operated and maintained, in a manner consistent with the manufacturer's or Contractor's recommended schedules and procedures from the date of Substantial Completion and OCS Measure/ECM

acceptance. All other OCS Measures/ECMs will be operated and maintained by the Contractor in accordance with the plan agreed to in the FinancialGrade Operational Audit (Attachment AA). In addition to any manufacturer's warranties applicable to the Equipment, the Contractor shall, during the first year beginning with the Substantial Completion and OCS Measure/ECM acceptance, repair or replace defective equipment and/or systems in accordance with Paragraph 9.B. – Warranties below, of this Contract. City staff will notify the Contractor in a timely manner and in any event within 48 hours upon determination of the existence of any malfunction, emergency or dangerous condition affecting the equipment and/or systems. City staff will take or cause to be taken all steps and actions necessary to protect the Equipment during the duration of such emergency.

The Contractor will provide operation and maintenance manuals and other appropriate information regarding the Equipment installed hereunder to the City at or before the time of Substantial Completion. The City shall, at its expense, repair, operate and maintain the Equipment in good working order during the term of this Contract, not specified as 'Contractor operated and/or maintained'. Following the date of the Certificate of Substantial Completion of an ECM/OCS Measure, the City shall, at its expense, repair and maintain (i) the Equipment and all other components which comprise the ECM/OCS Measure and (ii) all other equipment which is attached thereto and/or is integral to the proper functioning of the ECM/OCS Measure, not specified as 'Contractor operated and/or maintained'. The City shall at all times act reasonably to protect the ECM/OCS Measures from damage, theft or injury to the same extent and in the same manner in which it protects its other property.

Except in the case of emergency, the City shall not remove, move, alter, turn off or otherwise significantly affect the operation of the Equipment installed hereunder or the operation of the ECM/OCS Measures, or any individual part thereof, without the prior written approval of the Contractor, which approval shall not be unreasonably withheld. After receiving the Contractor's written approval, the City shall proceed as instructed. The City shall act reasonably to protect the ECM/OCS Measures from damage or injury, if, due to an emergency, it is not reasonable to notify the Contractor before acting. The City agrees to protect and preserve the facility envelope and the operating condition of all ECM/OCS Measures, mechanical systems, and other energy consuming systems located on the facility.

If the City does not reasonably operate, maintain, repair or otherwise protect the ECM/OCS Measures which are the City's responsibility to, and/or maintain the facilities in good repair and good working condition, then the Contractor may equitably adjust the baseline for any increased energy usages at the facilities that are conclusively attributable to the City's failure to do so.

The City shall notify the Contractor in writing prior to making any change(s) to the facilities that could reasonably be expected to have an effect on the energy usage at the facilities including, without limitation, changes in (i) the hours, days or time of year that the facilities are occupied or operated, (ii) the number of users of the facilities, (iii) the activities conducted at the facilities and (iv) the equipment, the facilities, or the size of the facilities. The City shall notify the Contractor regarding increases, over time, in numbers and usage of "plug in" devices such as computers and printers. In the event that the Contractor receives such notification or otherwise determines that such a change has occurred, it will make the appropriate revisions to the schedules and attachments hereto or take such other action as may be provided for hereunder. The Contractor may also make retroactive adjustments where the City has not provided timely notice and, in such instances, any payments made between the parties shall be retroactively reconciled to reflect the changed baseline. Anything in this Contract to the contrary notwithstanding, City will not be obligated to report occupancy changes that are a result of normal City business prior to their occurrence, but rather shall provide summary occupancy information periodically as requested by Contractor.

The City shall be responsible for installing and maintaining telephone lines and all associated costs, including internet/Ethernet charges, for the energy management system's telephone and communication lines. The Contractor may use the City's LAN, as approved, for the purposes of the energy management system improvements.

The City shall not move, alter or modify the ECM/OCS Measures or the measurement and verification systems or any components thereof without obtaining the Contractor's prior written approval which shall not be unreasonably withheld.

The City shall procure and pay for all energy and fuel for the operation of the facilities.

6 ECM/OCS Measures Savings and Commissioning Report

A. Once all of the OCS Measures/ECMs are implemented, an Initial Commissioning Report will be completed. Accumulated Realized Savings generated by the OCS Measures/ECMs will be monitored, measured, and calculated according to the M&V Plan. Acceptance by the City will not occur until the Contractor has demonstrated that all stated savings have shown, immediately after commissioning, the potential to be achieved. A Final Commissioning Report shall be issued to the City within ninety (90) calendar days after the Project Acceptance for all OCS Measures/ECMs. Verified Accumulated Realized Savings shall be compared to the Guaranteed Energy Savings as part of the Final Commissioning Report. Should there be a shortfall between the Accumulated Realized Savings and the Guaranteed Energy Savings, the Contractor will provide a detailed action plan describing those steps that will be taken to resolve and/or remedy any and all shortfalls.

B. The City will approve or provide exceptions to the Final Commissioning Report in writing within thirty (30) calendar days of receipt. Written approval of the Final Commissioning Report by the Parties will indicate that the Final Commissioning Report and stated savings have been accepted in accordance with the Contract.

7 Savings Coverage (Guarantee)

A. Under the savings coverage (guarantee) the Contractor, subject to the City satisfying its obligations under section 5 above, guarantees the Accumulated Realized Savings will meet or exceed the applicable level of annual Guaranteed Energy Savings set forth in Schedule C, and will provide documentation to demonstrate the Accumulated Realized Savings achieved and reported in the Final Commissioning Report. Savings measurements and verification shall be defined and provided in the M&V Plan, as agreed to between the Parties. The terms of billing and payment for Contractor's work under the M&V Plan will be provided for in the M&V Plan. Approval and acceptance of the Accumulated Realized Savings by the Parties to this Contract and a third party reviewer, if any, will be in writing. If the City terminates the Contractor's M&V services, then the City acknowledges and agrees that all Guaranteed Energy Savings shall be deemed to be met from the date of termination of the M&V services and for the remainder of the term of this Contract.

B. Subject to the City satisfying its obligation under section 5 above, if Accumulated Realized Savings do not meet or exceed the proposed stated Guaranteed Energy Savings at any time, during the 20 Year Contract term, and the Contract has not been terminated, the Contractor shall repair, replace, adjust or re-engineer the OCS Measures/ECMs it has installed under this Contract that are not meeting the Guaranteed Energy Savings within 90 days, at no additional cost to the City. The Accumulated Realized

Savings shall then again be measured in accordance with the M&V Plan. If the Accumulated Realized Savings still fail to meet or exceed the Guaranteed Energy Savings stated in the accepted Schedule C, and the Contractor has failed to remedy such non-conformance after receipt of written notice from the City, the City's exclusive remedy shall be to recover from the Contractor a payment equal to the positive difference, if any, between the Guaranteed Energy Savings and the Accumulated Realized Savings or, after a thirty (30) day written notice to Contractor, have the respective OCS Measure/ECM repaired, replaced, adjusted and/or re-engineered and re-installed by someone other than the Contractor to achieve the stated savings. All costs associated with the City having the non-savings achieved OCS Measures/ECMs repaired, replaced, adjusted and/or re-engineered and re-installed shall be paid by the Contractor within 60-days of said work completion. The positive difference, if any, between the proposed stated Guaranteed Energy Savings and the Accumulated Realized Savings will be calculated using the units, (Kwh, BTU, or Kw) multiplied by the Projected Utility Rate as defined in Schedule C the Installment Purchase Cash Flow Analysis for each year the 20-Year term of this Contract. Anything in this Contract to the contrary notwithstanding, Contractor shall not be required to repair, replace, adjust or re-engineer the OCS Measures/ECMs, or reimburse the City for such costs if the anticipated costs for such repair, replacement, adjustment or re-engineering, inclusive of all costs previously incurred to repair, replace, adjust or re-engineer the OCS Measures/ECMs for the specific measure in question, exceeds the net-present value of the predicted annual shortfall associated with such OCS Measure/ECMs over the remainder of the 20-year term of this Contract using a 5% discount rate.

C. Notwithstanding the provisions of paragraph 13D, Labor, should a disagreement arise as to the calculation of the Accumulated Realized Savings, and such disagreement cannot be resolved through good faith negotiations by the parties, unless the City chooses to use a Third-Party Consultant employed in accordance with NRS chapter 332, an independent accounting and/or engineering firm shall be engaged and paid by either Party to conduct a review and give an opinion on whether the calculation of annual dollar savings or deficiencies as prepared by Contractor is fairly stated in accordance with this Contract. The Parties will mutually agree upon the independent firm (if the parties cannot agree upon a firm, then each will designate a firm; and the two designated firms will identify a mutually agreeable third firm). The independent firm will include in its report any exceptions determined by its review. If a Third-Party Consultant is employed by the City in accordance with NRS chapter 332, such consultant's determination of Accumulated Realized Savings will be used for all payment computations. Contractor may appeal this decision to the City's administration; and, if the City's administration deems a separate and independent accounting / engineering firm should be hired, then the above will be followed. Exercising the right to request a review will in no way affect the City's obligation to make current payments pursuant to this Contract unless otherwise described herein. Any payments between the Parties necessary to resolve any irregularities identified in the review will be made within sixty (60) calendar days after submission of the review to the Parties. If the review determines that Contractor's preparation of the Accumulated Realized Savings was in error, the Contractor shall pay the entire cost of the review; however, if the Contractor's determination of the Accumulated Realized Savings is not in error, as determined by the independent firm, the City shall pay for the entire cost of the review. In any case, the Final Commissioning Report will be changed to reflect the findings of the review; and the calculations of Accumulated Realized Savings will be modified, if necessary, and payments will be made as applicable.

8 General Annual Report

A. Provided that the City (i) has retained the Contractor to perform the services under the M&V Plan, and (ii) has complied with the payment terms for such services the Contractor will prepare a measurement and verification report ("M&V Report") for **twenty (20) consecutive years** annually on the anniversary

date of the Final Commissioning Report. The M&V Report will outline the condition(s) of all OCS Measures/ECMs implemented as more particularly set forth in the M&V Plan. The following process and procedures shall be used to prepare the M&V Report for the City.

1. An M&V Report shall be supplied within sixty (60) calendar days after (i) the annual anniversary of the Final Commissioning Report and (ii) delivery of all utility billing information.

2. The M&V Report shall be provided to the City for each year of the Term of the Contract, subsequent to the Final Commissioning Report.

3. M&V Report – Detailed Report Requirements.

   (a) The M&V Report is intended to provide the City a status update of the OCS Measures/ECMs installed with respect to their condition, their expectation to provide energy savings, and documentation of any OCS Measures/ECMs that have been altered in nature or operation compared to Attachment AA.

   (b) This report is to be considered a validation of savings and is to encourage the Contractor/City to maintain OCS Measure/ECM integrity and further enhance energy savings.

   (c) For any year during the term of this Contract for which the City does not purchase Contractor's services for the preparation of the M&V Report and/or for measurement and verification services or has failed to comply with the payment terms for such M&V services, all of the Accumulated Energy Savings for such year shall be deemed to equal the Guaranteed Energy Savings.

4. The M&V Report will be structured and contain information as detailed below:

   (a) OCS Measures/ECMs where savings were 'Stipulated' savings the following requirements shall be met in the M&V Report;

   (b) An inspection of the OCS Measure/ECM components will be completed at the City. A random selection of components in accordance with the M&V Plan specified in the approved Financial-Grade Operational Audit will be inspected.

   (c) The M&V Report will contain the results of the inspection, including whether the OCS Measures/ECMs were observed to be in place, operating properly, and defining deficiencies observed during the inspection(s).

5. OCS Measures/ECMs where Option A of the IPMVP was used, the following requirements shall be met in the M&V Report:

   (a) An inspection of the OCS Measure/ECM components will be completed by the Contractor under the terms specified in the M&V Plan.

   (b) Spot measurements will be taken for the variable(s) used for 'Option A' verification and compared to the Final Commissioning Report as provided in the M&V Plan.

   (c) The M&V Report will contain the results of the inspection(s) and measurements including whether the OCS Measures/ECMs were observed to be in place, the measured value was

consistent, the OCS Measures/ECMs were observed to be operating properly, and defining any deficiencies observed during the inspection(s) and measurement process.

6. OCS Measures/ECMs where 'Option D' of the IPMVP was used, the following requirements will be met in the M&V Report.

   (a) An inspection of the OCS Measure/ECM components will be completed by the Contractor under the terms specified in the M&V Plan.

   (b) Any spot measurements deemed necessary by the Contractor's Measurement and Verification Professional (Certified Measurement and Verification Professional and Registered Professional Engineer), shall be taken.

   (c) The M&V Report will contain the results of the inspection, including whether the OCS Measures/ECMs were observed to be in place, operating properly, and defining deficiencies observed during the inspection(s).

7. An annual review of the City's utility bills will be included in the M&V Report. The following requirements will be met in the M&V Report.

   (a) The City will supply annually electric and gas bills to the Contractor no later than 10 calendar days after annual anniversary date of Project completion. The City agrees that delay in the delivery of the billing collection information will necessarily delay the M&V Report.

   (b) Electric and gas bills will be reviewed for the previous available twelve months. This data shall coincide with the required schedule for this report.

   (c) The bills will be reviewed and analyzed for;

      a. Changes in rates;
      b. Changes in weather;
      c. Changes in operations or an expansion of the facility usage; and,
      d. Changes due to observations and inspections covered herein.

   (d) The M&V Report will contain a utility bill review analysis for the City, describing the analysis and the overall expectations for future savings due to the OCS Measure/ECM implementation.

9 Warranties

A. Unless otherwise expressly provided, all materials and equipment incorporated in the Work shall be new, free of faults and defects, and shall conform to the Contract. Upon request, the Contractor shall furnish satisfactory evidence as to the type and quality of materials and equipment. All materials and equipment used in the Work shall be subject to inspection and testing in accordance with accepted standards to ensure conformity with the requirements of the Contract, laws, ordinances, rules and regulations, or orders of any public authority having jurisdiction. Where specific certificates concerning materials and/or equipment are required, securing payment for the prompt delivery of such certificates shall be the responsibility of Contractor. Such certificates shall be executed by qualified firms acceptable to the City, shall include all information required by the Contract, and shall clearly refer specifically to materials to be used in the Project. A list of all serial numbered items of equipment will be provided at the completion of construction. This list will reflect a description of the item, the serial number, the make and model of the item, and the location of the item. Should any items be replaced by

the Contractor over the term of the Contract, the Contractor will append the initial list of serial numbered items as appropriate.

B. Should the Work performed by Contractor pursuant to this Contract be found to be defective and such defect is reported to Contractor in writing within one year (or the period of guaranteed warranty for that specific item if other than one-year) from the date of Substantial Completion of the respective OCS Measure/ECM, the Contractor agrees to repair or re-adjust such item, and if necessary, furnish and install without charge a similar item to replace it; provided, however, that the original item is returned to the Contractor and inspection discloses a defect therein. Notwithstanding any language in this Contract to the contrary, when the need for maintenance or repairs arises due to: (i) an error, misuse, abuse, omission, negligence or willful misconduct of the City or any employee or other agent or invitee of the City; or (ii) any act which would customarily be covered by standard forms of property or casualty insurance then, in each case, the Contractor may charge the City for the reasonable and customary time and materials cost of the maintenance or repair (and such charges are in addition to all other payments due the Contractor under this Contract).

C. On all systems installed pursuant to this Contract, the Contractor will provide, at no charge during the one-year warranty period, any labor required to repair or replace defective equipment or parts. Such labor does not include normal maintenance requirements, but does cover adjustment of controls, air balancing (provided that air balancing was part of the original scope of work as reflected in the approved Financial Grade Operational Audit) and correction of mechanical difficulties if such adjustments are due to defective equipment and/or improper installation.

D. The Contractor shall assign to the City warranties made by equipment or component manufacturers, and, at the City's request shall prosecute warranty claims against the applicable manufacturer in the City's name.

E. **THE CONTRACTOR DISCLAIMS ALL IMPLIED AND EXPRESSED WARRANTIES NOT PROVIDED FOR IN THIS CONTRACT INCLUDING, WITHOUT LIMITATION, THE IMPLIED WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE**.

10 Representations, Warranties and Covenants of the City

A. The City hereby warrants and represents to the Contractor that: (i) the City has provided the Contractor with all records heretofore requested by the Contractor and the information set forth therein is, and all information in other records to be subsequently provided by the City pursuant to this Contract will be, true and accurate in all material respects; and (ii) the City presently intends to continue throughout the term of this Contract the use of the Facilities in a manner similar to its present use or use contemplated by this Contract.

B. The City will provide Contractor with copies of any successor or additional contracts for the management or servicing of pre-existing equipment or equipment installed under this Contract, which may be executed from time to time hereinafter, within thirty (30) business days after execution thereof.

11 Affirmative Covenants of the City

A. The parties agree that said OC/ECM savings will not likely be obtained unless certain procedures and methods of operation designed for utility conservation will be implemented and followed by the City on a regular, consistent basis. The City agrees that it will adhere to, follow, and implement the procedures and methods of operation and maintenance set forth in this Contract and the Schedules hereto.

B. The City agree that the Contractor shall have the right, with prior notice, to inspect the Facilities to determine if the City are complying and shall have complied with its obligations as set forth above, so long as it does not materially affect the City's regular course of business.

12 Required Design Reviews

The design of the Project shall comply with all applicable Standards, Codes, State Statutes, and Local Ordinances; and the Contractor shall be responsible for timely obtaining of all required reviews and approvals of the City and all state and local governmental authorities having jurisdiction over the Project and shall secure all building permits, building code inspections and shall pay all fees and charges relating thereto. Contractor shall have the design certified by a Professional Engineer registered in the State of Nevada.

13 Labor

A. The Contractor shall comply with, and ensure all Subcontractors are in compliance with any and all applicable labor laws and regulations, including, but not limited to, NRS chapter 338 and NRS Chapter 608 and the regulations promulgated thereto and with the overtime provisions of NRS 338.020. **If any funds from Federal sources are supporting this Contract, the Contractor shall ensure that all employees on the Project are paid in accordance with the Davis-Bacon Wage Rates <or> the Prevailing Wage Rates (Schedule H), as approved by the State of Nevada Labor Commission for the area or place of the Work, whichever is greater.** Contractor shall be subject to the remedies and any penalties set forth in NRS 338.060 and NRS 338.070. The Contractor will provide Certified Payrolls for all of its workers and all of its subcontractors. The Certified Payrolls will be provided to the City on a weekly basis for review and as part of the Open-Book Pricing of the Contractor. The Contractor shall execute the attached Schedule I, Acknowledgement and Stipulation of Bidder Regarding Penalties for Noncompliance with Prevailing Wage Requirements.

B. The City shall have the authority to issue cease work orders with respect only to the portion of the Work affected. The Contractor shall immediately comply with any cease work order and ensure that its Subcontractors and suppliers also comply with the order. The City may apply the remedies available in accordance with the City Ordinances and Codes. A breach of this paragraph shall constitute a material breach of contract.

C. The Parties agree that any disputes concerning the terms and conditions of this Contract that cannot be resolved after consultation and discussion between the parties shall be filed exclusively in a court of competent jurisdiction in Carson City, NV.

D. The Parties agree that the Contractor and its consultants, Subcontractors or other parties involved in the Project, may be joined in the mediation or litigation, at the request of either Party. Unless otherwise agreed in writing, Contractor shall carry on the Work and maintain its progress during any claims and controversies, and City shall continue to make payments to Contractor in accordance with the terms of this Contract. The mediator or trial court shall have the right to award to the prevailing party its reasonable attorney's fees, court costs, and other related expenses. This section must be included in all agreements with Contractor and Subcontractors.

1. MEDIATION OF DISPUTES. Notwithstanding Sections 13(C) and (D), all claims, disputes, and other matters in question between the parties to this Contract, arising out of or relating to this Agreement or the breach thereof, shall be first submitted to non-binding mediation prior to initiation of any litigation unless the parties mutually agree otherwise, or if one party fails to respond to a notice requesting mediation for thirty (30) calendar days after the request is made. The cost of said mediation shall be split equally between the parties. This Agreement to mediate shall be specifically enforceable under the prevailing laws of the State of Nevada.

14 Site Working Conditions

A. Unless expressly authorized in advance by the City, Work necessary to be performed after regular working hours, on weekends or legal holidays, shall be performed without additional expense to the City as an anticipated part of the Financial Grade Operational Audit (Attachment AA).

B. The City will provide the Contractor, at no additional cost, the following:

1. A level staging area for material at or on the OCS Measure/ECM location.

2. Up to five sets of keys to all agreed-upon buildings and facility rooms, except for restricted areas (where access will be provided by the City on a pre-coordinated basis).Keys supplied will be individually numbered, and in the event all keys are not returned Contractor shall be responsible for all expenses related to rekeying locks.

3. Parking for 3 vehicles.

C. The Contractor shall at its own expense provide locked fencing around the staging area.

D. The Contractor will return any Staging Areas to its preconstruction condition upon completion of the Project.

15 Termination of Contract

A. In the event of termination by either party, Contractor and the City will continue to be responsible for their respective payment obligations accrued under this Contract, prior to the effective date of termination. Additionally, the City shall be responsible for materials or equipment ordered but not delivered and any cancellation or restocking charges associated with the termination of such orders.

B. Termination for Non-appropriation. The continuation of this Contract beyond the current Fiscal Year is subject to and contingent upon sufficient funds being appropriated, budgeted, and otherwise made available by the City and/or Federal sources. The City may terminate this Contract, and, subject to the provisions of Subparagraph A of this paragraph, the Contractor waives any and all claim(s) for damages, effective immediately upon receipt of written notice (or any date specified therein) if for any reason funding from the City and/or Federal sources is not appropriated or is withdrawn, limited, or impaired.

C. Termination for Default or Breach. A default or breach may be declared with or without termination. Subject to Section 15(D), this Contract may be terminated upon written notice by the non-defaulting Party describing the default or breach to the other party as follows:

1. Contractor Defaults:

(a) If the Contractor fails to provide or satisfactorily perform any of the material conditions of this Contract within the time requirements specified in this Contract or within any granted extension of those time requirements; or

(b) If any material state, county, city or Federal license, authorization, waiver, permit, qualification or certification required by statute, ordinance, law, or regulation to be held by the Contractor to provide the Scope of Work required by this Contract is denied, revoked, debarred, excluded, terminated, suspended, lapsed, or not renewed; or

(c) If the Contractor becomes insolvent, subject to receivership, or becomes voluntarily or involuntarily subject to the jurisdiction of the bankruptcy court; or

(d) If it is found by the City that any quid pro quo or gratuities in the form of money, services, entertainment, gifts, or otherwise were offered or given by the Contractor, or any agent or representative of the Contractor, to any officer or employee of the City or the State of Nevada with a view toward securing a contract or securing favorable treatment with respect to awarding, extending, amending, or making any determination with respect to the performing of such Contract; or

(e) If it is determined by the City that the Contractor has failed to disclose a material conflict of interest relative to the performance of this Contract.

(f) If the Contractor defaults in any payment or any other obligation to the City under this Contract.

2. The City Defaults

(a) If it breaches any material duty under this Contract and any such breach impairs the Contractor's ability to perform or otherwise causes damage to the Contractor; or

(b) If it defaults in any payment or any other obligation to the Contractor under this Contract.

D. Time to Correct. Termination, and the exercise of any other remedies, upon a declared default or breach may be exercised only after service of formal written notice as specified in subparagraph C of this paragraph, and the subsequent failure of the defaulting party within thirty (30) calendar days after receipt of that notice to provide evidence, satisfactory to the aggrieved party, showing that the declared default or breach has been corrected, or, if additional time is required for correction, showing the amount of time reasonably required, together with a description of the actions to be taken and the time by which the default or breach shall be corrected.

E. Winding Up Affairs Upon Termination. In the event of termination of this Contract for any reason, the parties agree that the provisions of this paragraph survive termination:

1. The Parties will account for and properly present to each other all claims for fees and expenses incurred under this Contract and pay those which are undisputed and otherwise not subject to set off under this Contract. Neither Party may delay performance of winding up provisions solely based on nonpayment of fees or expenses accrued up to the time of termination;

2. The Contractor will satisfactorily complete Work in progress at the agreed rate (or a pro rata basis if necessary) if so requested by the City;

3. The Contractor will execute such documents as are reasonably necessary and in such form and substance as reasonably acceptable to Contractor and take any actions reasonably necessary to effectuate an assignment of this Contract if so requested by the City;

4. The Parties shall preserve and protect all proprietary information and Contractor will promptly deliver into the City's possession all proprietary information in accordance with Paragraph 22.

F. Remedies. Except as otherwise provided for by law or this Contract, the rights and remedies of the Parties shall not be exclusive and are in addition to any other rights and remedies provided by law or equity, including, without limitation, actual damages, and to a prevailing Party's reasonable attorneys' fees and costs. It is specifically agreed that reasonable attorneys' fees shall include without limitation a reasonable charge for in-house and governmental attorneys for the prevailing party.

NOTWITHSTANDING ANY PROVISION TO THE CONTRARY SET FORTH IN THIS CONTRACT, NEITHER PARTY SHALL BE LIABLE TO THE OTHER PARTY OR ANY THIRD PARTY FOR ANY SPECIAL, INDIRECT OR CONSEQUENTIAL, PUNITIVE OR EXEMPLARY DAMAGES.

16 Terms of Payment

A. Within 15 days of receipt of an invoice from the Contractor for payments during the construction installation phase of the Project, the City will submit an invoice, payment request form, and schedule of values to the lender. The Contractor's payment application shall include all Direct Project Costs, Indirect Project Costs, and Pass-Through Costs incurred by the Contractor for the period covering such invoice. The City shall have thirty (30) working days from the date of receipt of said invoices to notify the Contractor in writing of any irregularity in the billing. Nevertheless, the City shall pay to the Contractor the entire amount of the invoice less disputed amounts (disputed in good faith), subject to adjustment once the disputed amount is finally resolved. The City shall pay or cause to be paid to the Contractor all undisputed amounts within thirty (30) days after receipt of each invoice. In the event Contractor is owed the disputed amounts, the City shall pay such amounts with interest from the date such amounts were due until paid. The amounts shall bear interest in accordance with NRS Chapter 338

B. The Contractor may submit applications for payment in accordance with the Schedule of Values set forth in Schedule E (Payment Schedule). Applications for payment for any ongoing services including measurement and verification, operation and maintenance, as applicable, shall be monthly in arrears commencing on the date of Substantial Completion, in the amounts set forth in Schedule E.

D. The Contractor has based the proposed cost and pricing upon, and the City having accepted the Financial-Grade Operational Audit (Attachment AA) based upon, 'guaranteed maximum pricing.' The guaranteed maximum pricing shall be as set forth in Schedule C and pricing cost categories defined in Schedule E Schedule of Values hereto. The cost of interest, bond premiums, insurance, Third Party consultant fees, taxes and permit costs are considered 'Pass-Through' Costs; and as such not subject to Contractor profit.

E. Payments due the Contractor which are not paid when due shall bear interest in accordance with NRS Chapter 338.

F. In the event the Contractor fails to achieve Project Acceptance on or before the agreed date for Project Acceptance in Schedule F, Installation Schedule, subject to extension as provided herein, the City shall be entitled to 'setoff' or 'recover' from the Contractor a sum of $50 per day for any incomplete OCS

Measure/ECM as liquidated damages, for each day Project Acceptance is delayed. It is agreed that such sum is an amount reasonably estimated to compensate the City for damages that may be caused by delay in the use of the Project and not as a penalty and that Project schedule float is owned by neither the Contractor nor the City. All OCS Measures/ECMs completed by the Project Acceptance date in Schedule F, Installation Schedule will not be subject to a daily damage fee.

G. If the Contractor is delayed at any time in the progress of the Work by an act or by negligence of the City, the City's employees, separate contractors employed by the City, or by changes ordered in the Work, or by labor disputes, fire, unusual delay in deliveries, unavoidable casualties or other causes beyond the Contractor's control, or by delay authorized by the City pending mediation, or by limited or denied facility access for any reason, or by other causes which the City and the Contractor agree may justify delay, then the date of Project Acceptance shall be reasonably extended by Change Order. Delays less than one full day will be counted as a full day lost.

H. Forty five (45) calendar days after Design completion, and then again after Project Acceptance by the City, the Contractor will prepare and present a full accounting of Project costs subject to the 'Open-Book' provisions of the RFP and NRS 332; against which any Progress Payments will be made. Using Schedule D - Project Cost Summary and the other items within the Financial-Grade Operational Audit (Attachment AA), the City shall receive expense and refund accounting for the following:

1. Certified Payrolls for the Contractor and all subcontractors;
2. Fully documented Contractor Project burdens;
3. All vendor purchase orders (POs);
4. All Contractor subcontracts with any Modifications issued against;
5. Fully documented Contractor overhead recovery costs;
6. Fully documented construction management costs;
7. Bank construction interest certification;
8. Fully documented 'pre-approved' contingency costs;
9. Any Project savings on the accumulated total of total Direct Cost Labor & Materials and associated Overhead Recovery Costs and Fees.
10. Any Project savings on the accumulation of the following: training, bonds / insurance, permitting, detail study, quality control / contract management.

17 Independent Contractor

A. The Contractor is associated with the City only for the purposes and to the extent specified in this Contract, and in respect to performance of the contracted services pursuant to this Contract, the Contractor is and shall be an independent contractor and, subject only to the terms of this Contract, shall have the sole right to supervise, manage, operate, control, and direct performance of the details incident to its duties under this Contract. Nothing contained in this Contract shall be deemed or construed to create a partnership or joint venture, to create relationships of an employer-employee or principal-agent,

or to otherwise create any liability for the City whatsoever with respect to the indebtedness, liabilities, and obligations of Contractor or any other party.

B. The Contractor shall be solely responsible for, and the City shall have no obligation with respect to: (1) withholding of income taxes, FICA or any other taxes or fees; (2) industrial insurance coverage; (3) participation in any group insurance plans available to employees of the City; (4) participation or contributions by either the Contractor or the City to the Public Employees Retirement System; (5) accumulation of vacation leave or sick leave; or (6) unemployment compensation coverage provided by the City. Contractor shall indemnify and hold the City harmless from, and defend the City against, any and all losses, damages, claims, costs, penalties, liabilities, and expenses arising or incurred because of, incident to, or otherwise with respect to any such taxes or fees. Neither the Contractor, nor its employees, agents or representatives shall be considered employees, agents, or representatives of the City.

18 Casualty or Condemnation of Facilities / Force Majeure

Neither Party shall be deemed to be in violation of this Contract if it is prevented from performing any of its obligations hereunder due to strikes, failure of public transportation, civil or military authority, act of public enemy, acts of terrorism, accidents, fires, explosions, or acts of God, including, without limitation, earthquakes, floods, winds, or storms. In such an event the intervening cause must not be through the fault of the party asserting such an excuse, and the excused party is obligated to promptly perform in accordance with the terms of the Contract after the intervening cause ceases.

19 Notices

Any notice required or permitted to be given under this Contract shall be sufficient if in writing, including in the form of electronic mail or if personally delivered or registered or certified mail, postage prepaid, return receipt requested to either party at its address specified on the facing sheet to this Contract. A copy of any notice from Carson City to the Contractor shall be sent to Ameresco, Inc., 111 Speen Street, Suite 410, Framingham, MA 01701, Attention: General Counsel. Notices sent by electronic mail or personal delivery shall be effective when received with written confirmation of receipt. Notices sent by mail shall be effective upon the third business day following its deposit in the United States Mail.

20 Indemnification

A. Subject to Section 15(F) and to the fullest extent permitted by law, the Contractor shall indemnify, hold harmless and defend, not excluding the City's right to participate, the City from and against all liability, claims, actions, damages, losses, and expenses, including, without limitation, reasonable attorneys' fees and costs, to the extent arising out of any alleged negligent or willful acts or omissions of the Contractor, its officers, employees and agents which result in personal injury (including loss of life) or tangible property damage or loss. The indemnity provided for in this paragraph shall not extend or apply to liability, claims, actions, damages, losses, and expenses, including, without limitation, reasonable attorneys' fees and costs to the extent they result from the City's negligence, acts, omissions or fault. The Contractor's liability in contract for direct damages under this Contract shall in all cases be limited to the sum of the payments received by the Contractor hereunder. The Contractor's liability in tort (including negligence) will, in all cases, be limited to the proceeds of insurance maintained by the Contractor pursuant to the requirements of this Contract.

To the fullest extent permitted by law, and without waiving any NRS Chapter 41 liability limitations it is entitled to assert, the City shall indemnify, hold harmless and defend, not excluding the Contractor's right to participate, the Contractor from and against all liability, claims, actions, damages, losses, and expenses, including, without limitation, reasonable attorneys' fees and costs, to the extent arising out of any alleged negligent or willful acts or omissions of the City, its officers, employees and agents which result in personal injury (including loss of life) or tangible property damage or loss. The indemnity provided for in this paragraph shall not extend or apply to liability, claims, actions, damages, losses, and expenses, including, without limitation, reasonable attorneys' fees and costs to the extent they result from the indemnitee's negligence, acts, omissions or fault.

B. This Contract does not create an employee/employer relationship between the parties. It is the parties' intention that Contractor will be an independent contractor and not a City employee for all purposes, including but not limited to the application of the Fair Labor Standards Act, The Federal Unemployment Tax Act, the provisions of the Internal Revenue Code, Nevada State revenue and taxation law. Contractor will retain sole and absolute discretion in the judgment of the manner and means of carrying out Contractor's activities and responsibilities here under. Contractor agrees that it is a separate and independent enterprise from the public employer, that it has full opportunity to find other business, and that it has made its own investment in its business, and that in the performance of the Work it will utilize at least the same level of skill as would be consistent with the practice and customs within the industry of which it is a part. This agreement shall not be construed as creating any joint employment relationship between Contractor and the City, and the City will not be liable for any obligation incurred by Contractor, including but not limited to unpaid minimum wages and/or overtime premiums.

Contractor shall indemnify and hold the City harmless from all losses, injuries or damages, and wages or overtime compensation due its employees in rendering services pursuant to this agreement, including payment of reasonable attorney's fees and costs in the defense of any claim made under the Fair Labor Standards Act or any other federal or state law.

21 Governing Law; Jurisdiction

This Contract and the rights and obligations of the parties hereto shall be governed by, and construed according to, the laws of the State of Nevada, without giving effect to any principle of conflict-of-law that would require the application of the law of any other jurisdiction. The Parties consent to the jurisdiction of the First Judicial District Court, Carson City, Nevada for enforcement of this Contract.

22 The City's Ownership of Proprietary Information

A. All drawings and specifications prepared by the Contractor solely for this Project, and with the City's funds, shall remain the property of the Contractor until Project Acceptance has been made by the City, at which time said documents shall become the property of the City. In ***case of future re-use of the documents, data, and other items referred to in this Section by the City, the name and seal of AMERESCO'S design professionals shall be removed, and AMERESCO or its design professionals shall not be liable to the City or third parties resulting from their re-use. The City agrees to assume all risk of such reuse and agrees to add or cause to be added AMERESCO and its design professionals as additional insureds pursuant to the City's insurance program, and shall provide AMERESCO a Certificate of Insurance confirming such to be the case within thirty (30) days from the Effective Date.***

B. Upon payment in full by the City to Contractor of all amounts due under this Contract through the acceptance of the Project OCS Measures/ECMs, any reports, histories, studies, tests, manuals, instructions, photographs, negatives, blue prints, plans, maps, data, system designs, computer code (which is intended to be consideration under the Contract), or any other documents or drawings, pre-pared or in the course of preparation by the Contractor (or its subcontractors) in performance of its obligations under this Contract shall be the exclusive property of the City and all such materials or copies thereof shall upon written request be delivered into the City's possession by the Contractor upon completion and acceptance of the Project OCS Measures/ECMs; or upon termination or cancellation of this Contract. The Contractor shall not use, willingly allow, or cause to have such materials used for any purpose other than performance of the Contractor's obligations under this Contract without the prior written consent of the City. Notwithstanding the foregoing, the City shall have no proprietary interest in any materials licensed for use by the City that are subject to patent, trademark or copyright protection.

23 Severability

If any provision contained in this Contract is held to be unenforceable by a court of law or equity, this Contract shall be construed as if such provision did not exist and the non-enforceability of such provision shall not be held to render any other provision or provisions of this Contract unenforceable.

24 Assignment/Delegation

To the extent that any assignment of any right under this Contract changes the duty of either Party, increases the burden or risk involved, impairs the chances of obtaining the performance of this Contract, attempts to operate as a novation, or includes a waiver or abrogation of any defense to payment by the City, such offending portion of the assignment shall be void, and shall be a breach of this Contract. The Contractor shall neither assign, transfer nor delegate any rights, obligations or duties under this Contract without the prior written consent of the City. The City acknowledges that the Contractor may provide the Work and services under this Contract through Subcontractors, and such shall not be considered to be a breach of this paragraph.

25 Successors and Assigns

The obligations of this Contract shall be binding on the successors and assigns of the City and/or the Contractor.

26 Insurance

The insurance requirements are set forth in Schedule G.

27 Prior Agreements, Proprietary Rights

This Contract supersedes the terms and conditions of any prior agreements, understandings, or representations, oral or written, between the parties, excepting the incorporated documents to this Contract. The City will not, by virtue of this Contract, acquire any interest in any formulas, patterns, devices, secrets**,** or processes, copyrights, patents, other intellectual or proprietary rights, or similar items of property which are or may be used in connection with the OCS Measures/ECMs.

28 Excluded Material and Activities

A. The City recognizes that in connection with the Work, installation and/or service or maintenance of equipment and/or systems at the City's facilities, the Contractor may encounter, but is not responsible for, any Work relating to (i) asbestos, materials containing asbestos, or the existence, use, detection, removal, containment or treatment thereof, or (ii) mold, materials containing mold, or the existence, use, detection, removal, containment or treatment thereof, or (iii) pollutants, hazardous wastes, hazardous materials, contaminants (collectively "Hazardous Materials"), or the storage, handling, use, transportation, treatment, or the disposal, discharge, leakage, detection, removal, or containment thereof, with the exception of Hazardous Material Removal specified in the ECM Matrix in Attachment AA. The materials and activities listed in the foregoing sentence are hereinafter referred to as "Excluded Materials and Activities." The City agrees that if the Contractor's performance of any Work under this Contract involves Excluded Materials and Activities, upon receipt of any and all appropriate funding and approval, the City will perform or arrange for the performance of such Work and will bear the sole risk and responsibility therefore. In the event the Contractor discovers Hazardous Materials or determines that the Work will comprise Excluded Materials and Activities, the Contractor will immediately cease Work, remove all Contractor personnel or subcontractors from the site, and notify the City. The City will be responsible to handle such Hazardous Materials at the City's expense or appropriately compensate the Contractor for the removal of same. The Contractor will undertake no further Work at the facility except as authorized by the City in writing. Notwithstanding anything in this Contract to the contrary, any such event of discovery or remediation by the City will not constitute a default by the City.

B. To the extent permitted by law, the City agrees to release, indemnify, defend, and hold harmless the Contractor, its assigns, consultants, contractors, shareholders, officers, directors, agents, employees and affiliates, from and against all costs, claims, damages, or liability arising out of such Work related to Excluded Materials and Activities performed by or for the City, excepting only such costs, claims, damages, or liability as are the result of any act or omission of Contractor; provided that the Contractor gives the City written notice within ten (10) business days after receipt of notice of such claim or suit, that the City have the sole authority to defend or settle the claims, and that Contractor cooperates fully with the City in defending or settling such claims. The Contractor may participate in such defense at its own expense; in no event will the City be liable for the Contractor's attorney's fees or other litigation expenses in such action. The Contractor does not take title to any such materials, nor does it assume any responsibility for the transportation, handling or disposal of such property. The Contractor will be solely responsible for any hazardous or other materials that it may bring to the site.

29 Announcements

Except to the extent required by the rules and regulations of the Securities and Exchange Commission and any other securities exchange or market, neither Party will issue a press release publicizing or disclosing any affiliation with the other under this Contract, nor the terms hereof, without the written consent of the other. Notwithstanding the foregoing, the Contractor may include a reference to the Project in its portfolio of projects.

30 Confidential Business Information

A. Each Party recognizes that, in connection with its role in the performance of Services under this Contract, it shall be given access to information by the other Party, including proprietary information or trade secrets of such Party that are valuable because they are not generally known to the public or in the industry ("Confidential Business Information"). To the extent permitted by law, neither Party, and with respect to the City subject to Chapter 239 of the NRS and NRS 332.061, whether during the term of this Contract or thereafter for a period of three (3) years, shall directly or indirectly disclose any item of the other Party's Confidential Business Information to any third party, use any such item for its own benefit or for the benefit of any third party, or permit any third party hereto to so use or disclose said Confidential Business Information, without the prior express written consent of the disclosing Party, until such time as the Confidential Business Information shall have properly become known to the general public. When any request for disclosure of such information is made under any applicable freedom of information law (the "FOIL"), the City shall provide prompt written notice to Contractor such that Contractor will have the opportunity to timely object under the FOIL should it desire to object to such disclosure of that information in whole or in part. In the event that the City is required to make a filing with any agency or other governmental body, which includes such information, the City shall notify Contractor and cooperate with Contractor in order to seek confidential treatment of such information included within any such filing or, if all such information cannot be protected from disclosure, to request that the City be permitted to redact portions of such information, as Contractor may designate, from that portion of said filing which is to be made available to the public. Nothing herein shall preclude the City from disclosing information to third-party engineering consultants retained by the City to evaluate the Work and recommendations of the Contractor, or otherwise consult with the City, provided that such third-party engineering consultants execute a written agreement with the Contractor and the City binding them to the same requirements as the City listed throughout this Contract for the treatment of any and all confidential information. For purposes of this Contract, the term "Confidential Business Information" is defined in NRS 332.025.

B. The Contractor shall keep confidential all information, in whatever form, produced, prepared, observed or received by the Contractor to the extent that such information is confidential by law or otherwise required by this Contract.

31 Third Party Beneficiaries

There are no parties intended to be benefited by this Contract other than the City and the Contractor, and accordingly, all third-party beneficiaries are expressly disclaimed.

32 Phasing of Project Implementation

A. City and Contractor agree that the Work set forth in Schedule F will be done in phases in order to utilize savings from one phase for use in future phases. The addition of phases as funding is available will be addressed by Change Order in accordance with the terms herein.

B. The Parties agree that the award and Scope of Work contemplated under this Contract includes [the work identified under the Financial Grade Operational Audit, Attachment AA]. Work will begin upon funding and issuance of a notice to proceed from the City.

33 Materials & Equipment Purchasing

A. Taxes. The City acknowledges that the Pass Through Costs contain an amount for taxes which is based on the current tax rate. In the event there is either an upward or downward adjustment in the tax rate after the execution date of this Contract, the Pass Through Costs shall be adjusted to reflect the actual taxes paid in connection with the Work performed under this Contract. The Contractor shall reimburse the City for any overpayment of the Pass Through Costs received from the City. The City shall pay (or, if applicable, reimburse Contractor for the payment of) all property taxes, sales taxes, use taxes or other fees and assessments associated with the Scope of Work, except that any such payments may not result in exceeding the total contract amount reflected in Schedule C, attached hereto, without the express agreement of the City. The City shall have no liability for taxes measured by the net income of Contractor.

B. Transfer of Title. Upon installation and acceptance, the City will be the sole owner and title holder of all materials and equipment purchased by the Contractor for, and on behalf of the City. Acceptance shall not be unreasonably withheld or delayed. The Contractor shall not hold an ownership interest in the purchased materials and equipment once the same are installed and accepted. Consistent with the City's ownership of such materials and equipment, the City shall maintain full control over, and reserves the right to use, the materials and equipment as it pleases.

C. Purchase Price. The City, as owner and title holder of the materials and equipment purchased, installed, and accepted on its behalf by the Contractor, shall solely be responsible for the purchase price of such materials and equipment. Acceptance shall not be unreasonably withheld or delayed.

D. Risk of Loss. The City maintains the risk of loss with respect to all materials and equipment purchased by the Contractor for, and on behalf of the City once such materials and/or equipment are installed and accepted in/on the Project. Acceptance shall not be unreasonably withheld or delayed.

34 Environmental & Tax Credits

The Contractor shall have the right to all environmental, energy, tax, financial, and electrical-related attributes, rights, credits, benefits and characteristics associated with or arising out of the transactions contemplated by this Contract or associated with the OCS Measures/ECMs or with the energy, capacity or other electrical savings created under this Contract, howsoever created or recognized in the United States, any political subdivision thereof or any foreign jurisdiction (other than dollar savings realized by the City from reductions in its energy use or other operating costs). The City shall provide the Contractor all reasonable assistance in perfecting its rights to such attributes, rights, credits, benefits and characteristics. The Parties to this Contract agree that all environmental credits resulting from renewable energy installations shall be made assignable to the local utility as a part of the local utility's rebate transaction applicable to the work hereunder to which the credits relate.

35 Bonds

The Contractor shall furnish a Performance Bond in an amount equal to 100% of the contract sum as security for the faithful performance of this Contract and a Labor and Material Payment Bond in an amount not less than 100% of the contract sum as security for the payment of persons performing labor and/or furnishing materials in connection with the Contract. Notwithstanding the foregoing, The Labor and Material Payment Bond and the Performance Bond shall only apply to the installation portion of this Contract and do not apply in any way to energy savings guarantees, payments or maintenance provisions, except that the performance bond shall

guarantee that the installation will be free of defective materials and workmanship for a period of twelve (12) months following completion and acceptance of the work.

36 Drug And Alcohol Policy

A. Contractor acknowledges and agrees that in order to be eligible to perform work on a City public works construction project, Contractor is to have in place a drug and alcohol policy applicable to workers who will be employed on such project. This requirement is a reasonable precaution to ensure a safe and drug-free environment on City public works construction projects.

B. The policy is to be an approved Federal drug and alcohol policy/program which provides, at a minimum, that the use of alcohol, and use, possession, transfer, or sale of illegal drugs, narcotics, or other unlawful substances is prohibited while working on any site in connection with work performed under this contract and assurance that Contractor's subcontractors are required to cooperate with Contractor's policy.

C. Contractor shall demonstrate compliance with this provision by submitting a certification (form titled Affidavit of Certification for Drug and Alcohol Policy located at the end of this Contract) under penalty of perjury that the policy is in place, that it will be actively enforced and that workers who will be employed on the project will be subject to the policy.

37 Employment Requirements

A. Contractor acknowledges and agrees that, pursuant to NRS 338.130, in all cases where persons are employed in the construction of public works, preference must be given, the qualifications of the applicants being equal, first to persons who have been honorably discharged from the Army, Navy, Air Force, Marine Corps or Coast Guard of the United States, a reserve component thereof or the National Guard; and are citizens of the State of Nevada, and second to other citizens of the State of Nevada. If the provisions of this section are not complied with by Contractor, the contract is void, and any failure or refusal to comply with any of the provisions of this section renders any such contract void.

B. In connection with the performance of work under this contract, Contractor agrees not to discriminate against any employee or applicant for employment, upgrading, demotion or transfer, recruitment or recruitment advertising, layoff or termination, rates of pay or other forms of compensation, and selection for training, including apprenticeship because of race, creed, color, national origin, sex, sexual orientation, or age. Contractor further agrees to insert this provision in all subcontracts hereunder, except subcontracts for standard commercial supplies or raw materials. Any violation of such provision by Contractor shall constitute a material breach of contract. As used in this article, sexual orientation means having or being perceived as having an orientation for heterosexuality, homosexuality or bi-sexuality.

IN WITNESS THEREOF, the parties have caused this Agreement to be executed and delivered by their duly authorized officers as of the date first above written.

Ameresco, Inc.	**Carson City**	**Carson City Legal Counsel –**
		Carson City District Attorney: I have reviewed this contract and approve as to its legal form.
_____	_____	_____
By: Robert Georgeoff	**By: Nancy Paulson**	**By:**
Title: Vice President	**Title: Chief Financial Officer**	**Title: Deputy District Attorney**
Date: _____	**Date: _____**	**Date: _____**
	CONSULTANT will not be given authorization to begin work until this Contract has been signed by Purchasing and Contracts	
	_____	
	By: Laura Tadman, CPPB	
	Title: Purchasing & Contracts Administrator	
	Date: _____	

Schedule A: List of Buildings

Financial Grade Operational Audit Site Portfolio

Site No.	Site Name	Area (Sq. Ft.)	Year Built
1	Aquatic Facility	32,498	1976
2	Community Development Center (BRIC)	10,000	1947
3	Cemetery	3,000	2002
4	City Hall	34,097	1987
5	Community Center	43,230	1973
6	Corporate Yard Facility	79,880	Various
	Public Works	*34,500*	
	Building 2 (Fleet)	*6,500*	
	Building 3 (Sand Barn)	*N/A*	
	Building 7	*12,700*	
	Building 9	*19,180*	
	Building 11	*1,000*	
	Building 13	*6,000*	
7	Court House Complex	131,772	1999
8	Fire Station 51	18,074	1995
9	Fire Station 52 and Fire Training Building	27,769	1974
	Fire Training Building	*9,800*	
	Fire Station 52	*17,969*	
10	Fire Station 53	4,367	1974
11	Health and Human Resources	25,546	1991
12	Juvenile Administration Building	4,196	1999
13	Juvenile Annex	3,200	2009
14	Juvenile Detention Center and Juvenile Court	11,500	1983
15	Carson City Library	21,024	1970
16	Senior Center	59,341	1975
17	Sheriff's Administration Building	41,026	2008
18	Sheriff's Dispatch	2,948	1999
19	Mills Park Complex & Marv Teixeira Pavilion	N/A	1978
20	Centennial Park Complex	N/A	1989
21	Pete Livermore Sports Complex	N/A	1990
22	Fairview Drive	N/A	2010
23	MAC	N/A	2015
		Total:	**553,468**

ECMs to be Installed

		Aquatic Facility	Building Resource Innovation Center	Cemetery	City Hall	Community Center	Corporate Yard: Public Works A-D	Corporate Yard: Building 2 (Fleet)	Corporate Yard: Building 3 (Sand Barn)	Corporate Yard: Building 7	Corporate Yard: Building 9	Corporate Yard: Building 11	Corporate Yard: Building 13	Court House Complex	Fire Station 51	Fire Station 52 and Fire Training Building	Fire Station 53	Health and Human Resources	Juvenile Administration Building	Juvenile Annex	Juvenile Detention Center and Juvenile Court	Carson City Library	Senior Center	Sheriff's Administration Building	Sheriff's Dispatch	Mills Park Complex / Marv Teixeira Pavilion	Centennial Park Complex	Pete Livermore Sports Complex	Fairview Drive Street Lighting	MAC
ECM 1: Interior & Exterior Lighting Retrofits																														
1.1	Interior LED Lighting and Controls	X	X	X	X	X	X							X	X	X	X	X	X	X	X	X	X	X		X	X	X		
1.2	Exterior LED Lighting and Controls	X	X	X	X	X	X						X	X	X	X	X	X	X	X	X	X	X	X		X	X	X		
1.3	Can Lighting LED Retrofit													X																
ECM 2: Boiler Replacement																														
2.1	Install high-efficiency condensing boilers	X			X																									
ECM 3: Energy Management System Upgrades & Retro-																														
3.1	Upgrade existing IBEX controllers to BACtalk	X			X										X															
3.2	Global controller upgrade and network connection	X			X	X								X	X	X	X		X			X			X					
3.3	Upgrade network EMS software	X			X	X								X	X	X	X	X	X			X	X	X	X					
3.4	EMS front-end re-commissioning	X			X	X								X	X	X	X	X	X			X	X	X	X					
3.5	Install DDC EMS control system and connect to citywide network																													X
3.6	EMS for new boilers	X			X																									
3.7	New HVAC unit controls				X																									
ECM 4: Building Envelope																														
4.1	Repair air leakage at building envelope penetrations				X	X										X					X									
4.2	Repair air leakage at building windows	X				X										X														
4.3	Install weather-stripping at building doors	X			X	X										X					X				X					
4.4	Install destratifcation fans	X																												
ECM 5: City Hall HVAC Retrofit																														
5.1	Install new VAV AC supply unit with reheat system				X																									
ECM 7: Building Dynamics																														
7.1	Building Dynamics Monitoring & Reporting of Utility Bills - 5 years	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

*Note - ECM numbers revised for clarification

Schedule B: Standards of Operation and Comfort

Mechanical Systems for Carson City Modeled Buildings

Modeled Buildings		Existing						Proposed					
		Occupied		Unoccupied		Fan Schedule		Occupied		Unoccupied		Fan Schedule	
Name	Mechanical Systems/Zones	Cooling (F)	Heating (F)	Cooling (F)	Heating (F)	Schedule	Annual Hours	Cooling (F)	Heating (F)	Heating (F)	Cooling (F)	Schedule	Annual Hours
Library	AC - 1-5,7,8	74	68	85	45	Daily: 6:00 AM to 10:00 PM	5,840	74	68	95	55	M: 9:00 AM to 8:00 PM, T-TH: 9:00 AM to 9:00 PM, F: 9:00 AM to 8:00 PM, SS: 8:00 AM to 6:00 PM	4,056
Library	HRU - 6,9	74	68	74	68	24/7	8,760	74	68	95	55	M: 9:00 AM to 8:00 PM, T-TH: 9:00 AM to 9:00 PM, F: 9:00 AM to 8:00 PM, SS: 8:00 AM to 6:00 PM	4,056
Library	MZ-1	74	68	85	45	Daily: 6:00 AM to 10:00 PM	5,840	74	68	95	55	M: 9:00 AM to 8:00 PM, T-TH: 9:00 AM to 9:00 PM, F: 9:00 AM to 8:00 PM, SS: 8:00 AM to 6:00 PM	4,056
Public Safety	Jail AHU's - 1-5,7-9,12	72	70	72	70	24/7	8,760	72	70	72	70	24/7	8,760
Public Safety	Courthouse AHU's - 6,10,11	72	70	72	70	24/7	8,760	74	68	90	55	M-F: 6:00 AM to 6:00 PM SS: Off	3,120
Senior Center	AC - 1,2,4-9	72	68	72	68	24/7	8,760	74	68	90	55	M-F: 7:00 AM to 5:00 PM SS: Off	3,640
Senior Center	AC - 3	69	66	72	55	Daily: 8:00 AM to 6:00 PM	3,640	74	68	90	55	M-F: 7:00 AM to 5:00 PM SS: Off	3,640
Aquatic Center	AC-1 Exercise Rm	72	68	80	60	Daily: 5:00 AM to 10:00 PM	6,188	72	68	80	60	M-F: 4:00 AM to 8:00 PM SS: 8:00 to 6:00 PM	5,200
Aquatic Center	MUA - 1,2	N/A	78	N/A	60	Daily: 5:00 AM to 10:00 PM	6,188	N/A	78	N/A	60	M-F: 4:00 AM to 8:00 PM SS: 8:00 to 6:00 PM	5,200
Aquatic Center	MUA-3 Therapy	N/A	80	N/A	70	Daily: 5:00 AM to 10:00 PM	6,188	N/A	80	N/A	70	M-F: 4:00 AM to 8:00 PM SS: 8:00 to 6:00 PM	5,200
Aquatic Center	MUA-4 Locker Rooms	N/A	75	N/A	55	Daily: 5:00 AM to 10:00 PM	6,188	N/A	75	N/A	55	M-F: 4:00 AM to 8:00 PM SS: 8:00 to 6:00 PM	5,200
Fire Station #1	HP - 1,3,4,5	70	68	70	68	24/7	8,760	74	68	74	68	24/7	8,760
Fire Station #1	HP - 6,7	70	68	90	60	Daily: 6:00 AM to 8:00 PM	5,096	74	68	90	55	Daily: 6:00 AM to 8:00 PM	5,096

Continued. Mechanical Systems for Carson City Modeled Buildings

Modeled Buildings		Existing						Proposed					
		Occupied		Unoccupied		Fan Schedule		Occupied		Unoccupied		Fan Schedule	
Name	Mechanical Systems/Zones	Cooling (F)	Heating (F)	Cooling (F)	Heating (F)	Schedule	Annual Hours	Cooling (F)	Heating (F)	Heating (F)	Cooling (F)	Schedule	Annual Hours
Fire Station #1	HP - 2,8,9,10,11,12,13	70	68	90	60	M-F: 6:00 AM to 8:00 PM SS: Off	3,640	74	68	90	55	M-F: 6:00 AM to 8:00 PM SS: Off	3,640
City Hall	MZ-1	72	70	72	68	M-F: 5:00 AM to 10:00 PM SS: Off	4,420	74	68	90	55	M-F: 6:00 AM to 6:00 PM SS: Off	3,120
City Hall	AC - 1,2,3	74	68	90	55	M-F: 5:00 AM to 10:00 PM SS: Off	4,420	74	68	90	55	M-F: 6:00 AM to 6:00 PM SS: Off	3,120
Modeled Building System/Zone Average		**72**	**70**	**79**	**61**		**6,341**	**74**	**70**	**88**	**58**		**4,742**

Mechanical Systems for Carson City Non-Modeled Buildings

Non-Modeled Buildings		Existing						Proposed					
		Occupied		Unoccupied		Fan Schedule		Occupied		Unoccupied		Fan Schedule	
Name	Mechanical Systems/Zones	Cooling (F)	Heating (F)	Cooling (F)	Heating (F)	Schedule	Annual Hours	Cooling (F)	Heating (F)	Heating (F)	Cooling (F)	Schedule	Annual Hours
Community Center	AC - 1-12	75	66	83	58	M-F: 8:00 AM to 6:00 PM	2,600	74	68	90	55	M-F: 8:00 AM to 6:00 PM	2,600
Fire Station 52	AC - 1-2	76	65	86	50	24/7	8,760	74	68	90	55	24/7	8,760
Juvenile Detention	MZ - 1, AC-1	72	69	N/A	N/A	N/A	N/A	74	68	90	55	M-F: 7:00 AM to 6:00 PM	2,860
Juvenile Detention	MZ - 2	72	70	N/A	N/A	N/A	N/A	74	68	90	55	24/7	8,760
Sheriff's Dispatch	AC - 1-4	73	66	79	62	24/7	8760	74	68	90	55	24/7	8,760
Non-Modeled Building System/Zone Average		**74**	**67**	**83**	**57**		**6,707**	**74**	**68**	**90**	**55**		**6,348**

Schedule C: Installment Purchase Cash Flow Analysis

Project Proforma 10-31-2016
Carson City FGOA

Initial Project Costs:		
Detailed Energy Audit	$	76,000
Performance and Payment Bond (if applicable), Permits	$	41,132
Implementation Costs	$	4,129,654
Total Initial Project Costs	**$**	**4,246,786**
Nevada Governor's Energy Office Energy Audit Rebate	$	(76,000)
Celtic 3rd Party Consultant Fee (2%)	$	84,936
Cost of Issuance	$	90,000
Unerwriters Discount	$	-
Additional Proceeds	$	-
Customer Contribution	**$**	**-**
Net Project Costs	**$**	**4,345,722**
Construction Period Interest	**$**	**49,496**
Total Amount Financed	**$**	**4,395,218**

Financial Assumptions	
Term of Project (years)	20.0 yrs
Term of Financing (years)	20.0 yrs
Estimated Financing Rate	1.70%
Payments per Year (frequency)	12
Discount Rate	1.70%
Energy Escalation rate (annual)	2.94%
O&M Savings Escalation rate (annual)	3.00%
M&V Cost Escalation Rate (annual)	3.00%
O&M Cost Escalation Rate (annual)	3.00%
Project Simple Payback	21.95

Proforma		Year									
	Initial Values	1	2	3	4	5	6	7	8	9	10
1 Projected Annual Energy Cost Savings	$ 191,915	$ 197,565	$ 203,381	$ 209,368	$ 215,532	$ 221,877	$ 228,410	$ 235,134	$ 242,056	$ 249,182	$ 256,518
2 Guaranteed Energy Cost Savings	$ 178,269	$ 183,518	$ 188,920	$ 194,482	$ 200,208	$ 206,102	$ 212,170	$ 218,416	$ 224,846	$ 231,466	$ 238,280
3 O&M Savings	$ 15,189	$ 15,645	$ 16,114	$ 16,597	$ 17,095	$ 17,608	$ 18,136	$ 18,681	$ 19,241	$ 19,818	$ 20,413
4 Utility Rebates (Note 4)		$ 149,927									
5 Total Project Savings (Line 2 + Line 3 + Line 4)	**$ 193,458**	**$ 349,090**	**$ 205,034**	**$ 211,079**	**$ 217,303**	**$ 223,710**	**$ 230,306**	**$ 237,097**	**$ 244,087**	**$ 251,284**	**$ 258,693**
6 Payments for Financing Equipment		$ 327,665	$ 183,175	$ 188,771	$ 194,533	$ 200,464	$ 223,432	$ 230,223	$ 237,213	$ 244,410	$ 251,819
7 Payments for Measurement and Verification Services		$ 9,059	$ 9,331	$ 9,611	$ 9,899	$ 10,196	$ -	$ -	$ -	$ -	$ -
8 Celtic 3rd Party Consultant M&V Fee (1% of Annual Savings)		$ 1,835	$ 1,889	$ 1,945	$ 2,002	$ 2,061					
9 Payments for Operation and Maintenance Services	$ 3,550	$ 3,657	$ 3,766	$ 3,879	$ 3,996	$ 4,115	$ -	$ -	$ -	$ -	$ -
10 Total Payments		**$ 342,216**	**$ 198,161**	**$ 204,206**	**$ 210,429**	**$ 216,836**	**$ 223,432**	**$ 230,223**	**$ 237,213**	**$ 244,410**	**$ 251,819**
11 Net Annual Benefit		**$ 6,874**	**$ 6,873**	**$ 6,873**	**$ 6,874**	**$ 6,874**	**$ 6,874**	**$ 6,874**	**$ 6,874**	**$ 6,874**	**$ 6,874**
12 Cumulative Cash Flow	**$ 137,475**	$ 6,874	$ 13,747	$ 20,621	$ 27,495	$ 34,368	$ 41,243	$ 48,116	$ 54,990	$ 61,864	$ 68,738
13 **Net Present Value of Cash Flow**	**$ 115,718**										
14 Interest Rate	1.70%										
15 Discount Rate	1.70%										

Line #	Year										Totals
	11	12	13	14	15	16	17	18	19	20	
1 Projected Annual Energy Cost Savings	$ 264,070	$ 271,844	$ 279,848	$ 288,086	$ 296,568	$ 305,298	$ 314,286	$ 323,539	$ 333,064	$ 342,869	$ 5,278,498
2 Guaranteed Energy Cost Savings	$ 245,295	$ 252,516	$ 259,950	$ 267,603	$ 275,482	$ 283,592	$ 291,941	$ 300,535	$ 309,383	$ 318,491	$ 4,903,196
3 O&M Savings	$ 21,025	$ 21,656	$ 22,306	$ 22,975	$ 23,664	$ 24,374	$ 25,105	$ 25,858	$ 26,634	$ 27,433	$ 420,378
4 Utility Rebates (Note 4)											$ 149,927
5 Total Project Savings (Line 2 + Line 3 + Line 4)	**$ 266,320**	**$ 274,172**	**$ 282,256**	**$ 290,578**	**$ 299,146**	**$ 307,966**	**$ 317,046**	**$ 326,393**	**$ 336,017**	**$ 345,924**	**$ 5,473,501**
6 Payments for Financing Equipment	$ 259,446	$ 267,298	$ 275,382	$ 283,704	$ 292,272	$ 301,092	$ 310,172	$ 319,520	$ 329,143	$ 339,051	$ 5,258,786
7 Payments for Measurement and Verification Services	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 48,096
8 Celtic 3rd Party Consultant M&V Fee (1% of Annual Savings)											$ 9,732
9 Payments for Operation and Maintenance Services	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 19,413
10 Total Payments	**$ 259,446**	**$ 267,298**	**$ 275,382**	**$ 283,704**	**$ 292,272**	**$ 301,092**	**$ 310,172**	**$ 319,520**	**$ 329,143**	**$ 339,051**	**$ 5,336,027**
11 Net Annual Benefit	**$ 6,874**	**$ 6,873**	**$ 6,873**	**$ 6,873**	**$ 6,874**	**$ 6,874**	**$ 6,874**	**$ 6,873**	**$ 6,874**	**$ 6,873**	**$ 137,475**
12 Cumulative Cash Flow	$ 75,612	$ 82,485	$ 89,359	$ 96,232	$ 103,106	$ 109,980	$ 116,854	$ 123,728	$ 130,601	$ 137,475	

Notes:

1 *This cash flow reflects an estimated tax exempt lease rate of 1.7%. The actual rate will increase or decrease based on market conditions and customer credit rating at the time of lease funding.*
2 *Revenues are based on current utility rate structures and usage information provided for purposes of this project.*
3 *The performance and payment bonds apply only to the installation portion of the contract and do not apply in any way to energy savings guarantees, payments or maintenance provisions, except that the performance bond shall guarantee that the installation will be free of defective materials and workmanship for a period of 12 months following completion and acceptance of the work*
4 *The amount of the utility rebate(s) are not guaranteed. The final rebate amount will be determined by the utility company.*

Schedule D: Project Cost Summary

Project Construction Cost Category	Percentage of Trade Subcontractors, D/B Subcontracts & Equipment		
Pre-Construction Costs			
Design and other Engineering *Professional architectural and engineering services; Energy modeling*	***3.50%***	***$***	***95,128***
Pre-Construction Services *Construction management and project development services*	***3.50%***	***$***	***95,128***
Other Pre-Construction Costs *Site visits, City meetings, Legal review, Accounting services, etc.*	***2.00%***	***$***	***54,359***
Construction Costs			
Trade Subcontractors *Construction contractors subcontracted to ESCO; Lighting, construction, sheet metal, etc.* Design/Build Subcontracts *Construction and design contractors* Direct Purchase Equipment *Equipment directly purchased by ESCO*	All Categories	***$***	***2,717,955***
Construction Management *Construction manager and site superintendent*	***6.00%***	***$***	***163,077***
Project Engineering *Design engineer inspections; Engineering analysis*	***4.50%***	***$***	***122,308***
General Conditions *Miscellaneous non-staffing costs; Equipment rentals, security fencing, etc.*	***11.00%***	***$***	***298,975***
Construction Completion *Commissioning* *Training* *Construction M&V* *O&M Manuals*	***4.50%***	***$***	***122,308***
Other Construction Costs *Site visits, City meetings, Permits, Insurance, Bonds, Warranty Labor*	***5.00%***	***$***	***135,898***
Warranty	***2.00%***	***$***	***54,359***
	Subtotal	***$***	***3,859,495***
Profit	***7.00%***	***$***	***270,159***
IMPLEMENTATION COSTS		***$***	***4,129,654***
FINANCIAL GRADE OPERATIONAL AUDIT		***$***	***76,000***
PERFORMANCE AND PAYMENT BOND		***$***	***41,132***
TOTAL AMERESCO CONTRACT AMOUNT		***$***	***4,246,786***

MEASUREMENT AND VERIFICATION FEES

Year	Measurement & Verification Fee
1	$ 9,059
2	$ 9,331
3	$ 9,611
4	$ 9,899
5	$ 10,196
6	No M&V Report Selected
7	No M&V Report Selected
8	No M&V Report Selected
9	No M&V Report Selected
10	No M&V Report Selected
11	No M&V Report Selected
12	No M&V Report Selected
13	No M&V Report Selected
14	No M&V Report Selected
15	No M&V Report Selected
16	No M&V Report Selected
17	No M&V Report Selected
18	No M&V Report Selected
19	No M&V Report Selected
20	No M&V Report Selected

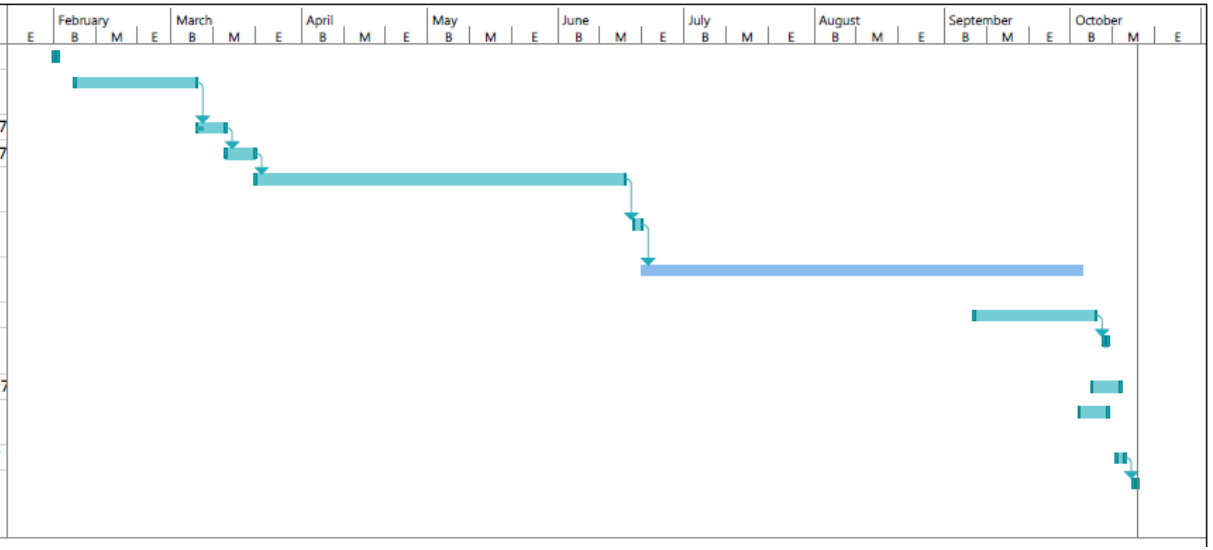
Schedule E: Payment Schedule

The monthly invoice amounts during construction will be based on the actual work completed during the month:

A	B	C	D	E	F	G	H	I
ITEM NO.	DESCRIPTION OF WORK	SCHEDULED VALUE	FROM PREV APPLICATION	THIS PERIOD	COMPLETED OR STORED TO DATE	PERCENT COMPLETE	BALANCE TO FINISH	RETENTION
1	Financial Grade Operational Audit	$76,000						
2	Performance and Payment Bond	$41,132						
3	Interior & Exterior Lighting & Controls (LED Tubes)	$2,029,545						
4	Boiler Replacements	$522,905						
5	Energy Management System Upgrades	$760,888						
6	Building Envelope	$183,519						
7	City Hall HVAC Retrofit	$619,882						
8	Building Dynamics	$12,915						
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
GRAND TOTALS		$4,246,786	$ -	$ -	$ -	0%	$ -	$ -

Schedule F: Project Schedule

ID	Task Name	Duration	Start	Finish
1	Notice to Proceed	1 day	Wed 2/1/17	Wed 2/1/17
2	Engineering and Design	21 days	Mon 2/6/17	Mon 3/6/17
3	Design Reviews	5 days	Tue 3/7/17	Mon 3/13/17
4	Permitting	5 days	Tue 3/14/17	Mon 3/20/17
5	Material Procurement	64 days	Tue 3/21/17	Fri 6/16/17
6	Construction Mobilization	2 days	Mon 6/19/17	Tue 6/20/17
7	Physical Construction	75 days	Wed 6/21/17	Tue 10/3/17
8	Commissioning	21 days	Fri 9/8/17	Fri 10/6/17
9	Substantial Completion	1 day	Mon 10/9/17	Mon 10/9/17
10	Punch List	5 days	Fri 10/6/17	Thu 10/12/17
11	Documentation and Drawings	5 days	Tue 10/3/17	Mon 10/9/17
12	Final Commissioning	2 days	Thu 10/12/17	Fri 10/13/17
13	Final Delivery, Acceptance Close Out	1 day	Mon 10/16/17	Mon 10/16/17



Schedule G: Insurance

The Contractor will determine the insurance requirements for the subcontractors and will verify coverage.

FORMAT/TIME

The Contractor shall provide City with Certificates of Insurance for coverages as listed below, and endorsements affecting coverage required by this Contract within **10 calendar days** after the award by the City. All policy certificates and endorsements shall be signed by a person authorized by that insurer and who is licensed by the State of Nevada in accordance with NRS 680A.300. All required aggregate limits shall be disclosed and amounts entered on the certificate of insurance, and shall be maintained for the duration of the contract and any renewal periods.

BEST KEY RATING

The City requires insurance carriers to maintain during the contract term, a Best Key Rating of A VII or higher, which shall be fully disclosed and entered on the certificate of insurance.

THE CITY COVERAGE

The City, its officers and employees must be expressly covered as additional insureds, except on workers' compensation and errors and omissions insurance coverages. The Contractor's insurance shall be primary (with the exception of workers' compensation and errors and omissions insurance) as respects the City, its officers and employees.

ENDORSEMENT/CANCELLATION

The Contractor's general liability insurance policy shall be endorsed to recognize specifically the Contractor's contractual obligation of additional insured to the City and must note that the City will be given 30 calendar days' notice of any policy cancellations except for 10 days' notice for nonpayment of premiums. Contractor will provide 30 days' notice of any policy change, and 10 days' notice for non-payment if the insurer will not provide that notice.

DEDUCTIBLES

All deductibles and self-insured retentions shall be fully disclosed in the Certificates of Insurance and may not exceed **$**100,000 without the express written permission of the City.

AGGREGATE LIMITS

If aggregate limits are imposed on bodily injury and property damage, then the amount of such limits must not be less than **$2,000,000**.

COMMERCIAL GENERAL LIABILITY

Subject to paragraph 6 of this attachment, the Contractor shall maintain limits of no less than **$5,000,000**(Primary and umbrella liability) per occurrence for bodily injury (including death), personal injury and property damages. Commercial General Liability coverage shall be on a "per occurrence" basis only and be provided either on a Commercial General Liability or a Broad Form Comprehensive General Liability (including a Broad Form CGL endorsement) insurance form or by other manuscript form providing equal or greater insurance coverage.

AUTOMOBILE LIABILITY

Subject to paragraph 6 of this attachment, in combination with the Contractor's umbrella liability insurance, the Contractor shall maintain limits of no less than **$1,000,000** combined single limit per occurrence for bodily injury and property damage, to include, but not be limited to, coverage against all insurance claims for injuries to persons or damages to property which may arise from services rendered by the Contractor and **any auto** used for the performance of services under this contract.

WORKERS' COMPENSATION

The Contractor shall obtain and maintain for the duration of this contract, a work certificate and/or a certificate issued by an insurer qualified to underwrite workers' compensation insurance in the State of Nevada, in accordance with Nevada Revised Statutes, regardless of whether the Contractor has any employees, and regardless of whether the insurer has determined that the Contractor is exempt from the provisions of the workers' compensation statutes.

FAILURE TO MAINTAIN COVERAGE

If the Contractor fails to maintain any of the insurance coverages required herein, the City may withhold payment, order the Contractor to stop the work, declare the Contractor in breach, suspend or terminate the contract, assess liquidated damages as defined herein, or may purchase replacement insurance or pay premiums due on existing policies. The City may collect any

replacement insurance costs or premium payments made from the Contractor or deduct the amount paid from any sums due the Contractor under this Contract.

ADDITIONAL INSURANCE

The Contractor is encouraged to purchase any such additional insurance, as it deems necessary.

DAMAGES

The Contractor is required to remedy all injuries to persons and damage or loss to any property of the City, to the extent caused by the negligence of the Contractor, its subcontractors or anyone employed, directed or supervised by Contractor.

COST

The Contractor shall pay all associated costs for the specified insurance. The cost shall be included in the bid price.

INSURANCE SUBMITTAL ADDRESS

All Insurance Certificates requested shall be sent to the City, Attention: Laura Tadman, Purchasing and Contracts, 201 N. Carson St. Suite 3, Carson City, NV 89701.

INSURANCE FORM INSTRUCTIONS

The Contractor's Insurance Company representative must fill in the following information:

A. Insurance Broker's company name, complete address, contact name, phone, and fax numbers.
B. Contractor's name, complete address, phone and fax numbers.
C. Insurance Company's Best Key Rating
D. Commercial General Liability (Per Occurrence)
    (1) Policy Number
    (2) Policy Effective Date
    (3) Policy Expiration Date
    (4) General Aggregate ($2,000,000)
    (5) Products-Completed Operations Aggregate ($2,000,000)
    (6) Personal & Advertising Injury ($1,000,000)
    (7) Each Occurrence ($1,000,000)
    (8) Fire Damage ($50,000)
    (9) Medical Expenses ($5,000)
E. Automobile Liability (Any Auto)
    (1) Policy Number
    (2) Policy Effective Date
    (3) Policy Expiration Date
    (4) Combined Single Limit ($1,000,000)
F. Workers' Compensation
G. Description: Name of Contract (must be identified on the initial insurance form and each renewal form).

Certificate Holder: (The Certificate Holder is named as an additional insured.)

City of Carson City
201 N. Carson Street, Suite 3
Carson City, NV 89701

Nevada Resident Agent Signature or Contractor's insurer if the insurer has a non-resident license.

ERRORS AND OMISSIONS

Contractor shall maintain during the term of this Contract errors and omissions insurance, with each subsequent renewal having a retroactive date which predates the date of this Agreement, in the amount of not less than one million dollars ($1,000,000). As evidence of errors and omissions insurance coverage, the City will accept certification of insurance by an authorized representative of the insurance carrier. The policy will bear a thirty (30) day written day notice of cancellation to the certificate holder.

PAYMENT BOND

Western Surety Bond #_____
Liberty Mutual Bond #_____

KNOW ALL MEN BY THESE PRESENTS, that Ameresco, Inc., (Principal) a corporation organized under the laws of the State of Delaware with its principal place of business at Suite 410,111 Speen Street, Framingham, MA. 01701 as Principal, and Western Surety Company a corporation organized under the laws of the State of South Dakota with its office located at 101 South Phillips Street, Sioux Falls, South Dakota, and Liberty Mutual Insurance Company, a corporation organized under the laws of the State of Massachusetts with its office located at 175 Berkeley Street, Boston, MA. 02116, as Co-Sureties, each being authorized to transact business in the State of, are held and firmly bound unto("Obligee"), in the penal sum of for the payment of which Principal and Co-Sureties bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents. It is understood among the parties hereto that in no event shall the surety be liable for a greater sum than the penalty of this bond.

WHEREAS, Principal has by written agreement dated entered into a Contract with Obligee for:

_____
_____hereinafter referred to as the Contract, and

WHEREAS, this Payment Bond applies only to the installation portion of the Contract and does not apply in any way to energy savings guarantees, payments or maintenance provisions thereof.

NOW, THEREFORE, the condition of this obligation is such that, if the Principal shall promptly make payment to all claimants as hereinafter defined, for all labor and material used in the performance of the installation portion of the Contract, then this obligation shall be null and void, otherwise to remain in full force and virtue, subject, however, to the following conditions: A claimant is defined as one having a direct contract with the Principal or with a subcontractor of the Principal for labor, materials or both, used or reasonably required for use in the performance of the installation portion of the Contract.

No suit or action shall be commenced hereunder by any claimant;
(a) Unless claimant, other than one having a direct contract with the Principal, shall have given written notice to any two of the following: the Principal, the Obligee or Co-Sureties above named within ninety (90) days after such claimant did or performed the last of the work or furnished the last of the materials for which said claim is made, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were furnished or for whom the work or labor was done or performed. Such notice shall be served by mailing the same by registered mail or certified mail, postage prepaid, in an envelope addressed to the Principal, Obligee, or Co-Sureties, at any place where an office is regularly maintained for the transaction of business, or served in any manner in which the legal process may be served in the state in which the aforesaid project is located, save that such service need not be made by a public officer.
(b) After the expiration of one (1) year following the date on which claimant performed labor or last furnished materials on the installation portion of said Contract, it being understood, however, that if any limitation embodied in this bond is prohibited by any law controlling the construction hereof such limitation shall be deemed to be amended so as to be equal to the minimum period of limitation permitted by such law.

IN WITNESS, WHEREOF, we have hereunto set our hands and seals this day of, 2016.

AMERESCO, INC.

BY:_____
John Granara, Chief Financial Officer

WESTERN SURETY COMPANY

BY: _____
Attorney-in-Fact

LIBERTY MUTUAL INSURANCE COMPANY

BY:_____
Attorney-in-Fact

PERFORMANCE BOND

Western Surety Bond #

Liberty Mutual Bond #

KNOW ALL MEN BY THESE PRESENTS, that Ameresco, Inc., (Principal) a corporation organized under the laws of the State of Delaware with its principal place of business at Suite 410,111 Speen Street, Framingham, MA. 01701 as Principal, and Western Surety Company a corporation organized under the laws of the State of South Dakota with its office located at 101 South Phillips Street, Sioux Falls, South Dakota, and Liberty Mutual Insurance Company, a corporation organized under the laws of the State of Massachusetts with its office located at 175 Berkeley Street, Boston, MA. 02116, as Co-Sureties, each being authorized to transact business in the State of, are held and firmly bound unto("Obligee"), in the penal sum of for the payment of which Principal and Co-Sureties bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents. It is understood among the parties hereto that in no event shall the surety be liable for a greater sum than the penalty of this bond.

WHEREAS, Principal has by written agreement dated entered into a Contract with Obligee for:
hereinafter referred to as the Contract, and

WHEREAS, this Performance Bond applies only to the installation portion of the Contract and does not apply in any way to energy savings guarantees, payments or maintenance provisions, except that this Performance Bond shall guarantee that the installation will be free of defective materials and workmanship for a period of twelve (12) months following completion and acceptance of the Contract.

NOW, THEREFORE, the condition of this obligation is such that, if the Principal shall promptly and faithfully perform the installation pursuant to the undertakings, covenants, agreements, terms and conditions of said Contract, and any extension thereof that may be granted by the Obligee, with or without notice to the Co-Sureties, and truly keep and perform all the undertakings, covenants, agreements, terms and conditions of any and all duly authorized modifications, alterations, changes or additions to said Contract that may hereafter be made, notice to the co-Sureties of such modifications, alterations, changes or additions being hereby waived, then this obligation shall become void, otherwise to remain in full force and virtue.

PROVIDED, HOWEVER, that no right of action shall accrue upon or by reason hereof to or for the use or benefit of anyone other than the Obligee(s) named herein; and that any suit, action or proceeding by the Obligee to recover on this Performance Bond shall be instituted within two years from the date of acceptance of the installation of the equipment by the Obligee, and

PROVIDED FURTHER, that whenever the Principal shall be and declared by the Obligee to be in default of the obligations under the Contract for equipment installation, the Obligee having performed its obligations under the Contract, the Co-Sureties shall: (a) arrange for the Principal, with the consent of the Obligee, to perform and complete the Contract; or (b) undertake to perform and complete the Contract itself through its agents or through Independent contractors; or (c) after investigation, determine the amount for which it may be liable to the Owner and, as soon as practical after the amount is determined, tender payment therefore to the Owner.

IN WITNESS, WHEREOF, we have hereunto set our hands and seals this day of , 2016.

AMERESCO, INC. **WESTERN SURETY COMPANY**

BY:_____ BY:_____

John Granara, Chief Financial Officer ,Attorney-in-Fact

LIBERTY MUTUAL INSURANCE COMPANY

BY:_____

, Attorney-in-Fact

Schedule H: Prevailing Wage Rates

2017 PREVAILING WAGE RATES
CARSON CITY

DATE OF DETERMINATION: October 1, 2016

APPLICABLE FOR PUBLIC WORKS PROJECTS BID/AWARDED OCTOBER 1, 2016 THROUGH SEPTEMBER 30, 2017*

***Pursuant to NAC 338.040(3), "After a contract has been awarded, the prevailing rates of wages in effect at the time of the opening of bids remain in effect for the duration of the project."**

As Amendments/Addenda are made to the wage rates, such will be posted to sites of the respective counties. Please review regularly for any amendments posted or contact our offices directly for further assistance with any amendments to the rates.

AIR BALANCE TECHNICIANALARM INSTALLERBOILERMAKERBRICKLAYERCARPENTERCEMENT MASON
ELECTRICIAN-COMMUNICATION TECH.
ELECTRICIAN-LINEELECTRICIAN-NEON SIGNELECTRICIAN-WIREMANELEVATOR CONSTRUCTORFENCE ERECTORFLAGPERSONFLOOR COVERERGLAZIERHIGHWAY STRIPERHOD CARRIER-BRICK MASONHOD CARRIER-PLASTERER TENDERIRON WORKERLABORERMECHANICAL INSULATOR
MILLWRIGHTOPERATING ENGINEEROPERATING ENG. STEEL FABRICATOR/ERECTOROPERATING ENGINEER-PILEDRIVERPAINTER
PILEDRIVER (NON-EQUIPMENT)
PLASTERERPLUMBER/PIPEFITTERREFRIGERATION
ROOFER (Does not include sheet metal roofs)
SHEET METAL WORKERSPRINKLER FITTER
SURVEYOR (NON-LICENSED)

TAPERTILE /TERRAZZO WORKER/MARBLE MASONTRAFFIC BARRIER ERECTORTRUCK DRIVERWELL DRILLER LUBRICATION AND SERVICE ENGINEER (MOBILE AND GREASE RACK)SOIL TESTER (CERTIFIED)SOILS AND MATERIALS TESTER

CRAFT	RATE	NSHE OR SCHOOL DISTRICT

PREVAILING WAGE RATES INCLUDE THE BASE RATE AS WELL AS ALL APPLICABLE FRINGES
NRS 338.010(21) "Wages" means:

(a) The basic hourly rate of pay; and
(b) The amount of pension, health and welfare, vacation and holiday pay, the cost of apprenticeship training or other similar programs or other bona fide fringe benefits which are a benefit to the workman.

NRS 338.035 Discharge of part of obligation of contractor or subcontractor engaged on public work to pay wages by making certain contributions in name of workman. The obligation of a contractor engaged on a public work or a subcontractor engaged on a public work to pay wages in accordance with the determination of the Labor Commissioner may be discharged in part by making contributions to a third person pursuant to a fund, plan or program in the name of the workman.

In accordance with AB 172:
The Labor Commissioner shall determine the prevailing wage to be 90 percent of the rate determined pursuant to paragraphs (a), (b) and (c) for:
(1) Any contract for a public work or any other construction, alteration, repair, remodeling or reconstruction of an improvement or property to which a school district or the Nevada System of Higher Education is a party; and
(2) A public work of, or constructed by, a school district or the Nevada System of Higher Education, or any other construction, alteration, repair, remodeling or reconstruction of an improvement or property of or constructed by a school district or the Nevada System of Higher Education.

AIR BALANCE TECHNICIAN	ADD ZONE RATE		
Air Balance-Journeyman		69.26	62.33
Air Balance-Foreman		71.61	66.25
Air Balance-General Foreman		77.95	70.16
ALARM INSTALLER			
Alarm Installer-Journeyman		34.44	31.00
BOILERMAKER			
Boilermaker		65.94	59.35
BRICKLAYER	ADD ZONE RATE		
Bricklayer-Journeyman		36.39	32.75
Bricklayer-Foreman		37.64	33.88
Bricklayer-General Foreman		39.39	35.45
CARPENTER	ADD ZONE RATE		
Carpenter-Journeyman		43.71	39.34
Carpenter-Foreman		46.60	41.94
CEMENT MASON	ADD ZONE RATE		
Cement Mason-Journeyman		38.52	34.67
Cement Mason-Foreman		41.31	37.18
ELECTRICIAN			
Communication Technician Installer		34.44	31.00
Communication Technician		38.07	34.26
Communication-Senior Technician		40.88	36.79
ELECTRICIAN-LINE			
Electrician-Groundman		40.19	36.17
Electrician-Lineman		60.40	54.36

Electrician-Foreman	66.29	59.66
Electrician-General Foreman	72.28	65.05
Heavy Equipment Operator	48.93	44.04

ELECTRICIAN-NEON SIGN

Electrician-Neon Sign	50.35	45.32

ELECTRICIAN-WIREMAN ADD ZONE RATE

Wireman	55.32	49.78
Cable Splicer	59.28	53.35
Wireman-Foreman	59.28	53.35
Wireman-General Foreman	63.25	56.92

ELEVATOR CONSTRUCTOR

Elevator Constructor-Journeyman Mechanic	87.91	79.12
Elevator Constructor-Mechanic in Charge	95.74	86.17

FENCE ERECTOR

Fence Erector	37.69	33.92

FLAGPERSON ADD LABORER ZONE RATE

Flagperson	31.85	28.67

FLOOR COVERER

Floor Coverer-Journeyman	39.19	35.27
Floor Coverer-Foreman	41.92	37.73

GLAZIER **SEE AMENDMENT 3**

Glazier	66.49	59.84

HIGHWAY STRIPER ADD LABORER ZONE RATE **SEE AMENDMENT 1**

Highway Striper	36.72	33.05

HOD CARRIER-BRICK MASON TENDER ADD ZONE RATE

Brick Mason-Journeyman	33.17	29.85
Brick Mason-Foreman	33.57	30.21

HOD CARRIER-PLASTER

ADD ZONE RATETENDER

Plasterer Tender-Journeyman	36.92	33.23
Plasterer-Gun Tender	37.92	34.13
Plasterer Tender-Foreman	38.28	34.45

IRON WORKER

Ironworker-Journeyman	63.95	57.56
Ironworker-Foreman	67.43	60.68
Ironworker-General Foreman	71.25	64.12

LABORER

ADD ZONE RATE

SEE GROUP CLASSIFICATIONS

Landscaper	29.56	26.60
Furniture Mover	31.06	27.95
Group 1	34.72	31.25
Group 1A	31.85	28.67
Group 2	34.82	31.34
Group 3	34.97	31.47
Group 4	35.52	31.97
Group 4A	36.47	32.82
Group 5	35.52	31.97
Group 6		

Nozzlemen, Rodmen	35.52	31.97
Gunmen, Materialmen	35.22	31.70
Reboundmen	34.87	31.38
Gunite Foremen	35.92	32.33

MECHANICAL INSULATOR ADD ZONE RATE

Mechanical Insulator-Mechanic	61.29	55.16
Mechanical Insulator-Foreman	64.29	57.86
Mechanical Insulator-General		
Foreman	66.29	59.66

MILLWRIGHT ADD ZONE RATE

Millwright	58.01	52.21

OPERATING ENGINEER
ADD ZONE RATE
SEE GROUP CLASSIFICATIONS

Group 1	49.69	44.72
Group 1A	52.45	47.21
Group 2	52.98	47.68
Group 3	53.25	47.93
Group 4	53.99	48.59
Group 5	54.29	48.86
Group 6	54.46	49.01
Group 7	54.71	49.24
Group 8	55.30	49.77
Group 9	55.62	50.06
Group 10	55.97	50.37
Group 10A	56.16	50.54
Group 11	56.40	50.76
Group 11A	58.04	52.24
Group 11B	58.85	52.97
Foreman	58.04	52.24
Add 7% to base rate for "Second" Shift		
Add 12.5% to base rate for "Special" shift		

OPERATING ENGINEER-STEEL
FABRICATOR & ERECTOR ADD ZONE RATE
SEE GROUP CLASSIFICATIONS

Group 1	64.99	58.49
Group 1 Truck Crane Oiler	58.82	52.94
Group 1 Oiler	56.86	51.17
Group 2	63.48	57.13
Group 2 Truck Crane Oiler	58.57	52.71
Group 2 Oiler	56.65	50.99
Group 3	62.24	56.02
Group 3 Truck Crane Oiler	58.35	52.52
Group 3 Oiler	56.43	50.79
Group 3 Hydraulic	58.02	52.22
Group 4	60.51	54.46
Group 5	59.41	53.47

Add 7% to base rate for "Second" Shift

Add 12.5% to base rate for "Special" Shift

OPERATING ENGINEER - PILEDRIVER

SEE GROUP CLASSIFICATIONSADD ZONE RATE

Group 1	64.46	58.01
Group 1 Truck Crane Oiler	59.00	53.10
Group 1 Oiler	57.08	51.37
Group 2	62.92	56.63
Group 2 Truck Crane Oiler	58.79	52.91
Group 2 Oiler	56.88	51.19
Group 3	61.47	55.32
Group 3 Truck Crane Oiler	58.57	52.71
Group 3 Oiler	56.65	50.99
Group 4	59.96	53.96
Group 5	58.85	52.97
Group 6	57.74	51.97
Group 7	56.78	51.10

Group 8		55.82	50.24
Add 7% to base for "Second" Shift			
Add 12.5% to base for "Special" Shift			

PAINTER

Brush/Roller Painter		36.14	32.53
Spray Painter/Paperhanger		37.38	33.64
Sandblaster		37.43	33.69
Structural Steel & Steeplejack		37.43	33.69
Swing Stage		38.14	34.33
Special Coating Application-Brush		37.38	33.64
Special Coating Application-Spray		37.43	33.69
Special Coating Application-Spray Steel		37.43	33.69
Foreman	$1.00 above highest Journeyman		

PILEDRIVER

Piledriver-Journeyman		55.46	49.91
Piledriver-Foreman		59.19	53.27

PLASTERER **ADD ZONE RATE**

Plasterer-Journeyman		38.77	34.94
Plasterer-Foreman		41.02	36.92

PLUMBER/PIPEFITTER

Plumber-Journeyman		49.80	44.82
Plumber-Foreman		53.08	47.77
Plumber-General Foreman		56.36	50.72

REFRIGERATION

Refrigeration-Journeyman		48.19	43.37

ROOFER (Does not include sheet metal roofs)

Roofer		17.53	15.80

SHEET METAL WORKER	**ADD ZONE RATE**	
Sheet Metal-Journeyman	56.43	50.79
Sheet Metal-Foreman	59.56	53.61
Sheet Metal-General Foreman	62.70	56.43
SPRINKLER FITTER		
Sprinkler Fitter-Journeyman	20.50	18.45
Sprinkler Fitter-Foreman	20.50	18.45
Sprinkler Fitter-General Foreman	20.50	18.45
SURVEYOR	**ADD ZONE RATE**	
Surveyor	53.25	47.93
TAPER		
Taper	41.41	37.27
TILE SETTER/TERRAZZO WORKER/MARBLE MASON-FINISHER		
Tile, Terrazzo and Marble Finisher	27.02	24.32

TILE SETTER/TERRAZZO
ADD ZONE RATE **WORKER/MARBLE MASON**

Tile Setter-Journeyman	35.58	Tile Setter-Foreman	36.83	
Tile Setter-General Foreman			38.58	
Terrazzo/Marble Mason-Journeyman			37.08	32.0233.15
Terrazzo/Marble Mason-Foreman			38.33	34.72
Terrazzo/Marble Mason-General Foreman			40.08	33.37 34.50

TRAFFIC BARRIER ERECTOR **ADD LABORER ZONE RATE**

Traffic Barrier Erector			34.72	36.07

TRUCK DRIVER **SEE AMENDMENT 2**

Truck Driver			52.62	31.25

WELL DRILLER

Well Driller			53.25	47.36

LUBRICATION AND SERVICE
ADD OPERATING ENG. ZONE
ENGINEER (MOBILE AND
RATE
GREASE RACK)

Lubrication and Service Engineer (mobile and grease rack)			54.71	47.93

SOIL TESTER (CERTIFIED)

Soil Tester (Certified)			38.06	34.25

SOILS AND MATERIALS
TESTER

Soils and Materials Tester			38.06	34.25

Regarding job descriptions for public works projects, please take notice of the following:

1. Pursuant to NAC 338.0095(1)(a), "A workman employed on a public work must be paid based on the type of work that the workman actually performs on the public work and in accordance with the recognized class of the workman."
2. The work description for a particular class is not intended to be jurisdictional in scope nor to be construed as limiting or prohibiting any worker from performing the work of one or more classes.
3. Any person who believes that a type of work is not classified, or who otherwise needs clarification pertaining to the recognized classes or job descriptions, shall contact the Labor Commissioner, in writing, for a determination of the applicable classification and pay rate for a particular type of work.
4. The job descriptions set forth or referenced herein supersede any and all descriptions previously agreed upon by the Labor Commissioner in any settlement agreements or stipulations arising out of contested matters.
5. The following specific provisions, where applicable, shall prevail over any general provisions of the job descriptions:

- Amendments to the prevailing wage determinations;
- Group Classifications and/or descriptions recognized by the Labor Commissioner and included with wage determinations for a particular type of work in a particular county.

AIR BALANCE TECHNICIAN, includes but is not limited to:
Inspecting, testing, programming, documenting, adjusting and balancing heating, cooling and ventilating systems using specialized tools and testing equipment to attain performance standards specified in the design of the systems.

ALARM INSTALLER, includes but is not limited to:

1. Installing or testing electrical protective signaling systems used to provide notification of fire, burglary or other irregularities on the premises of the subscriber of the system;
2. Installing of wiring and signaling units;
3. Repairing electrical protective signaling systems
4. Starting up, programming and documenting systems;

BOILERMAKER, includes but is not limited to:

1. Constructing, assembling, maintaining and repairing stationary steam boilers and boiler house auxiliaries;
2. Aligning structures or plate sections to assemble boiler frame tanks or vats;
3. Assisting in the testing of assembled vessels, directing cleaning of boilers and boiler furnaces;
4. Inspecting and repairing boiler fittings, including, without limitation, safety valves, regulators, automaticcontrol mechanisms, water columns and auxiliary machines.

BRICKLAYER, includes but is not limited to:
1. Laying materials, including without limitation, brick, structural tile and blocks of concrete, cinder, glass, gypsum and terra cotta, but not including stone, to construct or repair walls, partitions, arches, sewers, and other structures;
2. Laying and aligning bricks, blocks or tiles to build or repair structures for high temperature equipment, including, without limitation, cupola, kilns, ovens and furnaces; and
3. Fastening or fusing brick or other building materials to structures with wire clamps, anchor holes, torches or cement.
4. Pointing-cleaning-caulking of all types of masonry; caulking of window frames encased in masonry on brick, stone or cement structures, including grinding and cutting out on such work and sand blasting, steam cleaning and gunite work.
5. Pointing, cleaning and weatherproofing of buildings, grain elevators and chimneys built of stone, brick or concrete, including grinding and cutting out, sand blasting and gunite work on the same.

CARPENTER, includes but is not limited to:

1. Laying out, constructing, erecting, fabricating, installing and repairing structures and fixtures of wood, plywood, or alternative materials, doors and hardware and the fastening of the same, inclusive of garage or overhead door openers, cabinets, framework, floors, and acoustical ceiling systemsusing carpenter's hand tools and power tools;
2. Installing or erecting metal studs, drywall, lathing, wall partitions, prefabricated EFIS panels or any other system of panels that is attached to the interior or exterior of any building or structure, insulation and all types of ceilings;
3. Pre-cast concrete and concrete form work which includes but is not limited to: setting of templates, layout, fabrication, constructing, placing, erection, rigging and hoisting, stripping and removing of all forms which are to be reused;
4. Plywood decking, including, without limitation, stacking and installation of the plywood and the plywood decking;
5. Cutting, setting, removing of beam sides and soffits, bracing, and pads;
6. Constructing all wood panel forms and frame wall;
7. Building, erecting and disassembling self-supporting scaffolds that are more than 14 feet in height;
8. Laying out, cutting, joining, fitting of Foam Architectural Elements if same are attached mechanically; and
9. Shaping, cutting and planing by any means if done by hand or machine.

CEMENT MASON, includes but is not limited to:

1. Smoothing and finishing surfaces of poured concrete floors, walls, sidewalks and curbs to specified textures;
2. Patching holes with fresh concrete or an epoxy compound;
3. Molding expansion joints and edges through the use of edging tools, jointers and straightedges;
4. Setting of curb and gutter forms one board high;

ELECTRONIC COMMUNICATION TECHNICIAN, includes but is not limited to:

1. Pulling cable, installing and trimming devices, terminating loops, circuits, or other data gathering points;
2. Termination of main control panels, racks, or other head end equipment, as well as testing of all circuits from the field devices to the main control panels and/or equipment;
3. Utilizing test equipment for the purpose of troubleshooting and verifying the integrity of the circuits in question;
4. Using hand tools to assemble and install data communication lines and equipment computer systems, antennas and towers;
5. Disassembling equipment to adjust, repair or replace parts using hand tools;
6. Starting up, programming and documenting systems;
7. Measuring, cutting, splicing, connecting, soldering and installing wire and cable associated with communication systems

ELECTRICIAN LINEMAN, includes but is not limited to:

1. Erecting and repairing wood poles and prefabricated light duty metal towers, cable and related equipment to construct overhead transmission and distribution power lines used to conduct electrical energy between generating stations, substations and consumers;
2. Directing and assisting electrician ground men in attaching cross arms, insulators, lightning arresters, switches, wire conductors and auxiliary equipment to poles and towers in preparation of erecting the poles or towers;
3. Climbing erected poles or towers and installing equipment such as transformers
4. Strings wire conductors between erected poles with assistance of ground helpers and adjusts slack in conductors to compensate for contraction and elongation of conductors due to temperature variations, using winch.

ELECTRICIAN GROUNDMAN, includes but is not limited to:

1. Working under the direct supervision of linemen, including the operation of jackhammers and man hauls;
2. Loading and unloading of materials and equipment used by electrician lineman.
3. Does not include climbing poles, towers or other structures or working in the proximity of energized lines or equipment;

ELECTRICIAN-NEON SIGN, includes but is not limited to:

1. Installing, servicing and repairing plastic, neon and illuminated signs;
2. Ascending ladders or operating hydraulic or electric hoist to install, service, or examine sign to determine cause of malfunction;
3. Wiring, rewiring or removing defective parts and installing new parts using electrician's tools;
4. Removing sign or part of sign for repairs, such as structural fabrication, scroll repair, or transformer repair;

ELECTRICIAN WIREMAN, includes but is not limited to:

1. Laying out plans, installing, testing and repairing wiring, electrical fixtures, apparatus and control equipment;
2. Measuring, cutting, bending, threading, assembling and installing electrical conduit by using tools including, without limitation, a hacksaw, pipe threader, or conduit bender;
3. Pulling wiring through conduit;
4. Splicing wires;
5. Connecting wiring to lighting fixtures and power equipment;
6. Installing control and distribution apparatus, including, without limitation, switches, relays and circuit breakers, and fastening such apparatus into place;
7. Connecting power cables to equipment, including, without limitation, electric ranges and motors, and installing grounding leads;
8. Testing the continuity of a circuit to ensure electrical compatibility and safety of components using testing instruments, including, without limitation, an ohmmeter, a battery and buzzer, and an oscilloscope;
9. As necessary, cutting and welding steel structural members;

ELEVATOR CONSTRUCTOR, includes but is not limited to:

1. Assembling, installing, repairing and maintaining electric and hydraulic freight and passenger elevators, escalators and dumbwaiters;
2. Cutting pre-fabricated sections of framework, rails and other elevator components to specified dimensions, using acetylene torch, power saw, and disc grinder;
3. Installing cables, counterweights, pumps, motor foundations, escalator drives, guide rails, elevator cars, and control panels, using hand tools;

FENCE ERECTOR, includes but is not limited to:

1. Erecting or repairing chain link, wooden, tortoise, wire/wire mesh, or temporary fencing;
2. Mixing and pouring concrete around bases of posts and tamping soil into post hole to embed post;
3. Digging post holes with a spade, post hole digger or power driven auger;
4. Aligning posts through the use of lines or by sighting;
5. Verifying vertical alignment of posts with a plumb bob or spirit level;

FLAG PERSON, includes but is not limited to:

1. Directing movement of vehicular traffic through construction projects;
2. Distributing traffic control signs and markers along site in designated pattern;
3. Informing drivers of detour routes through construction sites;

FLOOR COVERER, includes but is not limited to:

1. Applying blocks, strips or sheets of shock-absorbing, sound-deadening or decorative covering to floors and walls, including carpets or rugs;
2. Measuring and cutting covering materials, such as rubber, linoleum, astro-turf, or cork tile and foundation material such as felt, using rule, straightedge, linoleum knife and snips;
3. Spreading adhesive cement over floor to cement foundation material to floor for sound-deadening, and to prevent covering from wearing at the board joints;
4. Rolling finished floors to smooth the floor and press cement into base and covering;
5. Fitting of devices for the attachment of carpet, linoleum, rubber and all resilient floor coverings and the fitting of metal edges, corners and caps used in the installation of the foregoing materials and all other preparatory work;

GLAZIER, includes but is not limited to:

1. Installing, setting, cutting, preparing, or removal of glass, or materials used in lieu thereof, including, without limitation, in windows, doorways, showers, bathtubs, skylights and display cases;
2. Installing glass on surfaces, including, without limitation, fronts of buildings, interior walls and ceilings;
3. Installing pre-assembled framework for windows and doors designed to be fitted with glass panels, including stained glass windows by using hand tools;
4. Loading and arranging of glass on trucks at the site of the public work;

HIGHWAY STRIPER, includes but is not limited to:

1. Painting highways, streets and parking surfaces by using manually propelled or mechanically propelled machines, brushes, rollers or spray guns;
2. Installing any device or application of any material used in lieu of paint for traffic direction, including, without limitation, buttons, tapes, plastics, rumble bars and other similar materials;

HOD CARRIER-BRICK MASON TENDER, includes but is not limited to:

1. Tending to or assisting brick masons, bricklayers and stonemasons;
2. Mixing, packing, wheeling and tempering mortar and fire clay;
3. Mixing, supplying and holding materials or tools;
4. Mixing, handling and conveying all other materials used by brick masons, bricklayers and stone masons;
5. Building scaffolds, trestles, boxes and swinging staging used exclusively by bricklayers and stone masons;

6. Hanging cables and placing putlogs;
7. Carrying bricks and mortar in a hod;
8. Cleaning work area and equipment of bricklayers and stone masons

HOD CARRIER-PLASTERER TENDER, includes but is not limited to:

1. Serving Plasterers in any capacity;
2. Handling materials after the materials are delivered as used by a Plasterer;
3. Building and handling all necessary trestle, scaffolding and planking of scaffolding for the exclusive use of Plasterers;
4. Building mortar boxes, mortar boards and stands.

IRONWORKER, includes but is not limited to:

1. Performing duties, as part of a crew, to raise, place and unite girders, columns and other structural steel members to form completed structures or structure frameworks;
2. Setting up hoisting equipment for raising and placing structural steel members;
3. Fastening steel members to cable of hoist, using chains, cable or rope;
4. Forcing steel members into final position using turnbuckles, crowbars, jacks, hand tools;
5. Aligning rivet holes in steel members with corresponding holes in previously placed steel members by driving drift pins to handle of wrench through holes;
6. Bolting aligned steel members to keep them in position until the steel members can be permanently riveted, bolted or welded into place;
7. Cutting and welding steel members;
8. Installing and repairing gates, iron doors, flagpoles, iron fences and roof decking;
9. Installing corrugated sheets when attached to steel frames;
10. Stud welding of all iron, steel and metal to structural steel;
11. Handling and setting of steel and metal joists;
12. Loading, unloading, hoisting, handling, signaling, placing and erecting of pre-stressed and pre-cast materials;
13. Handling, racking, sorting, cutting, bending, hoisting, placing, burning, welding and tying all material used to reinforce concrete construction;

LABORER, includes but is not limited to:
Perform tasks involving physical labor at building, highway, and heavy construction projects, tunnel and shaft excavations, and demolition sites. May operate hand and power tools of all types: air hammers, earth tampers, cement mixers, small mechanical hoists, and a variety of other equipment and instruments. May clean and prepare sites, dig trenches, set braces to support the sides of excavations, erect scaffolding, clean up rubble and debris, and remove asbestos, lead, and other hazardous waste materials. May assist other craft workers.

MARBLE MASON, includes but is not limited to:

1. Cutting, tooling, and setting marble slabs in floors and walls of buildings and renovating and polishing marble slabs previously set in buildings;
2. Trimming, facing and cutting marble to a specific size using a power saw, cutting and facing equipment, and hand tools
3. Drilling holes in marble slabs and attaching brackets;
4. Spreading mortar on the bottom and sides of a marble slab and on the side of adjacent marble slabs;
5. Setting blocks in positions, tamping a marble slab into place and anchoring bracket attachments with wire;
6. Filling joints between marble slabs with grout and removing excess grout with a sponge;
7. Cleaning and beveling cracks and chips on marble slabs using hand tools and power tools;

8. Heating cracked or chipped areas of a marble slab with a blowtorch and filling the defect with a composition mastic that matches the grain of the marble slab; and
9. Polishing marble slabs and other ornamental stone to a high luster by using hand tools and power tools.

MECHANICAL INSULATOR, includes but is not limited to:

1. Covering and lining structures with cork, canvas, tar paper, magnesia and related materials;
2. Installing blown-on insulation on pipe and machinery;
3. Lining of mechanical room surfaces and air handling shafts;
4. Filling and damming of fire stops and penetrations including, but not limited to, electrical and mechanical systems;
5. Foam applications for the purpose of thermal, acoustical, or fire protective purposes, including RTV foams or equivalents, applied to mechanical or electrical systems;
6. Duct lining and duct wrapping, direct application and installation of fire protection of grease ducts, exhaust systems, or any other ductwork for acoustical or thermal purposes;
7. Insulation of field joints on pre-insulated underground piping and the pouring of Gilsilite or its equivalent;
8. The application of material, including metal and PVC jacketing, on piping, fittings, valves, flanges, boilers, ducts, plenums, flues, tanks, vats, equipment and any other hot or cold surface for the purpose of thermal control;

MILLWRIGHT, includes but is not limited to:

1. Installing machinery and equipment according to layout plans, blueprints and other drawings in industrial establishments by using hoists, lift trucks, hand tools and power tools;
2. Dismantling machines by using hammers, wrenches, crowbars and other hand tools;
3. Assembling and installing equipment, including, without limitation, shafting, conveyors, monorails and tram rails, by using hand tools and power tools;
4. Constructing foundations for machines by using hand tools and building materials, including, without limitation, wood, cement and steel;
5. Assembling machines and bolting, welding, riveting or otherwise fastening them to a foundation or other structure by using hand tools and power tools; and
6. Repairing and lubricating machines and equipment (at the site of the public work) assembled and used by millwrights.

OPERATING ENGINEER, includes but is not limited to:

Operate one or several types of power construction equipment, such as motor graders, bulldozers, scrapers, compressors, pumps, derricks, shovels, tractors, or front-end loaders to excavate, move, and grade earth, erect structures, or pour concrete or other hard surface pavement.

PAINTER, includes but is not limited to:

1. All painting of walls, equipment, buildings, bridges and other structural surfaces by using brushes, rollers and spray guns;
2. Application of wall coverings/wall paper;
3. Removing old paint to prepare surfaces before painting the surface;
4. Mixing colors or oils to obtain desired color or consistency;
5. Sanding surfaces between coats and polishing final coat to a specified finish;
6. Cutting stencils and brushing and spraying lettering and decorations on surfaces;
7. Washing and treating surfaces with oil, turpentine, mildew remover or other preparations;
8. Filling cracks, holes and joints with caulk, putty, plaster or other filler by using caulking gun or putty knife;

PILEDRIVER, includes but is not limited to:

1. Operating pile drivers mounted on skids, barge, crawler, treads or locomotive crane to drive piling as foundations for structures including, without limitation, buildings, bridges and piers;
2. Barking, shoeing, splicing, form building, heading, centering, placing, driving, staying, framing, fastening, automatic pile threading, pulling and/or cutting off of piling;
3. Fabricating, forming, handling and setting of all such pre-cast, pre-stressed and post-stressed shapes that are an integral part of docks, piers, wharves, bulkheads, jetties, and similar structures;

PIPEFITTER, includes but is not limited to:

Assembling, installing, modifying and maintaining pipe systems, pipe supports and pneumatic equipment and related machines and equipment components for steam, hot water, heating, cooling, lubricating, sprinkling and industrial and processing systems which may require:

a. Cutting, threading and hammering pipe to specifications using tools, including, without limitation, saws, cutting torches and pipe threaders and benders;
b. Attaching pipes to walls, structures and fixtures, including without limitation, radiators or tanks, using brackets, clamps, tools, or welding equipment;
c. Coating non-ferrous piping materials by dipping in mixture of molten tin and lead to prevent erosion, or galvanic and electrolytic action;

PLASTERER, includes but is not limited to:

1. Applying coats of plaster onto interior or exterior walls, ceilings, or partitions of buildings to produce a finished surface according to blueprints, architects' drawings and oral instruction;
2. Creating decorative textures in finish coat by using sand, pebbles or stones;
3. Installing guide wires on exterior surfaces of buildings to indicate thickness of plaster or stucco;
4. Applying weatherproof, decorative covering to exterior surfaces of a building;
5. Molding and installing ornamental plaster pieces, panels and trim;
6. Directing workers to mix plaster to a desired consistency;
7. Assembly of EFIS panels;
8. Laying out, cutting, joining, fitting and installation of Architectural Foam Elements which are trowel applied or adhesive set;
9. Applying, shaping, cutting, and planing in preparation for netting done by hand or machine;
10. All plaster or synthetic finishes applied to Foam Architectural Elements

PLUMBER, includes but is not limited to:

Assembling, installing and repairing pipes, fittings and fixtures for heating, water and drainage systems inside of buildings and to a point 5 feet outside of buildings which may therein require:

a. Repairing and maintaining plumbing by replacing defective washers, repairing or mending broken pipes, and opening clogged drains;
b. Assembling pipe sections, tubing and fittings by using screws, bolts, solder, plastic solvent and caulking;
c. Installing pipe assemblies, fittings, valves and fixtures, including, without limitation, sinks, toilets and tubs, by using hand tools and power tools;
d. Cutting openings in structures, excluding concrete, to accommodate pipe and pipe fittings by using hand tools and power tools;

e. Filling pipes and plumbing fixtures with water or air and observing pressure gauges to detect and locate leaks.

REFRIGERATION MECHANIC, includes but is not limited to:

1. Installing and repairing industrial and commercial refrigeration systems;
2. Mounting compressors, condensers and other refrigeration components to the frame of a refrigerator by using hand tools and acetylene welding equipment;
3. Assembling structural and functional components needed for refrigeration, including, without limitation, controls, switches, gauges, wiring harnesses, valves, pumps, compressors, condensers, cores and pipes;
4. Installing expansion and control valves by using hand tools and acetylene welding equipment;
5. Cutting, bending, threading and connecting pipe from functional components to water, power or refrigeration systems;
6. Fabricating and assembling components and structural portions of a refrigeration system;

ROOFER, includes but is not limited to:

1. Installing and covering roofs and structures with slate, asphalt, wood and other related materials, other than sheet metal, by using brushes, knives, punches, hammers and other tools;
2. Spraying roofs, sidings and walls with material to bind, seal, insulate or soundproof sections of a structure;
3. Installation of all plastic, slate, slag, gravel, asphalt and composition roofing, and rock asphalt mastic when used for damp and waterproofing;
4. Installation of all damp resisting preparations when applied on roofs with mop, three-knot brush, roller, swab or spray system;
5. All types of preformed panels used in waterproofing;
6. Handling, hoisting and storing of all roofing, damp and waterproofing materials;
7. The tear-off and/or removal of roofing and roofing materials;

SHEET METAL WORKER, includes but is not limited to:

1. Fabricating, assembling, dismantling, installing or repairing:
   - Sheet metal roofs, including #30 felt roofing paper installed to form a metal roofing system;
   - Sheet metal parts or equipment, including, without limitation, duct work, metal lockers and kitchen equipment;
   - Air-veyor and air-handling systems, regardless of materials used;
2. Setting up and operating fabrication machines to cut, bend and straighten sheet metal;
3. Shaping metal over anvils, blocks or forms using a hammer;
4. Operating soldering and welding equipment to join sheet metal parts;
5. Inspecting, assembling and smoothing seams and joints of burred surfaces;
6. Welding, soldering, bolting, riveting, screwing, clipping, caulking or bonding component parts to assemble products by using hand tools, power tools and devices for lifting and handling;

SPRINKLER FITTER, includes but is not limited to:

Installing, dismantling, maintaining, repairing, adjusting and correcting all fire protection and fire control systems, including the installation of piping or tubing, appurtenances and equipment pertaining thereto, including both overhead and underground water mains, fire hydrants, and hydrant mains, standpipes and hose connection to sprinkler systems, sprinkler tank heaters, air lines and thermal systems used in connection with sprinkler and alarm systems.

SURVEYOR, includes but is not limited to:

1. Planning ground surveys designed to establish base lines, elevation and other geodetic measurements;
2. Compiling data relevant to the shape, contour, gravitation, location, elevation and dimension of land and land features on or near the surface of the Earth for engineering, map making, mining, land evaluation, construction and other purposes;
3. Surveying bodies of water to determine navigable channels and to secure data for construction of breakwaters, piers and other marine structures;
4. Computing data necessary for driving and connecting underground passages, underground storage and volume of underground deposits.

TAPER, includes but is not limited to:

1. Sealing joints between plasterboard or other wallboards to prepare a wall surface for painting or papering;
2. Mixing sealing compound by hand or with a portable electric mixer and spreading the compound over the joints between boards using a trowel, broad knife, or spatula;
3. Filling cracks and holes in walls and ceilings with sealing compound ;
4. Applying texturing compound and primer to walls and ceiling to prepare a surface for a final finish by using brushes, rollers and spray guns;
5. Coating of joint compound or taping mud;

TERRAZZO WORKER, includes but is not limited to:
1. Applying cement, sand, pigment and marble chips to floors and stairways to attain durable and decorative surfacing according to specifications or drawings;
2. Spreading mixtures of sand, cement and water over surface with a trowel to form terrazzo;
3. Cutting metal division strips and pressing the metal division strips into a terrazzo base so that top edges form a desired design or pattern and define level of finished floor surface;
4. Spreading mixtures of marble chips, cement, pigment and water over a terrazzo base to form a finished surface by using a float and trowel;
5. Pre-casting terrazzo blocks in wooden forms

TILE SETTER, includes but is not limited to:

1. Applying tile and materials made for tile in tile-like units to walls, floors, ceilings and promenade roof decks following design specification;
2. Applying glazed, unglazed, mosaic and other ceramic tiles, which are used as a surface on floors, walls, ceilings, and other surfaces and which must be set to specific grade;
3. Applying and floating all setting beds into which glazed, unglazed, mosaic, or other ceramic tiles are set;
4. Leveling and plumbing tiles to a specified grade

TILE, TERRAZZO AND MARBLE FINISHER, includes but is not limited to:

1. Supplying and mixing construction materials for a tile setter, terrazzo worker or marble setter;
2. Applying grout and finishing the surface of installed tile, terrazzo and marble;
3. Cleaning installed tile, terrazzo and tile surfaces;
4. Renovation and filling chipped, cracked and broken pieces of tile, terrazzo and marble;
5. Grinding and polishing tile, terrazzo and marble;
6. Assisting a tile setter, terrazzo worker or marble setter;

TRAFFIC BARRIER ERECTOR, includes but is not limited to:

Erects or places instruments to provide directional assistance to traffic on or near the public works construction project.

TRUCK DRIVER, includes but is not limited to:

Driving a tractor trailer combination or a truck to transport goods or materials at the site of a public work or between sites of a public work. (Also, see descriptions listed with Truck Driver rates, if any.)

WELL DRILLER, includes but is not limited to:

1. Setting, operating or tending to portable drilling rig machinery and related equipment to drill wells; 2. Extending stabilizing jackscrews to support and level a drilling rig;
3. Installing water well pumps;
4. Drillings wells for industrial water supplies, irrigation water supplies or water supplies for any other purpose; dewatering or other similar purposes; exploration; hole drilling for geologic and hydrologic information; and core drilling for geologic information.

GROUP CLASSIFICATIONS

LABORER, includes but is not limited to:

Group 1

All cleanup work of debris, grounds, and building including windows and tile
Dumpmen or Spotter (other than asphalt)
Handling and Servicing of Flares, Watchmen
General Laborer
Guide Posts and Highway Signs
Guardrail Erection and Dismantling
Limber, Brushloader and Piler
Pavement Marking and Highway Striping
Traffic Control Supervisor

Group 2

Choker setter or Rigger (clearing work only) Pittsburgh
Chipper and similar type brush shredders
Concrete worker (wet or dry) all concrete work not listed in Group 3
Crusher or Grizzly Tender
Greasing Dowels
Guinea Chaser (Stakemen)
Panel Forms (wood or metal) handling, cleaning and stripping of Loading and unloading, (Carrying and handling of all rods and material for use in reinforcing concrete
Railroad Trackmen (maintenance, repair or builders)
Sloper
Semi-Skilled Wrecker (salvaging of building materials other than those listed in Group 3)

Group 3

Asphalt Workers (Ironers, Shovelers, Cutting Machine)
Buggymobile
Chainsaw, Faller, Logloader and Bucker
Compactor (all types)
Concrete Mixer under 1/2 yard
Concrete Pan Work (Breadpan type), handling, cleaning\stripping

Concrete Saw, Chipping, Grinding, Sanding, Vibrator
Cribbing, Shoring, Lagging, Trench Jacking, Hand-Guided Lagging Hammer
Curbing or Divider machine
Curb Setter (precast or cut)
Ditching Machine (hand-guided)
Drillers Helper, Chuck Tender
Form Raiser, Slip Forms
Grouting of Concrete Walls, Windows and Door Jams
Headerboardmen
Jackhammer, Pavement Breaker, Air Spade
Mastic Worker (wet or dry)
Pipewrapper, Kettlemen, Potmen, and men applying asphalt, creosote and similar type materials
All Power Tools (air, gas, or electric), Post Driver
Riprap-Stonepaver and RockSlinger, including placing of sack concrete wet or dry Rototiller
Rigging and Signaling in connection with Laborers' work
Sandblaster, Potmen, Gunmen or Nozzlemen
Vibra-screed
Skilled Wrecker (removing and salvaging of sash, windows, doors, plumbing and electrical fixtures)

Group 4
Burning and Welding in connection with Laborers' work
Joy Drill Model TWM-2A, Gardner Denver Model DN143 and similar type drills (in accordance with Memorandum of Understanding between Laborers and Operating Engineers dated at Miami, Florida, Feb. 3, 1954) and Track Drillers, Diamond Core Drillers, Wagon Drillers, Mechanical Drillers on Multiple Units High scalers
Concrete pump operator
Heavy Duty Vibrator with Stinger 5" diameter or over
Pipelayer, Caulker and Bander
Pipelayer-waterline, Sewerline, Gasoline, Conduit
Cleaning of Utility Lines
Slip Lining of Utility Lines (including operation of Equipment)
TV Monitoring and Grouting of Utility Lines
Asphalt Rakers

Group 4A
Foreman

Group 5
Construction Specialists
Blasters and Powdermen, all work of loading, placing, and blasting of all powder and explosives of any type, regardless of method used for such loading and placing
Asbestos removal
Lead abatement
Hazardous waste
Material removal

Group 6
Gunite Foremen, Nozzlemen, Rodmen, Gunmen, Materialmen, Reboundmen

OPERATING ENGINEER, includes but is not limited to:

Group 1
Engineer Assistant

Group 1A
Heavy Duty Repairman Helper
Oiler
Parts man

Group 2
Compressor Operator
Material Loader and/or Conveyor Operator (handling building materials) Pump Operator

Group 3
Bobcat or similar loader, 1/4 cu. yd. or less
Concrete Curing Machines (streets, highways, airports, canals)
Conveyor Belt Operator (tunnel)
Forklift (under 20)
Engineer Generating Plant (500 K.W.)
Mixer Box Operator (concrete plant)
Motorman
Rotomist Operator
Oiler (truck crane)

Group 4
Concrete Mixer Operator, Skip type
Dinky Operator
Forklift (20' or over) or Lumber Stacker
Ross Carrier
Skip Loader Operator (under one (1) cu. yd.)
Tie Spacer

Group 5
Concrete Mixers (over one (1) cu. yd.)
Concrete Pumps or Pumpcrete Guns
Elevator and Material Hoist (one (1) drum)
Groundman for Asphalt Milling and similar

Group 6
Auger type drilling equipment up to and including 30 ft. depth digging capacity m.r.c.
Boom Truck or Dual Purpose a-Frame Truck
B.L.H. Lima Road Pactor or similar
Chip Box Spreader (Flaherty type or similar)
Concrete Batch Plant (wet or dry)
Concrete Saws (highways, streets, airports, canals)
Locomotives (over thirty (30) tons)
Maginnis International Full Slab Vibrator (airports, highways, canals and warehouses)
Mechanical Finishers (concrete) (Clary, Johnson, Bidwell Bridge Deck or similar types)
Mechanical Burn, Curb and/or Curb and Gutter Machine (concrete or asphalt)
Pavement Breaker, Truck Mounted, with compressor combination
Pavement Breaker or Tamper (with or without compressor combination)
Power Jumbo Operator (setting slip-forms, etc., in tunnels)
Roller Operator (except asphalt)
Self-Propelled Tape Machine
Self-Propelled Compactor (single engine)

Self-Propelled Power Sweeper Operator
Slip-Form Pump (power-driven by hydraulic, electric, air, gas, etc. lifting device for concrete forms) Small Rubber-Tired Tractors
Snooper Crane, Paxton-Mitchell or similar
Stationary Pipe Wrapping, Cleaning and Bending Machine Operator

Group 7

Auger type drilling equipment over 30 ft. depth digging capacity m.r.c.
Compressor (over 2)
Concrete Conveyor or Concrete Pump, truck or equipment mounted (any assistance required shall be performed by an Assistant to Engineer) Boom length to apply
Concrete Conveyor, Building Site
Drilling and Boring Machine, vertical and horizontal (not to apply to waterliners, wagon drills or jack hammers) Crusher Plant Engineer
Generators
Kolman Loader
Material Hoist (two (2) or more drums)
Mechanical Finishers or Spreader Machine (asphalt, Barber-Greene or similar)
Mine or Shaft Hoist
Pipe Bending Machines (pipeline only)
Pipe Cleaning Machines (tractor-propelled and supported)
Pipe Wrapping Machines (tractor-propelled and supported)
Portable Crushing and Screening Plants
Post Driller And/Or Driver
Pumps (over 2)
Roller Operator (asphalt)
Screedman (except asphaltic or concrete paving)
Screedman (Barber-Greene and similar) (asphaltic or concrete paving)
Self-Propelled Boom-Type Lifting Device (center mount) (on ten (10) ton capacity or less) Slusher Operator
Surface Heater and Planer Operator
Trenching Machine (maximum digging capacity three (3) ft. depth) (Any assistance in the operation, if needed, shall be performed by an Assistant to Engineer)
Truck-Type Loader
Welding Machines (gasoline or diesel)

Group 8

Asphalt Plant Engineer
Asphalt Milling Machine
Cast-In-Place Pipe-Laying Machine
Combination Slusher and Motor Operator
Concrete Batch Plant (multiple units)
Dozer Operator
Drill Doctor
Elevating Grader Operator
Grooving and Grinding Machine (highways)
Ken Seal Operator
Loader (up to and including two and one-half (2 1/2) cu. yds)
Mechanical Trench Shield
Mixermobile Push Cats
Road Oil Mixing Machine Operator Wood-Mixer (and other similar Pugmill equipment)
Rubber-Tired Earthmoving Equipment (up to and including thirty-five (35) cu. yds. "struck " m.r.c., Euclids, TPulls, DW10, 20, 21 and similar)
Self-Propelled Compactors with Dozer; Hyster 450, Cat 825 or similar Sheepfoot

Small Tractor (with boom)
Soil Stabilizer (P & H or equal)
Timber Skidder (rubber-tired) or similar equipment
Tractor-Drawn Scraper
Tractor Operator
Tractor-Mounted Compressor Drill Combination
Trenching Machine Operator (over three (3) feet depth)
Tri-Batch Paver
Tunnel Badger or Tunnel Boring Machine Operator
Tunnel Mole Boring Machine
Vermeer T-600b Rock Cutter

Group 9

Chicago Boom
Combination Backhoe and Loader (up to and including 3/8 cu. yd.)
Combination Mixer and Compressor (gunite)
Heavy Duty Repairman and/or Welder
Lull Hi-Lift (twenty (20) feet or over)
Mucking Machine
Sub-Grader (Gurries or other types)
Tractor (with Boom) (D6 or larger)
Track-Laying-Type Earthmoving Machine (single engine with tandem scrapers)

Group 10

Boom-Type Backfilling Machine
Bridge Crane
Cary-Lift or similar
Chemical Grouting Machine
Derricks (two (2) Group 10 Operators required when swing engine remote from hoist)
Derrick Barges (except excavation work)
Euclid Loader and similar types
Gradesetter, Grade Checker
Heavy Duty Rotary Drill Rigs
Lift-Slab (Vagtborg and similar types)
Loader (over two and one-half (2 1/2 cu. yds. up to and including four (4) cu. yds.)
Locomotive (over one hundred (100) tons, single or multiple units)
Multiple-Engine Earthmoving Machines (Euclid Dozers, etc.)
Pre-Stress Wire Wrapping Machine
Rubber-Tired Scraper, Self-Loading
Single-Engine Scraper (over thirty-five (35) cu. yds.)
Shuttle Car (Reclaim Station)
Train Loading Station
Trenching Machine multi-engine with sloping attachments (Jefco or similar)
Vacuum Cooling Plant
Whirley Crane (up to and including twenty-five (25) tons)

Group 10A

Backhoe-Hydraulic (up to and including one (1) cu. yd.)
Backhoe (up to and including one (1) cu. yd.) (Cable)
CMI Dual Lane Auto-Grader SP30 or similar type
Cranes (not over twenty-five (25) tons) (hammerhead and gantry)
Finish Blade
Gradalls (up to and including one (1) cu. yd.)
Motor Patrol Operator

Power Shovels, Clamshells, Draglines, Cranes (up to and including one (1) cu. yd.)
Rubber-Tired Scraper, Self-Loading (twin engine)
Self-Propelled Boom-Type Lifting Device, center mount (over 10 tons up to and including 25 tons)

Group 11

Automatic Asphalt or Concrete Slip-Form Paver
Automatic Railroad Car Dumper
Canal Trimmer
Cary Lift, Campbell or similar type
Cranes (over twenty-five (25) tons)
Euclid Loader when controlled from the Pullcat
Highline Cableway Operator
Loader (over four (4) cu. yds. up to and including twelve (12) cu. yds.)
Multi-Engine Earthmoving Equipment (up to and including seventy-five (75) cu. yds. struck m.r.c.)
Multi-Engine Scrapers (when used to Push Pull)
Power Shovels, Clamshells, Draglines, Backhoes Gradalls (over one (1) cu. yd. and up to and including seven (7) cu. yds. m.r.c.)
Self-Propelled Boom-Type Lifting Device (center mount) (over 25 tons m.r.c.)
Self-Propelled Compactor (with multiple-propulsion power units)
Single-Engine Rubber-Tired Earthmoving Machine, with Tandem Scraper
Slip-Form Paver (concrete or asphalt)
Tandem Cats and Scraper
Tower Crane Mobile (including Rail Mount)
Truck Mounted Hydraulic Crane when remote control equipped (over 10 tons up to and including 25 tons)
Universal Liebher and Tower Cranes (and similar types)
Wheel Excavator (up to and including seven hundred fifty (750) cu. yds. per hour) Whirley Cranes (over twenty-five (25) tons)

Group 11A

Band Wagons (in conjunction with Wheel Excavators)
Operator of Helicopter)when used in construction work)
Loader (over twelve (12) cu. yds.)
Multi-Engine Earthmoving Equipment (over seventy-five (75) cu. yds. "struck" m.r.c.)
Power Shovels. Clamshells, Draglines, Backhoes, and Gradalls (over seven 7 cu. yds. m.r.c.)
Remote-Controlled Earth Moving Equipment
Wheel Excavator (over seven hundred fifty (750) cu. yds. per hour)

Group 11B

Holland Loader or similar or Loader (over 18 cu. yds.)

OPERATING ENGINEERS - Steel Fabricator & Erector

Group 1
Cranes over 100 tons
Derrick over 100 tons
Self-Propelled Boom Type Lifting Devices over 100 tons

Group 2
Cranes over 45 tons up to and including 100 tons
Derrick, 100 tons and under
Self Propelled Boom Type Lifting Device, over 45 tons Tower Crane

Group 3
Cranes, 45 tons and under
Self Propelled Boom Type Lifting Device, 45 tons and under

Group 4
Chicago Boom
Forklift, 10 tons and over
Heavy Duty Repairman/Welder

Group 5
Boom Cat

OPERATING ENGINEER -Piledriver

Group 1
Derrick Barge Pedestal mounted over 100 tons Clamshells over 7 cu. yds.
Self Propelled Boom Type Lifting Device, over 100 tons
Truck Crane or Crawler, land or barge mounted over 100 tons

Group 2
Derrick Barge Pedestal mounted 45 tons up to and including 100 tons Clamshells up to and including 7 cu. yds.
Self Propelled Boom Type Lifting Device over 45 tons
Truck Crane or Crawler, land or barge mounted, over 45 tons up to and including 100 tons

Group 3
Derrick Barge Pedestal mounted under 45 tons
Self Propelled Boom Type Lifting Device 45 tons and under
Skid/Scow Piledriver, any tonnage
Truck Crane or Crawler, land or barge mounted 45 tons and under

Group 4
Assistant Operator in lieu of Assistant to Engineer
Forklift, 10 tons and over
Heavy Duty Repairman/Welder

Group 5
No current classification

Group 6
Deck Engineer

Group 7
No current classification

Group 8
Deckhand
Fireman

ZONE RATES

AIR BALANCE

In addition to AIR BALANCE rates add the applicable amounts per hour, calculated on a radius from the City Hall of Las Vegas, Nevada:

Zone 1-0 to 30 miles	$0.00
Zone 2-31 to 50 miles	$2.50
Zone 3-51 to 100 miles	$3.50 (including Laughlin)
Zone 4-over 100 miles	$5.00

BRICKLAYER

In addition to BRICKLAYER rates add the applicable amounts per hour, calculated based on a radius of over fifty (50) miles from the Washoe County Courthouse in Reno, Nevada:

Zone 1-0-35 Miles	0.00
Zone 2-36-75 Miles	1.25
Zone 3-Over 75 Miles	5.37

CARPENTER (Building and Heavy Highway and Dam Construction)

In addition to CARPENTER rates add the applicable amounts per hour, calculated from the Washoe County Courthouse:

Zone 1-0 to 50 miles	$0.00 (road miles of either the Carson City Courthouse or the Washoe County Courthouse)
Zone 2-51-150 miles	$3.00
Zone 3-151-300 miles	$4.00
Zone 4-301 miles and over	$5.00

CEMENT MASON

In addition to CEMENT MASON rates add the applicable amounts per hour, calculated from the Reno Post Office, 50 So. Virginia St., Reno, Nevada:

Zone 1-0-90 miles	$0.00
Zone 2-91 miles and over	$6.00

ELECTRICIAN

In addition to Electrician rates add the applicable amounts per hour, calculated from the Washoe County Courthouse:

Zone 1-0-70 miles	$0.00
Zone 2-71-90 miles	$8.00
Zone 3 -91 miles and over	$10.00

ELECTRICIAN-COMMUNICATION TECH

In addition to Electrician Communication Tech rates add the applicable amounts per hour, calculated from the Washoe County Courthouse:

Zone 1-0-70 miles	$0.00
Zone 2-71-90 miles	$5.00
Zone 3 -91 miles and over	$7.00

HOD CARRIER-BRICK MASON TENDER

In addition to Hod Carrier Brick Mason Tender rates, add the applicable amounts per hour, calculated based on road miles from the Washoe County Courthouse:

Zone 1-35 to 75 miles	$1.25
Zone 2-76 miles and over	$7.50

HOD CARRIER-PLASTERER

In addition to Hod Carrier Plasterer rates add the applicable amounts per hour, calculated based on a road miles from So. Virginia St., Reno, Nevada:

Zone 1-70 miles	$0.00
Zone 70 miles and over	$8.00

LABORER (Highway and Dam Construction only)

In addition to LABORER rates add the applicable amounts per hour, calculated based on a radius from either the Carson City Courthouse or the Washoe County Courthouse:

Zone 1-0 to 50 miles	$0.00
Zone 2-51 to 150 miles	$3.00
Zone 3-151 to 300 miles	$4.00
Zone 4-301 miles and over	$5.00

LABORER (Building Construction)

In addition to LABORER rates add the applicable amounts per hour, calculated based on road miles from either the Carson City Courthouse or the Washoe County Courthouse:

Zone 1-0 to 50 miles	$0.00
Zone 2-51 to 150 miles	$3.00
Zone 3-151 to 300 miles	$4.00
Zone 4-301 miles and over	$5.00

MECHANICAL INSULATOR

In addition to MECHANICAL INSULATOR rates add the applicable amounts per hour, calculated based on a radius figured from Reno City Hall:

Zone 1-0-20 miles-	$1.25
Zone 2-21-40 miles-	$2.50
Over 40 miles-	$10.63

MILLWRIGHT

In addition to MILLWRIGHT rates, add the applicable amounts per hour, calculated on road miles from either the Carson City Courthouse or the Washoe County Courthouse:

Zone 1-1 to 14 miles	$0.00
Zone 2-15 to 35 miles	$1.50
Zone 3-35 miles and over	$3.25

OPERATING ENGINEER

In addition to: OPERATING ENGINEER; STEEL FABRICATOR and ERECTOR, PILEDRIVER, SURVEYOR, and LUBRICATION AND SERVICE ENGINEER rates add the applicable amounts per hour calculated based on a radius from the Washoe County Courthouse:

Zone 1-0 to 75 miles	$0.00
Zone 2-75 to 150 miles	$3.00
Zone 3-151 to 300 miles	$4.00
Zone 4-301 miles and over	$5.00

PLASTERER

In addition to PLASTERER rates add the applicable amounts per hour, calculated from the South Virginia and Mill Street, Reno, Nevada:

Zone 1-0-70 miles	$0.00
Zone 2-70 miles and over	$8.00

SHEET METAL WORKER

In addition to SHEET METAL WORKER rates, add the applicable amounts per hour, calculated based on a radius from the courthouse in Reno, Nevada:

Zone 1-0 to 75 miles	$0.00
(including the City of Fallon and the Fallon Naval Air Base) Zone 2-over 75 miles	$8.12

TILE SETTER/TERRAZZO WORKER/MARBLE MASON

In addition to TILE SETTER/TERRAZZO WORKER/MARBLE MASON rates add the applicable amounts per hour, calculated based on a radius of over thirty five (35) miles from the Washoe County Courthouse in Reno, Nevada:

Zone 1-0-35 Miles	$0.00
Zone 2-35-75 Miles	$1.25
Zone 3-Over 75 Miles	$5.00

Schedule I: Prevailing Wage Acknowledgement

ACKNOWLEDGEMENT AND STIPULATION OF BIDDER REGARDING PENALTIES FOR NONCOMPLIANCE WITH NEVADA PREVAILING WAGE REQUIREMENTS

PERFORMANCE-BASED CONTRACT

Contract No. 1415-123
PWP (PWP #)

The undersigned, Ameresco, acknowledges and stipulates that:

1. This contract is for a public work as set forth in Nevada Revised Statutes Chapter 338.
2. A contractor engaged on public works shall forfeit, as a penalty to the public body in behalf of which the contract has been made and awarded to the contractor, not less than $20 nor more than $50 for each calendar day or portion thereof that each workman employed on the public work is paid less than the designated rate for any work done under the contract, by the contractor or any subcontractor under him, unless waived by the Labor Commissioner for good cause shown.
3. A contractor engaged on a public work shall forfeit, as a penalty to the public body on behalf of which the contract has been made and awarded to the contractor, not less than $20 nor more than $50 for each calendar day or portion thereof for each workman employed on the public work for which the contractor or subcontractor willfully included inaccurate or incomplete information in the monthly record required to be submitted to the public body pursuant to subsection 5 of NRS 338.070, unless waived by the Labor Commissioner for good cause shown.
4. A contractor engaged on a public work shall forfeit, as a penalty to the public body on behalf of which the contract has been made and awarded to the contractor, not less than $20 nor more than $50 for each calendar day or portion thereof that each workman employed on the public work is not reported to the public body awarding the contract by the contractor or any of his subcontractors as required pursuant to subsection 5 of NRS 338.070, unless waived by the Labor Commissioner for good cause shown, up to a maximum amount of
   (a) For the first failure to comply during the term of the contract for the public work, $1,000; and
   (b) For each subsequent failure to comply during the term of the contract for the public work, $5,000.
5. If a violation of more than one provision of subsections 1, 2 and 3 involves the same workmen, the contractor shall forfeit the penalty set forth in each subsection that was violated, unless waived by the Labor Commissioner for good cause shown.
6. If a penalty is imposed pursuant to this section, the costs of the proceeding, including investigative costs and attorney's fees, may be recovered by the labor commissioner.

Ameresco

Robert Georgeoff, VP
Name and Title of Authorized Representative

Signature

11/3/2016
Date

Schedule J: Certificate of Drug and Alcohol Policy

AFFIDAVIT OF CERTIFICATION FOR DRUG AND ALCOHOL POLICY

PERFORMANCE-BASED CONTRACT
Contract No. 1415-123

County of Maricopa

State of Arizona

COMES NOW Robert Georgeoff, and being duly sworn under penalty of perjury, deposes and says:

I am the Vice President for the Southwest Region and am authorized by said firm to certify that AMERESCO, Inc. has in place a drug and alcohol policy that will be actively enforced and that all workers who will be employed on the City's Public Works Construction Project will be subject to the policy.

Further affiant sayeth naught.

By: (owner and/or officer of entity)

SUBSCRIBED and SWORN to before me this 3rd day of November, 2016.

SHARON COLE
NOTARY PUBLIC, ARIZONA
MARICOPA COUNTY
My Commission Expires
July 14, 2019

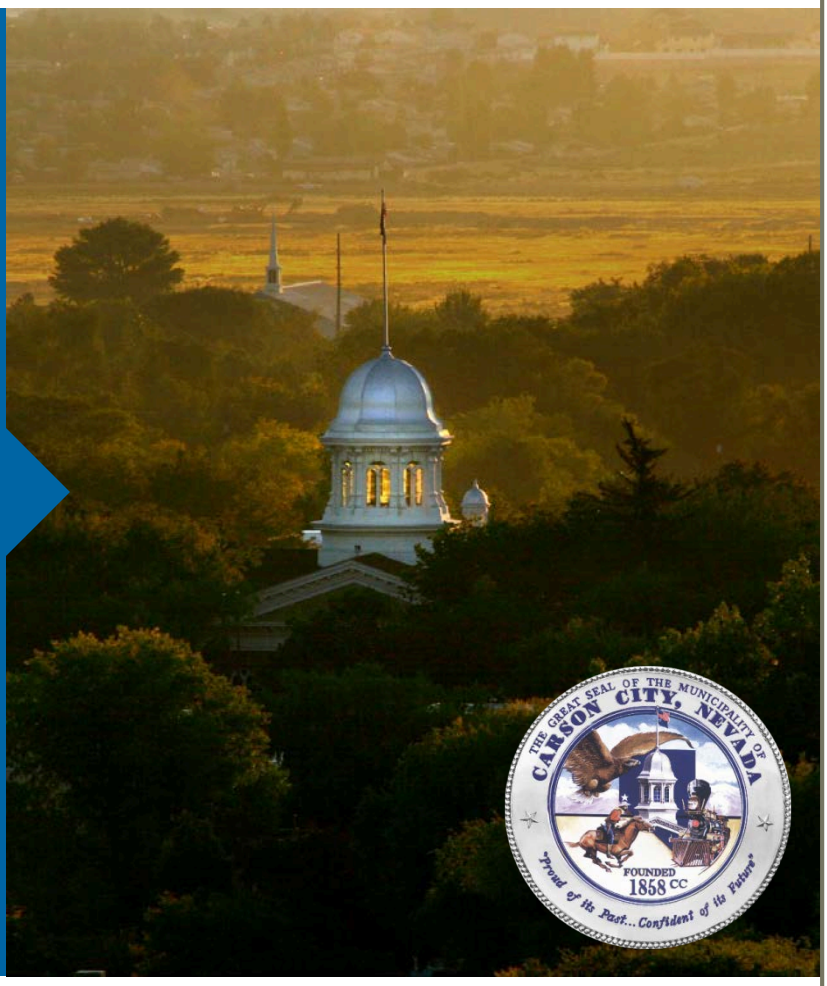
NOTARY PUBLIC

Attachment AA

Prepared for

Carson City, Nevada

Carson City, Nevada Financial Grade Operational Audit 100 Percent Report



November 2, 2016

AMERESCO
Green • Clean • Sustainable

Carson City, Nevada
Financial Grade Operational Audit
100 Percent Report

November 2, 2016

Prepared for

Carson City, Nevada

Presented by

Ameresco, Inc.
Steven Frost, PE, CEM
Senior Business Development Engineer
639 Isbell Road, Suite 360
Reno, NV 89509

P: 602.881.1313
F: 508.598.3380
E: sfrost@ameresco.com

Table of Contents

This page is intentionally left blank.

1.0 Project Executive Summary

Carson City, Nevada (City) issued an RFP for a Performance Contract for Energy/Operating Cost Saving Measures back in early 2015. Ameresco was ultimately selected by the City and put under contract on October 1, 2015. The scope of work for the Financial Grade Operational Audit (FGOA) encompasses the 23 sites listed in Table 1.0 and shown on the map below.

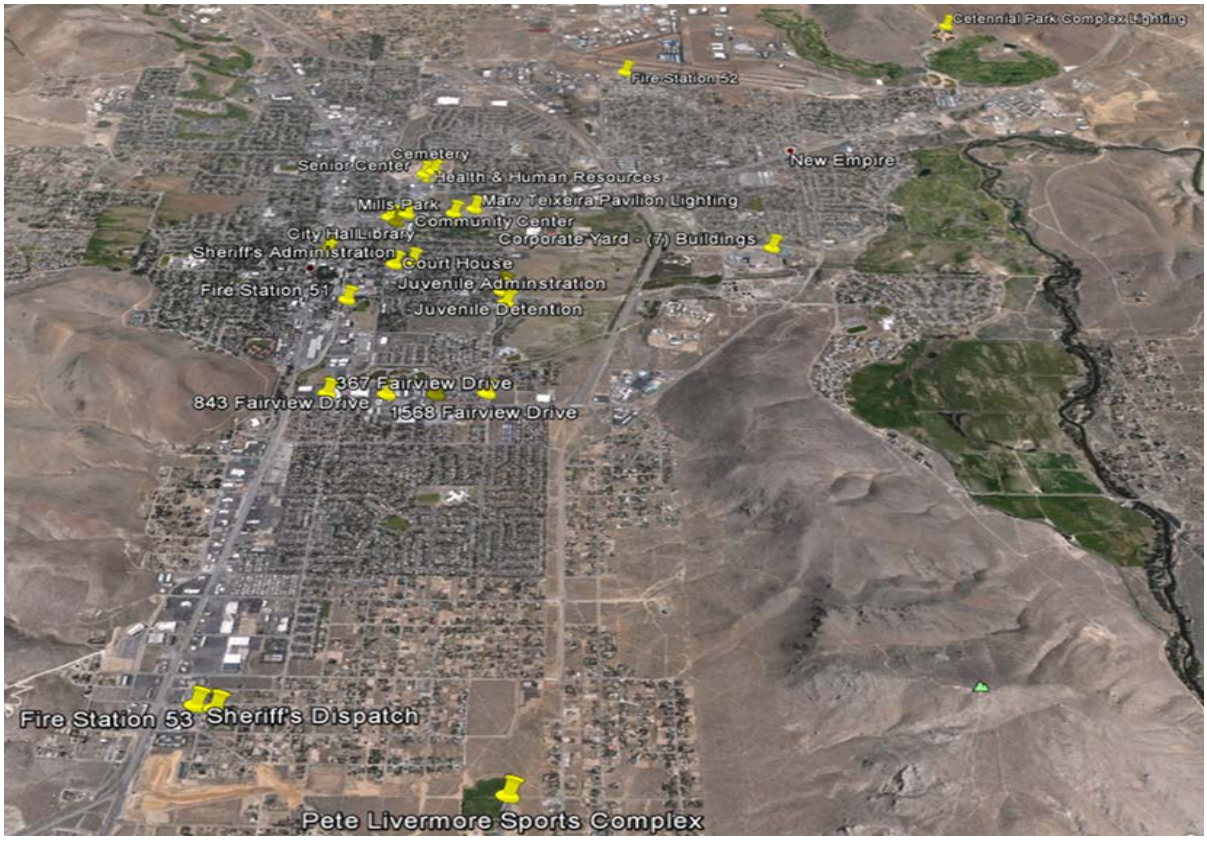


Figure 1.0. Financial Grade Operational Audit Site Portfolio Location Map

Table 1.0. Financial Grade Operational Audit Site Portfolio

Site No.	Site Name	Area (Sq. Ft.)	Year Built
1	Aquatic Facility	32,498	1976
2	Community Development Center (BRIC)	10,000	1947
3	Cemetery	3,000	2002
4	City Hall	34,097	1987
5	Community Center	43,230	1973
6	Corporate Yard Facility	79,880	Various
	Public Works	*34,500*	
	Building 2 (Fleet)	*6,500*	
	Building 3 (Sand Barn)	*N/A*	
	Building 7	*12,700*	
	Building 9	*19,180*	
	Building 11	*1,000*	
	Building 13	*6,000*	
7	Court House Complex	131,772	1999
8	Fire Station 51	18,074	1995
9	Fire Station 52 and Fire Training Building	27,769	1974
	Fire Training Building	*9,800*	
	Fire Station 52	*17,969*	
10	Fire Station 53	4,367	1974
11	Health and Human Resources	25,546	1991
12	Juvenile Administration Building	4,196	1999
13	Juvenile Annex	3,200	2009
14	Juvenile Detention Center and Juvenile Court	11,500	1983
15	Carson City Library	21,024	1970
16	Senior Center	59,341	1975
17	Sheriff's Administration Building	41,026	2008
18	Sheriff's Dispatch	2,948	1999
19	Mills Park Complex & Marv Teixeira Pavilion	N/A	1978
20	Centennial Park Complex	N/A	1989
21	Pete Livermore Sports Complex	N/A	1990
22	Fairview Drive	N/A	2010
23	MAC	N/A	2015
	Total:	**553,468**	

This Financial Grade Operational Audit 100 Report documents the results of the collaborative effort between key City personnel and the Ameresco development team. This report presents the energy conservation measures (ECMs) proposed for implementation in an energy savings performance contract (ESPC) that is funded by guaranteed energy savings within the contemplated 20-year project financing term.

The FGOA is the first step of the ESPC process. This approach has been used by federal, state and local governments to achieve facility infrastructure improvements. The improvements are funded with a budget neutral, self-funding financial approach with the savings paying for the project over the project term. Ameresco, in cooperation and consultation with Carson City facilities and capital planning staff, have identified $4,395,218 in facility improvements. These ECMs include the package of measures listed in Table 1.1.

The proposed energy conservation measures include the following:

1. Interior & Exterior Lighting Retrofits: The interior lighting retrofit measure replaces existing interior lamps with new light emitting diode (LED) lamps. The exterior lighting retrofit involves replacing existing wall-mounted and pole-mounted area light fixtures with new LED fixtures.
2. Boiler Replacements: This measure replaces old, inefficient boilers with new high efficiency condensing boilers. Energy savings will be realized, in addition to improved boiler reliability and redundancy.
3. Energy Management System Upgrades & Retro-Commissioning: The intent of this measure is to upgrade Carson City's energy management controls systems and to correct and improve existing control sequences, provide control system internet connectivity to more sites and repair and replace obsolete control components. This will result in improved building comfort, operations, maintenance performance and energy efficiency.
4. Building Envelope: This measure improves the thermal performance of the building shell, particularly in building areas where air leakage occurs. Air sealing measures will be implemented resulting in energy savings, as well as improvements in building occupant comfort.
5. City Hall HVAC Retrofit: The intent of this measure is to replace the existing constant volume, 7-zone multi-zone unit at City Hall with a variable volume air conditioning unit. Additionally, approximately 20 variable air volume zone boxes will be added to the system for zone control. Replacing this equipment as a part of this project will result in avoided future capital costs, energy cost savings, and improved comfort.
6. Building Dynamics: This measure will include monitoring and reporting of energy consumption and historical utility data and a public facing dashboard that will display building electric and natural gas consumption.

Table 1.1 also shows the ECM costs and savings on a simple payback basis prior to financing, taxes, third-party, and measurement and verification costs. Project costs that are not specific to an ECM, such as the 3rd Party Consultant Fee and the Cost of Issuance for the financing, are included in the cash flow. Figure 1.1 indicates which measures will be applied at each building.

Table 1.1. Financial Grade Operational Audit 100 Percent ECM Summary Table

ECM No.	Energy Conservation Measure	Annual Electric Demand Savings (kW)	Annual Electric Energy Savings (kWh)	Annual Electric Savings ($)	Annual Natural Gas Savings (Therms)	Annual Natural Gas Savings ($)	Operations & Maintenance Savings ($)	Total Savings ($)	Total Implementation Cost	Simple Payback
1	Interior & Exterior Lighting Retrofits	3,189	1,325,714	$97,076	-	-	$15,189	$112,265	$2,029,545	16
2	Boiler Replacements	(10)	(6,729)	-$435	15,018	$9,267	-	$8,832	$522,905	53.5
3	Energy Management System Upgrades & Retro-Commissioning	411	533,198	$29,946	33,426	$21,022	-	$50,968	$760,888	13.6
4	Building Envelope	-	88,802	$4,320	12,239	$8,113	-	$12,433	$183,519	13.6
5	City Hall HVAC Retrofit	111	98,056	$5,888	4,424	$3,073	-	$8,961	$619,882	Capital Project
7	Building Dynamics	-	-	-	-	-	-	-	$12,915	-
	Total:	**3,700**	**2,039,040**	**$136,795**	**65,108**	**$41,474**	**$15,189**	**$193,459**	**$4,129,654**	**19.2**

		Aquatic Facility	Building Resource Innovation Center	Cemetery	City Hall	Community Center	Corporate Yard: Public Works A-D	Corporate Yard: Building 2 (Fleet)	Corporate Yard: Building 3 (Sand Barn)	Corporate Yard: Building 7	Corporate Yard: Building 9	Corporate Yard: Building 11	Corporate Yard: Building 13	Court House Complex	Fire Station 51	Fire Station 52 and Fire Training Building	Fire Station 53	Health and Human Resources	Juvenile Administration Building	Juvenile Annex	Juvenile Detention Center and Juvenile Court	Carson City Library	Senior Center	Sheriff's Administration Building	Sheriff's Dispatch	Mills Park Complex / Marv Teixeira Pavilion	Centennial Park Complex	Pete Livermore Sports Complex	Fairview Drive Street Lighting	MAC
ECM 1: Interior & Exterior Lighting Retrofits																														
1.1	Interior LED Lighting and Controls	X	X	X	X	X	X							X	X	X	X	X	X	X	X	X	X	X		X	X	X		
1.2	Exterior LED Lighting and Controls	X	X	X	X	X	X						X	X	X	X	X	X	X	X	X	X	X	X		X	X	X		
1.3	Can Lighting LED Retrofit													X																
ECM 2: Boiler Replacement																														
2.1	Install high-efficiency condensing boilers	X			X																									
ECM 3: Energy Management System Upgrades & Retro-																														
3.1	Upgrade existing IBEX controllers to BACtalk	X			X										X															
3.2	Global controller upgrade and network connection	X			X	X								X	X	X	X		X			X			X					
3.3	Upgrade network EMS software	X			X	X								X	X	X	X	X	X			X	X	X	X					
3.4	EMS front-end re-commissioning	X			X	X								X	X	X	X	X	X			X	X	X	X					
3.5	Install DDC EMS control system and connect to citywide network																													X
3.6	EMS for new boilers	X			X																									
3.7	New HVAC unit controls				X																									
ECM 4: Building Envelope																														
4.1	Repair air leakage at building envelope penetrations				X	X										X					X									
4.2	Repair air leakage at building windows	X				X										X														
4.3	Install weather-stripping at building doors	X			X	X										X					X				X					
4.4	Install destratifcation fans	X																												
ECM 5: City Hall HVAC Retrofit																														
5.1	Install new VAV AC supply unit with reheat system				X																									
ECM 7: Building Dynamics																														
7.1	Building Dynamics Monitoring & Reporting of Utility Bills - 5 years	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

*Note - ECM numbers revised for clarification

Figure 1.1. Energy Conservation Measure Matrix

This page is intentionally left blank.

The energy savings associated with the ECMs are guaranteed by Ameresco and provide positive cash flow to fund annual finance payments for the City improvements over the 20-year term. Ameresco will make-up any annual shortfalls by providing additional energy conservation measures or by writing a check to the City for the shortfall.

The highlights of the estimated financing package are as follows:

Total Initial Project Costs:	$4,246,786
Total Amount Financed:	$4,395,218
Guaranteed Annual Energy Cost Savings:	$
Operation and Maintenance Savings:	$15,189
Preliminary Interest Rate:	1.7%
Project Term:	20 years

A proposed project cash flow proforma detailing the financing associated with this project follows.

This page is intentionally left blank.

> Carson City Project Proforma

Initial Project Costs:		
Detailed Energy Audit	$	76,000
Performance and Payment Bond (if applicable), Permits	$	41,132
Implementation Costs	$	4,129,654
Total Initial Project Costs	**$**	**4,246,786**
Nevada Governor's Energy Office Energy Audit Rebate	$	(76,000)
Celtic 3rd Party Consultant Fee (2%)	$	84,936
Cost of Issuance	$	90,000
Underwriters Discount	$	-
Additional Proceeds	$	-
Customer Contribution	**$**	**-**
Net Project Costs	**$**	**4,345,722**
Construction Period Interest	**$**	**49,496**
Total Amount Financed	**$**	**4,395,218**

Financial Assumptions	
Term of Project (years)	20.0 yrs
Term of Financing (years)	20.0 yrs
Estimated Financing Rate	1.70%
Payments per Year (frequency)	12
Discount Rate	1.70%
Energy Escalation rate (annual)	2.94%
O&M Savings Escalation rate (annual)	3.00%
M&V Cost Escalation Rate (annual)	3.00%
O&M Cost Escalation Rate (annual)	3.00%
Project Simple Payback	21.95

Proforma	Initial Values	Year 1	2	3	4	5	6	7	8	9	10
1 Projected Annual Energy Cost Savings	$ 191,915	$ 197,565	$ 203,381	$ 209,368	$ 215,532	$ 221,877	$ 228,410	$ 235,134	$ 242,056	$ 249,182	$ 256,518
2 Guaranteed Energy Cost Savings	$ 178,269	$ 183,518	$ 188,920	$ 194,482	$ 200,208	$ 206,102	$ 212,170	$ 218,416	$ 224,846	$ 231,466	$ 238,280
3 O&M Savings	$ 15,189	$ 15,645	$ 16,114	$ 16,597	$ 17,095	$ 17,608	$ 18,136	$ 18,681	$ 19,241	$ 19,818	$ 20,413
4 Utility Rebates (Note 4)		$ 149,927									
5 Total Project Savings (Line 2 + Line 3 + Line 4)	**$ 193,458**	**$ 349,090**	**$ 205,034**	**$ 211,079**	**$ 217,303**	**$ 223,710**	**$ 230,306**	**$ 237,097**	**$ 244,087**	**$ 251,284**	**$ 258,693**
6 Payments for Financing Equipment		$ 327,665	$ 183,175	$ 188,771	$ 194,533	$ 200,464	$ 223,432	$ 230,223	$ 237,213	$ 244,410	$ 251,819
7 Payments for Measurement and Verification Services		$ 9,059	$ 9,331	$ 9,611	$ 9,899	$ 10,196	$ -	$ -	$ -	$ -	$ -
8 Celtic 3rd Party Consultant M&V Fee (1% of Annual Savings)		$ 1,835	$ 1,889	$ 1,945	$ 2,002	$ 2,061					
9 Payments for Operation and Maintenance Services	$ 3,550	$ 3,657	$ 3,766	$ 3,879	$ 3,996	$ 4,115	$ -	$ -	$ -	$ -	$ -
10 Total Payments		**$ 342,216**	**$ 198,161**	**$ 204,206**	**$ 210,429**	**$ 216,836**	**$ 223,432**	**$ 230,223**	**$ 237,213**	**$ 244,410**	**$ 251,819**
11 Net Annual Benefit		**$ 6,874**	**$ 6,873**	**$ 6,873**	**$ 6,874**	**$ 6,874**	**$ 6,874**	**$ 6,874**	**$ 6,874**	**$ 6,874**	**$ 6,874**
12 Cumulative Cash Flow	**$ 137,475**	$ 6,874	$ 13,747	$ 20,621	$ 27,495	$ 34,368	$ 41,243	$ 48,116	$ 54,990	$ 61,864	$ 68,738
13 **Net Present Value of Cash Flow**	**$ 115,718**										
14 Interest Rate	1.70%										
15 Discount Rate	1.70%										

Line #	Year 11	12	13	14	15	16	17	18	19	20	Totals
1 Projected Annual Energy Cost Savings	$ 264,070	$ 271,844	$ 279,848	$ 288,086	$ 296,568	$ 305,298	$ 314,286	$ 323,539	$ 333,064	$ 342,869	$ 5,278,498
2 Guaranteed Energy Cost Savings	$ 245,295	$ 252,516	$ 259,950	$ 267,603	$ 275,482	$ 283,592	$ 291,941	$ 300,535	$ 309,383	$ 318,491	$ 4,903,196
3 O&M Savings	$ 21,025	$ 21,656	$ 22,306	$ 22,975	$ 23,664	$ 24,374	$ 25,105	$ 25,858	$ 26,634	$ 27,433	$ 420,378
4 Utility Rebates (Note 4)											$ 149,927
5 Total Project Savings (Line 2 + Line 3 + Line 4)	**$ 266,320**	**$ 274,172**	**$ 282,256**	**$ 290,578**	**$ 299,146**	**$ 307,966**	**$ 317,046**	**$ 326,393**	**$ 336,017**	**$ 345,924**	**$ 5,473,501**
6 Payments for Financing Equipment	$ 259,446	$ 267,298	$ 275,382	$ 283,704	$ 292,272	$ 301,092	$ 310,172	$ 319,520	$ 329,143	$ 339,051	$ 5,258,786
7 Payments for Measurement and Verification Services	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 48,096
8 Celtic 3rd Party Consultant M&V Fee (1% of Annual Savings)											$ 9,732
9 Payments for Operation and Maintenance Services	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 19,413
10 Total Payments	**$ 259,446**	**$ 267,298**	**$ 275,382**	**$ 283,704**	**$ 292,272**	**$ 301,092**	**$ 310,172**	**$ 319,520**	**$ 329,143**	**$ 339,051**	**$ 5,336,027**
11 Net Annual Benefit	**$ 6,874**	**$ 6,873**	**$ 6,873**	**$ 6,873**	**$ 6,874**	**$ 6,874**	**$ 6,874**	**$ 6,873**	**$ 6,874**	**$ 6,873**	**$ 137,475**
12 Cumulative Cash Flow	$ 75,612	$ 82,485	$ 89,359	$ 96,232	$ 103,106	$ 109,980	$ 116,854	$ 123,728	$ 130,601	$ 137,475	

Notes:

1. *This cash flow reflects an estimated tax exempt lease rate of 1.7%. The actual rate will increase or decrease based on market conditions and customer credit rating at the time of lease funding.*
2. *Revenues are based on current utility rate structures and usage information provided for purposes of this project.*
3. *The performance and payment bonds apply only to the installation portion of the contract and do not apply in any way to energy savings guarantees, payments or maintenance provisions, except that the performance bond shall guarantee that the installation will be free of defective materials and workmanship for a period of 12 months following completion and acceptance of the work*
4. *The amount of the utility rebate(s) are not guaranteed. The final rebate amount will be determined by the utility company.*

This page is intentionally left blank.

1.1 Environmental Benefits

The total guaranteed energy savings from implementing these ECMs are $178,269. An additional $15,189 of maintenance savings will accrue from the lighting retrofits due to the longer life of the LEDs. This savings reflects reduced material purchases only. The total cost for constructing the project is $4,345,722. This cost includes third party consultant fees, detailed audit fees, performance and payment bond and implementation costs. Simple payback time for the project is 21.7 years including the rebates. Installation of all five ECMs would annually reduce:

- Electricity consumption by 2,039,040 kilowatt-hours
- Natural gas consumption by 65,108 therms
- The production of 1,598 tons of carbon dioxide, 518 pounds of sulfur dioxide and 26 pounds of nitrous oxides

In terms of emission reductions, the environmental benefits associated with this energy conservation project are equivalent to…

annual greenhouse gas emissions from removing **376** passenger cars from the road, *or*

CO_2 emissions from **200,089** gallons of gasoline consumed annually, *or*

CO_2 emissions from the energy use of **188** typical American homes for 1 year, *or*

46,084 tree seedlings grown for 10 years, *or*

greenhouse gas emissions avoided by not landfilling **565** tons of waste

This page is intentionally left blank.

2.0 Introduction

This Financial Grade Operational Audit (FGOA) 100 Percent Report provides the recommended improvements that Ameresco proposes for implementation as part of an energy services performance contract (ESPC). Ameresco has developed subcontractor scopes of work, obtained subcontractor proposals, developed firm project costs and completed detailed energy savings analyses and calculations. This FGOA identifies a package of conservation measures and capital improvements that can be implemented as a self-funded project over a 20-year term.

Specifically, this FGOA presents the following:

- Section 3.0 Project Financials. Proposed project cash flow proforma. This section includes the high-level project cost build-up items such as annual debt service payments, measurement and verification costs, financing rates, escalation, etc.
- Section 4.0 Historical Utility Baseline. Detailed, site-by-site level baseline utility consumption and costs, as well as portfolio level benchmarking.
- Section 5.0 Facility and System Descriptions. Detailed facility descriptions of the baseline conditions for the portfolio of buildings.
- Section 6.0 Savings Analysis. Savings analysis, including energy modeling details and spreadsheet calculations.
- Section 7.0 Energy Conservation Measures. Energy conservation measures (ECMs) developed as part of the FGOA; a package of potential measures and associated project term; and measures recommended for implementation as part of a proposed energy performance contract.
- Section 8.0 Measurement and Verification Plan. Outline of the M&V Plan for each of the proposed ECMs, including detailed M&V procedures.
- Section 9.0 Commissioning Plan. Overview of the Commissioning Plan for the project, including a sample of the proposed documentation for one of the ECMs.
- Section 10.0 Operations and Maintenance Plan. Outline of how the installed ECMs are to be operated and maintained by Carson City.
- Section 11.0 Construction Schedule. Proposed construction period for the ECMs.
- Appendices. Appendices are a catalog of supporting data garnered during the audit, including control system trend log information, logger data and utility data. ECM cost estimates and the executable building energy simulation models are also included.

This page is intentionally left blank.

3.0 Project Financials

Ameresco, in cooperation and consultation with Carson City staff, has identified $4,395,218 in facility improvements that can be implemented within a 20-year financing term. These improvements are in the form of energy conservation measures (ECMs). The savings associated with the ECMs are guaranteed by Ameresco, and provide positive cash flow to fund annual finance payments for the City improvements over the 20-year term. Should a shortfall occur, Ameresco will make-up any annual shortfall by providing additional energy conservation measures or by writing a check to the City for the balance.

Details of the project financials are described below and result in the project proforma that follows.

Project Financed Costs	
Total Initial Project Costs: *Includes audit costs, audit rebate, bonding and permitting, direct and indirect construction costs and fees, third party consultant fees, and taxes.*	$4,246,786
Total Amount Financed: *Includes initial project costs, financing origination costs, and construction period interest.*	$4,395,218
Utility Rebates: *Includes NV Energy Commercial Incentive rate of $0.30 per kWh saved for energy savings associated with lighting.*	$149,927
Annual Savings	
Guaranteed Annual Utility Cost Savings: *Includes first year cost savings prior to escalation.*	$178,269
Annual Operations and Maintenance Savings: *Includes first year cost savings prior to escalation.*	$15,189
Annual Payments	
Year 1 Annual Payment for Measurement and Verification: *Includes first year cost savings for M&V services provided by Ameresco.*	$9,059
Year 1 Payment for Financing Equipment:	$327,665
Financing and Escalation Rates	
Estimated Financing Rate: *Final rate to be determined prior to EPC contract execution.*	1.7%
Energy Escalation Rate:	2.944%
Operations and Maintenance Escalation Rate:	3.0%
Measurement and Verification Escalation Rate:	3.0%
Project Term:	20 years
Net Annual Benefit:	$6,874

This page is intentionally left blank.

4.0 Historical Utility Baseline

Utility analysis is critical in the evaluation of the potential for cost effective energy conservation measures (ECMs). To identify ECM opportunities, Ameresco evaluated utility rates, as well as utility consumption and cost for each of the 28 individually meters included as part of this Financial Grade Operational Audit (FGOA). (Note that some building sites have multiple utility meters).

To establish an energy baseline for the included facilities, Ameresco collected and analyzed utility data spanning from July 2012 through October 2015. A baseline was selected of July 2014 to June 2015, based on the continuity of utility data, weather and typical operations throughout this period.

> Spending Analysis

Annual site utility spending was approximately $1.1 million for the baseline period. Electricity expenditures represent 70 percent of the total utility spend. A summary of available utility spending is provided in Table 4.0 and Figure 4.0.

Table 4.0, below, compares utility costs for all 28 metered sites in the Ameresco portfolio. Carson City has spent an average of $1.1 million per year over the last 3 years for electricity and the last two years for natural gas, and utility costs have relatively remained the same overall at $1.1 million over the most recent 12 months ending in June, 2015. The -0.29 percent decrease over the average is primarily a result of fluctuations in electric rate and natural gas rates.

Table 4.0. Annual Utility Spending

Utility	Three Year Average (Electricity) Two Year Average (Natural Gas) ($)	12 Month Baseline ($)	Difference (%)
Electricity	$778,502	$770,032	-1.09%
Natural Gas	$330,942	$336,211	1.59%
Total:	**$1,109,444**	**$1,106,243**	**-0.29%**

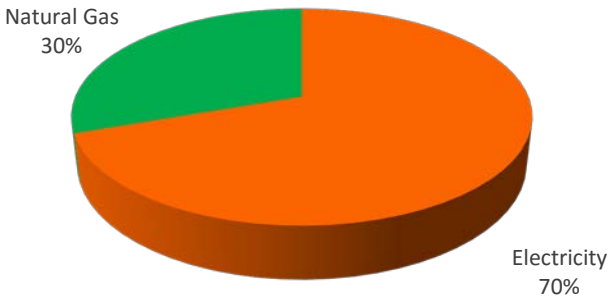


Figure 4.0. Utility Expenditures by Type

The energy cost index (ECI), or total energy utility spending per gross square foot, is one of the most common ways to compare energy costs between facilities. This metric includes 12 months of energy cost data as reported on monthly utility bills and is divided by the total square footage of the building. The ECI allows the energy costs of buildings that are different sizes to be compared, thus identifying which buildings performs better. An ECI analysis was conducted using the 12-month baseline ECI data and is shown in Figure 4.1.

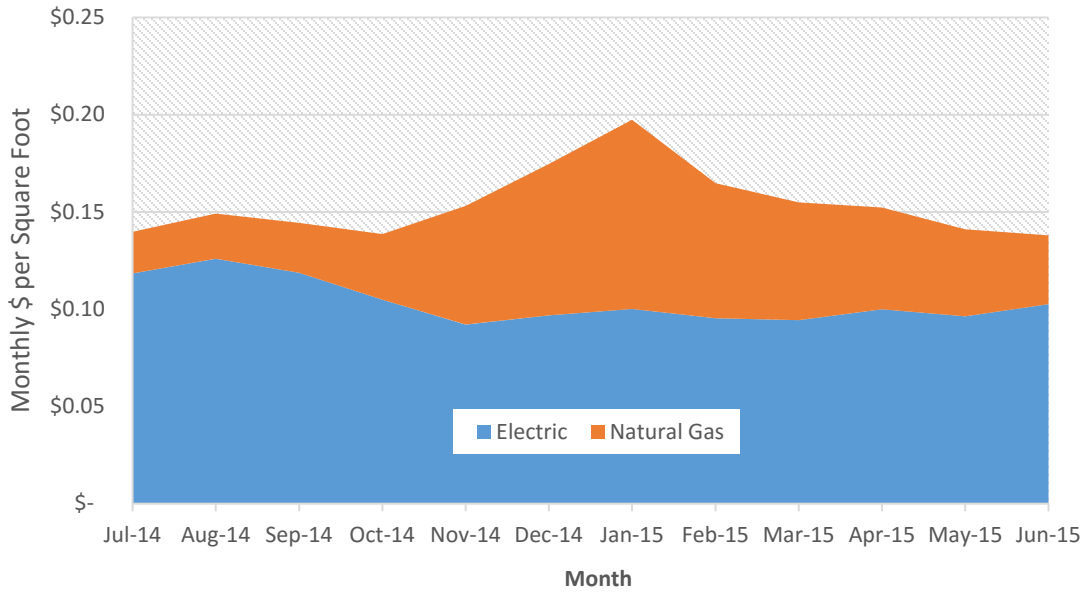


Figure 4.1. Historical Site ECI

Utility usage and cost data has been collected for 28 of the City's facilities. Tables 4.1 and 4.2 include electrical and natural gas billing summaries for the last three and two years respectively. Electrical summaries for each year include billing from July (preceding year) through June from 2012 through 2015. The natural gas summaries for each year include billing from August (preceding year) through July from 2013 through 2015. In all cases, the billing data is derived from Carson City supplied billing summary spread sheets.

The electric and natural gas utility for each site are NV Energy and Southwest Gas, respectively.

Table 4.1. Ameresco Sites Electrical Baseline Data; Carson City Facilities. EUI units are KBtu/sf/year

Facility	Electricity												
	Cost $			kWh			kW			3 - Year Average			
	2012	2013	2014	2012	2013	2014	2012	2013	2014	Cost $	kWh	kW	EUI
Aquatic Facility	$100,908	$106,626	$102,943	1,091,520	1,125,361	1,151,040	210	214	227	$103,492	1,122,640	217	118
BRIC	$5,724	$5,767	$5,335	51,477	51,126	48,629	0	0	0	$5,609	50,411	-	17
Cemetery	$1,968	$1,974	$1,913	16,760	16,380	16,200	0	0	0	$1,952	16,447	-	19
City Hall	$38,403	$41,377	$40,452	391,500	424,200	427,800	102	99	104	$40,077	414,500	102	41
Community Center	$31,209	$32,299	$30,414	255,680	257,040	260,800	130	134	135	$31,307	257,840	133	20
Corporate Yard #2	$2,920	$3,311	$3,991	26,400	29,840	38,480	0	0	0	$3,407	31,573	-	17
Corporate Yard #3	$1,321	$1,461	$1,299	10,310	11,277	9,625	0	0	0	$1,360	10,404	-	N/A
Corporate Yard #7	$5,071	$4,713	$4,403	48,000	43,800	42,880	0	0	0	$4,729	44,893	-	12
Corporate Yard #9	$4,347	$4,782	$3,832	40,840	43,700	36,920	0	0	24	$4,320	40,487	8	7
Corporate Yard #11	$373	$367	$729	722	451	3,501	0	0	0	$490	1,558	-	5
Corporate Yard #13	$871	$1,222	$1,199	5,761	9,031	8,523	0	0	0	$1,097	7,772	-	4
Public Works	$24,009	$23,300	$22,926	213,216	191,136	201,984	95	84	102	$23,411	202,112	94	20
Court House Complex	$187,044	$192,981	$188,565	2,009,160	2,039,040	2,089,080	430	485	464	$189,530	2,045,760	460	53
Fire Station 51	$29,511	$27,800	$25,104	329,365	315,137	295,404	72	69	61	$27,472	313,302	67	59
Fire Station 52	$14,384	$12,820	$13,301	128,408	113,706	124,315	51	46	51	$13,502	122,143	49	15
Fire Station 53	$6,956	$7,825	$7,627	68,237	80,074	79,304	0	0	0	$7,469	75,872	-	59
Health and Human	$71,782	$66,056	$62,267	790,800	701,920	698,760	142	137	196	$66,702	730,493	158	98
Juvenile Administration	$4,188	$3,709	$3,515	39,072	33,776	33,363	0	0	0	$3,804	35,404	-	29
Juvenile Annex	$2,942	$2,802	$2,792	22,814	20,552	20,299	0	0	0	$2,845	21,222	-	23
Juvenile Detention	$22,188	$19,672	$19,482	239,520	187,380	210,480	50	59	61	$20,447	212,460	57	63
Library	$38,046	$38,063	$39,892	387,000	375,600	407,520	101	104	117	$38,667	390,040	107	63
Senior Center	$37,023	$35,716	$34,666	360,480	340,560	347,680	116	122	116	$35,802	349,573	118	20
Sheriff's Administration	$57,939	$63,343	$60,410	623,920	674,000	680,640	155	138	139	$60,564	659,520	144	55
Sheriff's Dispatch	$12,783	$13,992	$13,741	136,980	146,699	155,700	25	30	29	$13,506	146,460	28	170
Mills Park Complex	$15,222	$14,998	$17,297	137,765	133,527	162,174	48	48	50	$15,839	144,489	49	N/A
Centennial Park	$34,827	$38,101	$35,472	163,215	198,241	182,232	303	301	310	$36,133	181,229	305	N/A
Pete Livermore Sports	$16,610	$19,190	$20,252	111,100	125,740	131,800	111	123	121	$18,684	122,880	118	N/A
Fairview Street Lighting	$6,286	$6,350	$6,214	54,206	53,589	53,747	0	0	0	$6,283	53,847	-	N/A

Table 4.2. Ameresco Sites Natural Gas Baseline Data; Carson City Facilities. EUI units are KBtu/sf/year

	Natural Gas						
	Cost $		Therms		2 - Year Average		
Facility	2014	2015	2014	2015	Cost $	Therms	EUI
Aquatic Facility	$68,865	$79,271	91,752	86,449	$74,068	89,101	274
BRIC	$1,152	$1,368	824	875	$1,260	850	8
Cemetery	$1,393	$1,355	1,080	891	$1,374	986	33
City Hall	$14,134	$17,487	15,723	16,560	$15,810	16,142	47
Community Center	$23,005	$21,432	24,656	19,011	$22,219	21,834	51
Corporate Yard #2 (Fleet)	$8,504	$9,089	8,418	7,556	$8,797	7,987	123
Corporate Yard #7	$7,428	$8,398	7,010	7,416	$7,913	7,213	57
Corporate Yard #9	$5,095	$5,590	4,957	4,562	$5,342	4,760	25
Corporate Yard #11	$2,441	$2,514	2,157	1,880	$2,477	2,019	202
Corporate Yard #13	$3,766	$3,690	3,549	2,902	$3,728	3,226	54
Public Works	$11,974	$9,631	11,705	7,823	$10,803	9,764	28
Court House Complex	$66,641	$73,656	89,803	80,345	$70,149	85,074	65
Fire Station 51	$14,633	$6,978	15,310	5,769	$10,805	10,540	58
Fire Station 52	$1,611	$1,914	902	1,126	$1,763	1,014	4
Fire Station 53	$2,439	$2,245	2,179	1,598	$2,342	1,889	43
Health and Human Resources	$30,696	$34,476	37,356	32,664	$32,586	35,010	137
Juvenile Administration	$1,341	$1,402	1,017	907	$1,372	962	23
Juvenile Annex	$1,485	$1,468	1,172	965	$1,477	1,069	33
Juvenile Detention	$11,750	$10,852	12,681	9,488	$11,301	11,085	96
Library	$9,430	$9,603	9,688	8,124	$9,517	8,906	42
Senior Center	$12,792	$12,793	13,953	11,561	$12,792	12,757	21
Sheriff's Administration	$19,840	$22,068	23,321	21,491	$20,954	22,406	55
Mills Park Complex	$2,638	$1,550	2,271	1,037	$2,094	1,654	N/A

> Energy Analysis

City-wide electrical consumption was roughly eight million kilowatt hours in the 12-month baseline period and natural gas consumption was roughly 35,000 dekatherms. A summary of available utility consumption data is provided in Table 4.3 and Figure 4.2. Consumption for electricity and natural gas has been converted to mmBtus for a like-to-like unit comparison in Figure 4.2.

Table 4.3. Annual Utility Consumption

Utility	Three Year Average (Electricity) Two Year Average (Natural Gas) Consumption	12 Month Baseline Consumption	Difference (%)
Electricity (kWh)	7,805,330	7,918,880	1.45%
Natural Gas (dtherm)	35,624	32,886	-7.69%

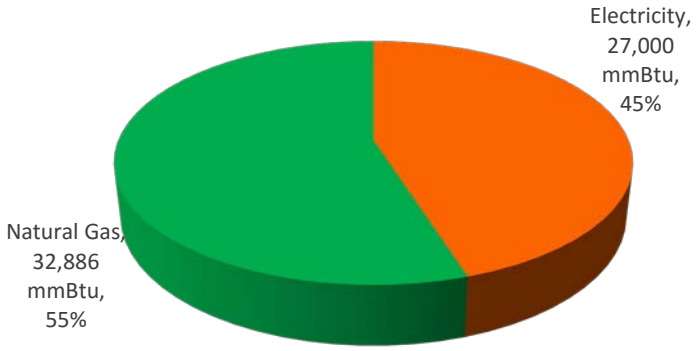


Figure 4.2. Energy Consumption (mmBtu) by Type

Overall electrical consumption has been relatively stable over the evaluation period. Natural gas consumption saw a decrease of about 7 percent.

The portfolio energy use indices (EUI) were calculated and benchmarked using the Commercial Buildings Energy Consumption Survey (CBECS) 2003. The CBECS provided whole facility benchmark and end-use data for similar facilities within the same region. A EUI analysis was performed for all Carson City facilities, excluding the Corporate Yard Sand Barn, parks and street lighting. The overall portfolio energy use indices for the 12-month baseline period are 45.5 kBtu/sqft for electricity and 59.1 kBtu/sqft for natural gas. The electric EUI is less than the benchmark index of 62.1 kBtu/sqft for office facilities located in Climate Zone #2; however, the natural gas EUI is over 31 percent higher than the 59.1 kBtu/sqft benchmark index for natural gas. An average monthly analysis of the EUI for the baseline year is shown in Figure 4.3.

An EUI analysis for each facility compared to the benchmark EUI can be found in Appendix C.

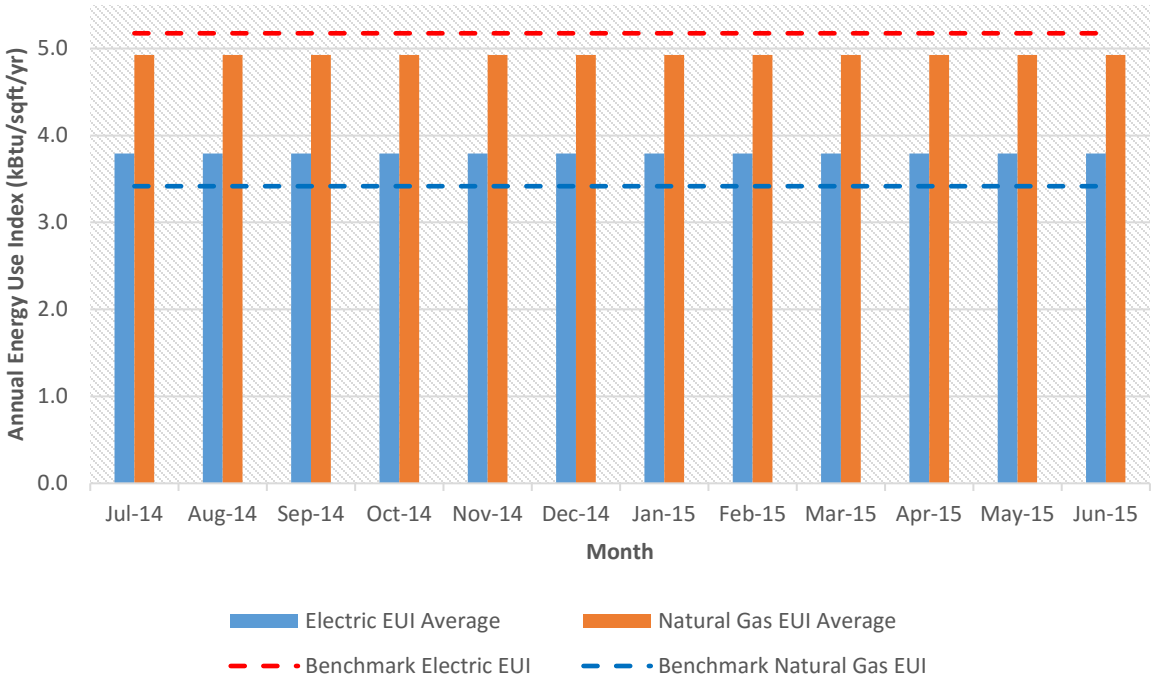


Figure 4.3. Historical Site EUI

Additional analysis was performed in order to determine the energy consumption of the end-uses within the portfolio. Table 4.4 provides the energy disaggregation for the portfolio and is a representation of both electrical (kWh) and natural gas (therms) combined into (kBtus). The disaggregation shown in Table 4.4 is based on site surveys, monitoring and trending and spot measurements.

Both the EUI and disaggregation analysis indicate that there are potential opportunities for both energy and energy cost savings. In particular, the cooling, heating, ventilation, interior lighting and exterior lighting end-use consumption is significantly more that the benchmark.

Table 4.4. Whole Building Energy End-Use Disaggregation

End Use	Benchmark End Use EUI (kBtu/ft2/yr)	Actual End Use EUI (kBtu/ft2/yr)	Difference (%)
Space Heating	32.8	40.1	22%
Cooling	8.9	10.7	20%
Ventilation	5.2	6.6	27%
Water Heating	2	2.1	5%
Lighting	23.1	23.5	2%
Cooking	0.3	0.2	-33%
Refrigeration	2.9	3.0	3%
Office Equipment	2.6	2.9	12%
Computers	6.1	6.6	8%
Other	9	8.9	-1%
Total:	**92.9**	**104.6**	**13%**

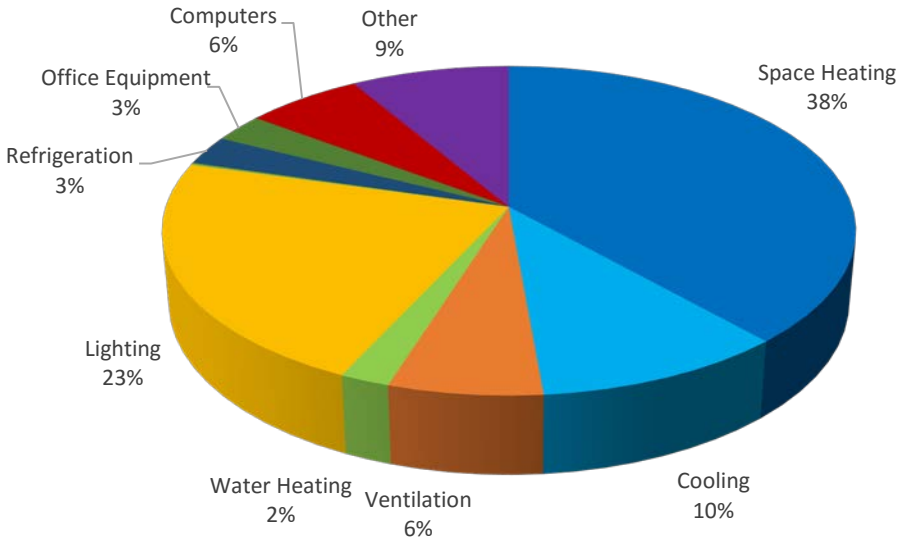


Figure 4.4. Energy End-Use Disaggregation

> Rate Analysis

Electric energy utilities are provided by NV Energy and charged according to GS-1, GS-2, OGS1_TOU or OGS2_TOU rate tariffs depending the size of the service. A summary of the electric rates is provided in Table 4.5. A historical analysis of the GS-1 and GS-2 electric rate from the baseline period until now can be found in Figure 4.5.

Table 4.5. NV Energy Electric Energy Utility Rates
Effective 4/6/2016

Rate Schedule	Demand Charge ($/kW-month)	Facilities Charge ($/kW-month)	Energy Rate ($/kWh/month)	Notes
GS-1	$0.00	$0.00	$0.07434	
GS-2	$4.04	$6.10	$ 0.04864	
OGS-1 TOU	$0.00	$0.00	$0.37576 $0.17873 $0.04196 $0.06031 $0.04196	Summer On-Peak Summer Mid-Peak Summer Off-Peak Winter On-Peak Winter Off-Peak
OGS-2 TOU	$7.90 $4.05 $0.00 $1.24 $1.20 $0.00	$6.09	$0.10588 $0.06712 $0.04328 $0.04810 $0.04230 $0.03808	Summer On-Peak Summer Mid-Peak Summer Off-Peak Winter On-Peak Winter Mid-Peak Winter Off-Peak

Rate Periods Are:			
Summer	July 1 – September 30		
	Off-Peak	9pm to 10am; All Hours	Weekdays Weekends
	Mid-Peak	10am to 1pm; 6pm to 9pm	Weekdays
	Peak	1pm to 6pm	Weekdays
Winter	October 1 – June 30		
	Off-Peak	9pm to 7am	Daily
	Mid-Peak	7am to 5pm	Daily
	Peak	5pm to 9pm	Daily

Demand Charges include a Facility Charge
Consumption Charges include misc. rate charges - see Tariff

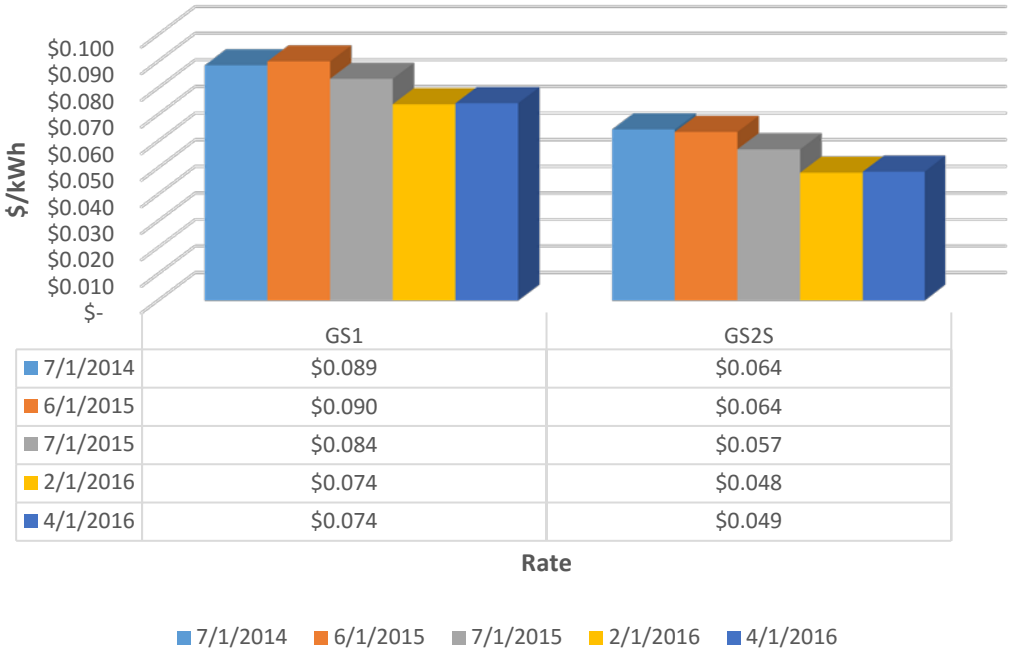
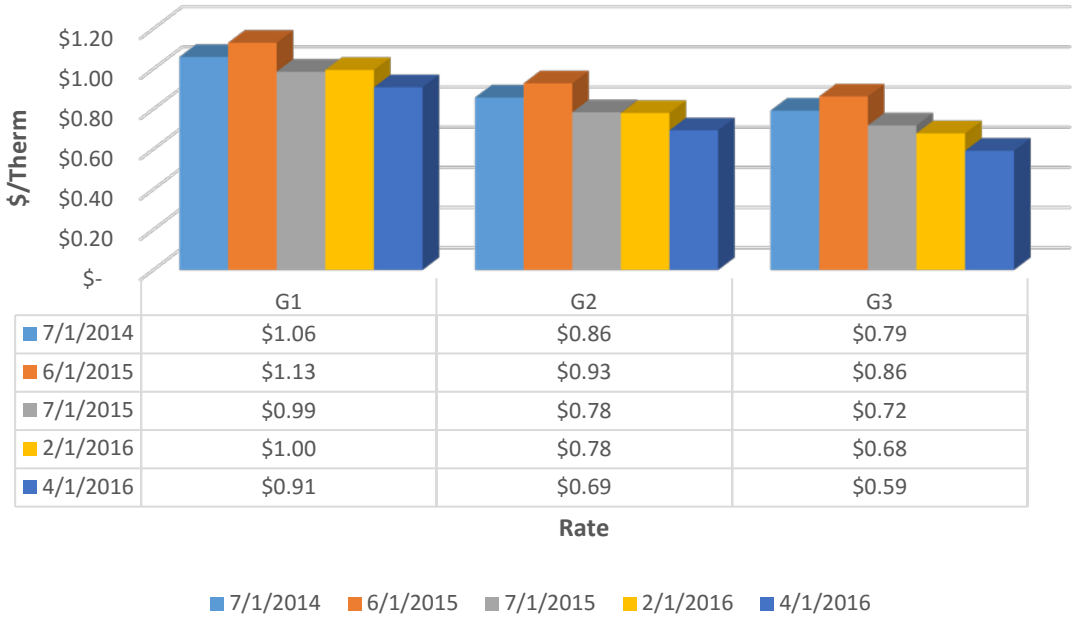


Figure 4.5. Electrical Rate Historical Analysis

Natural gas is supplied by Southwest Gas and charged according the GS-1, GS-2 and GS-3 rates depending on maximum annual consumption. A summary of the rates is provided in Table. 4.6. A historical analysis of the electric rate from the baseline period until now can be found in Figure 4.6.

Table 4.6. Natural Gas Utility Rates

Rate Schedule	Rate	Billing Unit
NG-G1	$0.91	therm
NG-G2	$0.70	therm
NG-G3	$0.59	therm



	G1	G2	G3
7/1/2014	$1.06	$0.86	$0.79
6/1/2015	$1.13	$0.93	$0.86
7/1/2015	$0.99	$0.78	$0.72
2/1/2016	$1.00	$0.78	$0.68
4/1/2016	$0.91	$0.69	$0.59

Rate

7/1/2014 6/1/2015 7/1/2015 2/1/2016 4/1/2016

Figure 4.6. Natural Gas Historical Rate Analysis

5.0 Facility and System Descriptions

The Carson City portfolio audited by Ameresco, includes 23 sites distributed throughout the City. Included in this portfolio are 26 City buildings, three park complexes, street lighting on Fairview Drive, and one athletic complex. The total area of this portfolio is 553,468 square feet, with the oldest facility constructed in 1947 and the newest in 2015.

The City facilities included are one-, two- and three-story buildings. Their operating schedules range from 24 hours-a-day, 365 days-a-year at fire stations and sheriff's facilities to typical city office operating hours. A map depicting the site portfolio locations is shown in Figure 5.0 and summary of this portfolio has been included in Table 5.0.

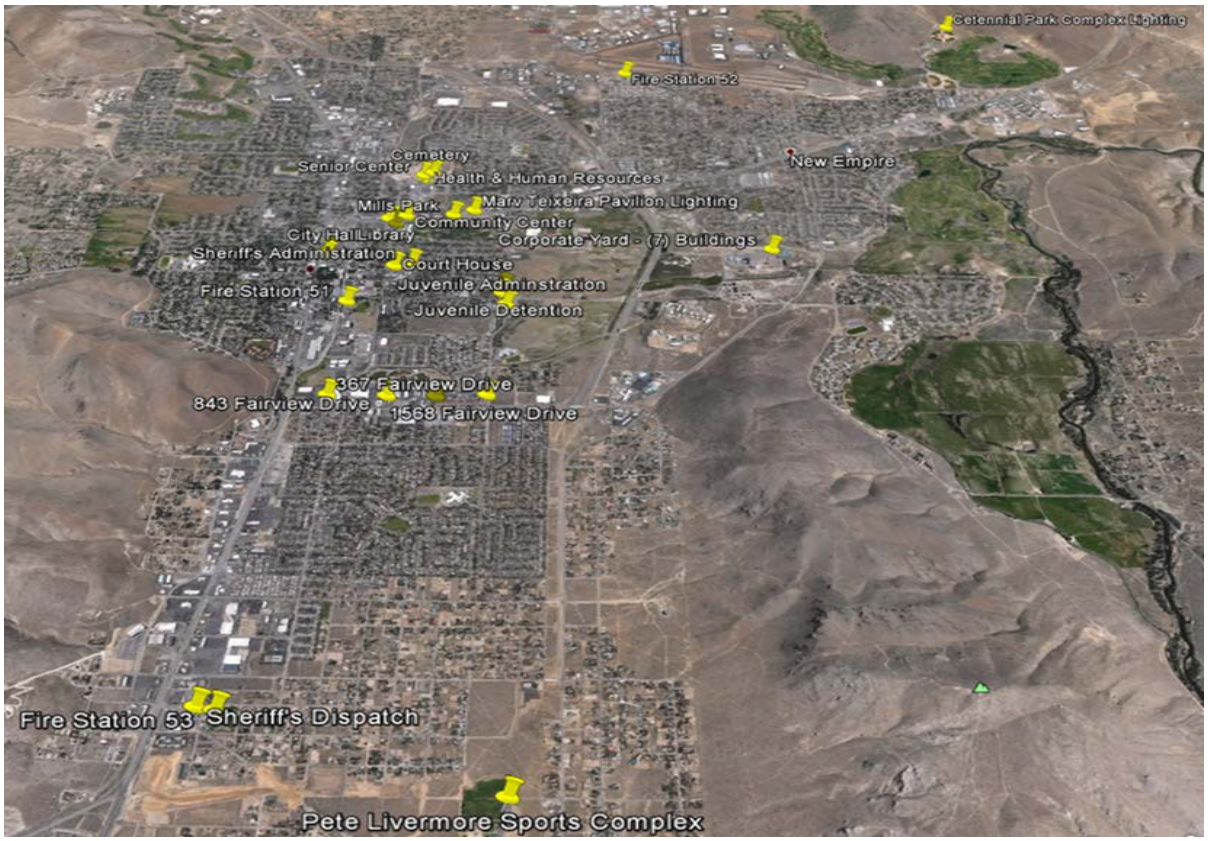


Figure 5.0. Financial Grade Operational Audit Site Portfolio Location Map

Table 5.0. Financial Grade Operational Audit Site Portfolio

Site No.	Site Name	Area (Sq. Ft.)	Year Built
1	Aquatic Facility	32,498	1976
2	Community Development Center (BRIC)	10,000	1947
3	Cemetery	3,000	2002
4	City Hall	34,097	1987
5	Community Center	43,230	1973
6	Corporate Yard Facility	79,880	Various
	Public Works	*34,500*	
	Building 2 (Fleet)	*6,500*	
	Building 3 (Sand Barn)	*N/A*	
	Building 7	*12,700*	
	Building 9	*19,180*	
	Building 11	*1,000*	
	Building 13	*6,000*	
7	Court House Complex	131,772	1999
8	Fire Station 51	18,074	1995
9	Fire Station 52 and Fire Training Building	27,769	1974
	Fire Training Building	*9,800*	
	Fire Station 52	*17,969*	
10	Fire Station 53	4,367	1974
11	Health and Human Resources	25,546	1991
12	Juvenile Administration Building	4,196	1999
13	Juvenile Annex	3,200	2009
14	Juvenile Detention Center and Juvenile Court	11,500	1983
15	Carson City Library	21,024	1970
16	Senior Center	59,341	1975
17	Sheriff's Administration Building	41,026	2008
18	Sheriff's Dispatch	2,948	1999
19	Mills Park Complex & Marv Teixeira Pavilion	N/A	1978
20	Centennial Park Complex	N/A	1989
21	Pete Livermore Sports Complex	N/A	1990
22	Fairview Drive	N/A	2010
23	MAC	N/A	2015
	Total:	**553,468**	

**Note: MAC building is excluded from the Existing Facility Descriptions because the building just recently finished being built and was still under construction during the time of the FGOA.*

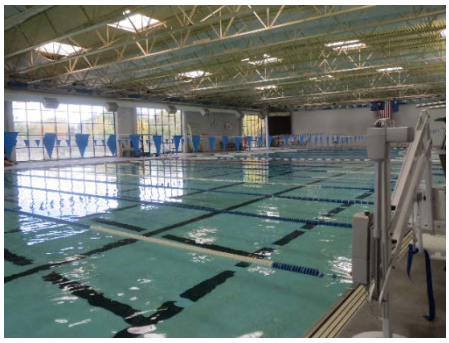
5.1 Aquatic Facility

> Building Description

Year	1976
Square Feet	32,498
Floors	1

The Carson City Aquatic Facility is located at 841 N. Roop Street. It was originally constructed in 1976 and is approximately 32,498 square feet in size. The facility has undergone several additions and renovations over the years. The Aquatic Facility includes a 50-meter indoor pool; one training pool; one therapy pool; an outdoor pool and a weight and exercise room. The facility offers lap swimming as well as open swim, water aerobics classes, year-round swimming instruction and programs for the disabled.

The indoor pools have covers which are put on the pools after use each day, except for the 50-meter pool where the cover is not used from October through May. During winter months, the outdoor pool is not utilized and remains covered. The typical hours of operation for the Aquatic Facility are Monday through Friday from 5:45 AM to 7:00 PM and Saturday from 9:45 AM to 4:30 PM with occasional after hours work or special events.



Building Envelope

This building is primarily a single-story facility and the building envelope consists of precast concrete, concrete block and stucco construction with hard board insulation, furring strips and/or framing and gypsum board or exposed concrete on the face of the interior walls. The floors of the building are slab-on-grade with carpet, finished concrete and tile or vinyl finishes. Ceilings are open showing the buildings structural elements in the pool areas or with lay-in acoustical tile in office areas and drywall ceilings in areas such as locker rooms and restrooms. The roof of the building is primarily a flat modified bitumen roofing system with perimeter capped parapet wall. The exterior windows on the facility are significant and are constructed of aluminum or hollow metal frames and are tinted double-pane. The facility also has many skylights throughout.

> Energy Using Systems

HVAC Systems

Heating, ventilating and air conditioning for the Exercise Room is supplied by one five-ton McQuay rooftop packaged natural gas heating, electric cooling unit. The unit is located on the roof over the lobby of the building.

Space heating for the therapy pool area of the building consists of one HeatEx make-up air unit located on the roof over the lobby with heat recovery air to air heat exchangers. This HeatEx make-up air unit has a Reznor heating section. This unit is a variable air volume unit and has associated variable frequency drives on its supply and exhaust fans.

Space heating for the 50-meter pool area of the building consists of two large HeatEx make-up air units located on the north and south sides of the of the facility with heat recovery air-to-air heat exchangers serving the large pool area. Each make-up air units has two integral Reznor heating units; serving the east and west side of pool for the north unit and serving the north and south side of the pool area for the south unit. Both of these units are variable air volume units and have variable frequency drives on their supply and exhaust fans.

Space heating for the locker room area of the building is provided by a natural gas-fired Sterling make-up air unit utilizing 100 percent outside air located on the roof above the lobby.

Air conditioning for the Kidz Klub is provided by a residential split-system air conditioning system with the furnace located in an interior building closet and the condensing unit located on the roof. Air conditioning for the Director's Office, which is an enclosed glass area next to the 50-meter pool, is provided by a small wall-mounted air conditioning unit.

The swimming pools are heated by two Raypak 2.5 MBtu natural gas-fired boilers located in the pool mechanical room. Water is filtered, chemically treated, and then pumped through heat exchangers to each of the pools. The heat exchangers are all flat plate style and manufactured by Armstrong and ITT. The five heat exchangers serve the 50-meter pool, the training pool, the therapy pool, the outdoor pool and the domestic hot water system. The pool filtration system runs 24 hours-a-day to meet filtration specifications.

The abandoned cogeneration system has not operated for several years but was intended to provide heating to the pool while also providing electricity to the building.

There are also several miscellaneous exhaust fans throughout the facility serving restrooms, locker rooms, storage rooms, attics, kitchen hoods, mechanical rooms, electric rooms and other spaces.

Thermostats and sensors that communicate with the DDC control system are located throughout the facility spaces.

Building space conditioning for this facility is accomplished through an Alerton IBEX DDC control system with a front-end located at both the Aquatic Center Manager's Office and at the Corporate Yard in Building 9.

Lighting Systems

The predominant lighting used throughout the Aquatic Facility are 32-watt T8 and 250-watt incandescent fixtures. Additionally, there are 1,000-watt metal halide ceiling lights at the perimeter of the 50-meter by 25-yard pool. Exterior lighting is primarily wall packs or pole lights that are high pressure sodium with some metal halide.

Plug Load Equipment

The building has a variety of plug load equipment. Front desks and offices generally have computers with flat screen monitors, printers, copying machines, fax machines and general office equipment.

Exercise equipment such as treadmills and other cardio equipment are located in the weight and exercise room.

There are also vending machines throughout the facility.

Plumbing Systems

The plumbing systems and associated fixtures at the Aquatic Facility are of typical low-flow efficiency and consist of 1.6 GPF toilets and 1.0 GPF urinals. There are many faucets, showers and drinking fountains located throughout the building with a variety of different flows.

Operational & Maintenance Issues

- Existing atmospheric boilers are very old and approaching the end of their useful life expectancy. Replacement of these boilers is desired by Carson City facilities personnel.
- Existing Alerton IBEX controls are antiquated and in need of an upgrade to newer hardware and software. Currently, all but a few buildings are not connected to the City's network server.
- Building energy management system schedules should be adjusted to actual hours of operation and City temperature setpoint standardization should be incorporated.
- The building has infiltration issues that are in need of repair. Additionally, the Aquatic Facility has pressurization problems. The City has resolved this issue with the installation of a gravity pressurization relief vent in one of the existing skylight openings.
- Current lighting consists of T8 lamps, metal halide and HID fixtures. Due to maintenance and uniformity reasons, Carson City would like to upgrade all lighting to LED.

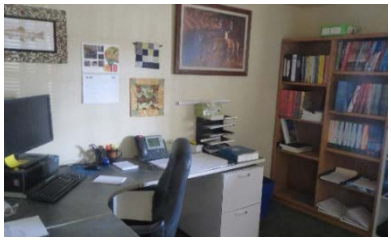
5.2 Community Development Center (BRIC)

> Building Description

Year	1947
Square Feet	10,000
Floors	2

The Business Resource Innovation Center (BRIC),located at 108 E. Proctor Street, was originally constructed in 1947 and is approximately 10,000 square feet in size. This building houses various city offices including the Carson City Library – Business Branch, Business Development Office, Community Partners Office, Permit Center, Building Division, Planning Division, Business License Division and the Engineering Division. The building was previously was a hotel and restaurant prior to being purchased and remodeled by Carson City. Typical hours of operation for the BRIC building are Monday through Friday from 8:00 AM to 5:00 PM with occasional after hours work or meetings.

Building Envelope



The building is primarily a two-story facility with a small basement storage room. The building envelope consists of precast concrete, concrete block, brick and wood frame construction with insulation, furring strips and/or framing and gypsum board on the face of the interior walls.

The floors of the building are slab-on-grade or wood framed with carpet, tile or vinyl finishes while the ceilings are suspended drywall ceilings over framing in the majority of areas. The roof of the building is a pitched metal and composite roofing system. The exterior windows of the facility are tinted double-pane, some are fitted with shades.

> Energy Using Systems

HVAC Systems

The heating, ventilating and air conditioning for this building consists of closet, attic and rooftop units serving the entire building. There are two Bryant upright residential heating and air conditioning split-system units located in closets within the building; one on the first floor and one on the second floor; and one Bryant horizontal residential heating and air conditioning unit located in the attic. The condensing units for these systems are located on the outside roof and all appear to be in the range of approximately three- to four-tons. Two packaged gas/electric units are located on the roof. The first of these units is a Carrier rooftop packaged unit and the second is a Trane rooftop packaged unit. Both of

these units appear to be in approximately the three- to four-ton size range, as well. The two rooftop self-contained packaged units serve the east and west areas of the first floor and the first floor closet split-system unit serves the southeast corner of the first floor. The second floor closet split-system unit and the attic split-system unit serve the entire second floor.

Domestic hot water is provided by a natural gas-fired water heater.

There are also several miscellaneous exhaust fans throughout the facility serving restrooms, locker rooms, storage rooms, attics, kitchen hoods, mechanical rooms, electric rooms, etc.

Building space conditioning is accomplished through local control via Honeywell seven-day programmable thermostats with night setback for each of the five units. There is currently no connection of this building to the city-wide Alerton DDC control system.

Lighting Systems

The predominant lighting used throughout the Business Resource Innovation Center is 32-watt T8 recessed fixtures. Exterior lighting is primarily wall packs or pole lights that are high pressure sodium with some metal halide.

Plug Load Equipment

The building has a variety of plug load equipment. Front desks and offices generally have computers with flat screen monitors, printers, copying machines, fax machines, general office equipment, etc. The facility has a small lunch area with a refrigerator, coffee machine and microwave oven.

Plumbing Systems

The plumbing systems and associated fixtures at the Business Resource Innovation Center are of typical low-flow efficiency and consist of 1.6 GPF toilets and 1.0 GPF urinals. There are many faucets located throughout the building with a variety of different flows.

Operational & Maintenance Issues

- Existing controls are local seven-day programmable thermostats with night setback capability. There is no connection to the City's EMS system.
- Building energy management system schedules should be adjusted to actual hours of operation and City temperature setpoint standardization should be incorporated.
- The building has infiltration issues that are in need of repair.
- Current lighting consists of T8 lamps, compact fluorescents and HPS fixtures. Due to maintenance and uniformity reasons, Carson City would like to upgrade all lighting to LED.

5.3 Cemetery

> Building Description

Year	2002
Square Feet	3,000
Floors	1

The Carson City Cemetery facility is also known as Lone Mountain Cemetery and is located at 1044 Beverly Drive. The Cemetery encompasses a 40-acre site that includes two buildings, a primary office building and a maintenance building. The Cemetery dates back to the mid-1860's and its two current buildings were constructed in 2002 and are approximately 3,000 square feet in size. The main building houses the Cemetery Business Office while there is a maintenance shed behind the main building. The Lone Mountain Cemetery gates are open from dawn to dusk seven days-a-week and the office hours are 7:30 AM to 3:30 PM, Monday through Friday each week.

Building Envelope

The Cemetery Business Building is a pre-manufactured one-story building. The building envelope consists of a wood construction building sitting on a concrete perimeter foundation with insulation, furring strips and/or framing and gypsum board on the face of the interior walls. The floors of the building are wood framed with carpet, tile or vinyl finishes while the ceilings are lay-in acoustical tile in office areas and suspended drywall ceilings over metal channels in areas such as restrooms. The roof of the building is a pitched roof with composite roofing tiles. The exterior windows the facility are vinyl frames with insulated dual-pane glass.

The Cemetery Maintenance Building is a one-story building. The building sits on a concrete pad and its envelope consists of wood framed construction with metal siding and metal roofing. The interior walls and roof are insulated with fiberglass batt. The majority of the building's interior walls are covered with plywood. The floors of the building are bare finished concrete while there are no finished ceilings in the building. The roof of the building is a pitched roof with metal panels. The exterior windows the facility are vinyl frames with insulated dual-pane glass.

> Energy Using Systems

HVAC Systems

Space conditioning for the Cemetery Office Building consists of one residential upright Bryant split-system, natural gas-fired, condensing furnace with the cooling coil located in an interior closet. It serves

the entire building. The heating and air conditioning system is ducted throughout the building and the condensing unit sits outside the building on the ground.

Domestic hot water is provided by one small electric hot water heater located under the sink in the kitchen.

The Cemetery Office Building space conditioning is accomplished through local control via a White-Rodgers seven-day programmable thermostat with night setback. There is currently no connection with this building to the city-wide Alerton DDC Control System.

The space conditioning for the Cemetery Maintenance Building consists of one Reznor natural gas-fired unit heater and one wall-mounted swamp cooler.

Domestic hot water is provided by one small electric water heater located next to the sink.

There are also several miscellaneous exhaust fans throughout the facility serving restrooms, locker rooms, storage rooms, attics, kitchen hoods, mechanical rooms, electric rooms, etc.

The Reznor unit is controlled with a Honeywell non-programmable thermostat while the wall-mounted swamp cooler is controlled with a simple wall switch. There is currently no connection from this building to the city-wide Alerton DDC control system.

Lighting Systems

The predominant lighting used throughout the Cemetery Business Office and Cemetery Maintenance Building is 32-watt T8 recessed fixtures and 32-watt T8 hanging fixtures. Exterior lighting is primarily wall packs or pole lights that are high pressure sodium.

Plug Load Equipment

The Cemetery Office Building has a variety of plug load equipment. Front desks and offices generally have computers with flat screen monitors, printers, copying machines, fax machines, general office equipment, etc. The facility has a small lunch area with a refrigerator, coffee machine, microwave oven and toaster oven.

Plumbing Systems

The plumbing systems and associated fixtures at the Cemetery Office Building and Cemetery Maintenance Building are of typical low-flow efficiency and consist of 1.6 GPF toilets and 1.0 GPF urinals.

There are two restrooms in the office area and no restrooms in the maintenance area. There are three sinks with faucets located in the office area and one sink with a faucet located in the maintenance area with a variety of different flows.

Operational & Maintenance Issues

- Existing controls are local seven-day programmable thermostats with night setback capability. There is no connection to the City's EMSsystem.
- Building energy management system schedules should be adjusted to actual hours of operation and City temperature setpoint standardization should be incorporated.
- The building has infiltration issues that are in need of repair.
- Current lighting consists of T8 lamps, compact fluorescents and HPS fixtures. Due to maintenance and uniformity reasons, Carson City would like to upgrade all lighting to LED.

5.4 City Hall

> Building Description

Year	1987
Square Feet	34,097
Floors	1

The Carson City Hall Building is located at 201 N. Carson Street. It was constructed in 1987 and is approximately 34,097 square feet in size. The City Hall houses various city offices including the Finance Office, the Assessor's Office, the Information Technology Department and the Treasurer's Office.

The building was previously a bank before it was purchased and remodeled by Carson City. Carson City also made an addition to the building that is now the City Assessor and Human Resources Office. The typical hours of operation for the City Hall building are Monday through Friday from 8:00 AM to 5:00 PM with occasional after hours work or meetings conducted. Employees typically arrive at the building shortly before the facility opens in the morning and leave within a reasonable time after closing time.

Building Envelope

This is primarily a one-story facility with a small basement mechanical room and basement parking garage. The building envelope consists of exterior precast concrete, concrete block and brick construction with hard board insulation, furring strips and/or framing and gypsum board on the face of the interior walls. The floors of the building are slab-on-grade or concrete with carpet, tile or vinyl finishes while the ceilings are lay-in acoustical tile in office areas and suspended drywall ceilings over metal channels in areas such as restrooms. The roof of the building is a flat, grey modified bitumen roofing system with perimeter capped parapet wall. The exterior windows the facility are either aluminum or hollow metal frames with laminated tinted double-pane glass.

> Energy Using Systems

HVAC Systems

Space conditioning for the building at City Hall consists of a seven-zone Mammoth multi-zone air handling unit located in a penthouse on the roof. It serves the main building. Three Carrier Weathermaster four-ton rooftop packaged gas/electric units serve the City Assessor and Human Resources Offices. The multi-zone unit also has motorized zone dampers on two of its zones serving the Executive Conference Room and the Capital Conference Room.

The multi-zone unit has hot water heating coils and DX cooling coils. Hot water is supplied to the heating coils in the multi-zone unit by a Kewanee 990 Mbtu natural gas-fired standard efficiency boiler in the basement and cooling is supplied by a Carrier air cooled condensing unit located on the roof.

Heating water is piped and pumped from the Kewanne boiler located in the basement mechanical room to the multi-zone unit heating coils using a hot water pump.

There are two Carrier computer room split-system air conditioning units serving the IT Server Room located in the vault.

Domestic hot water is provided by one natural gas-fired Bradford White 40-gallon, 40,000 Btu/Hr hot water heater located in the basement mechanical room.

Additionally, there is a 5,400 CFM exhaust fan with associated carbon monoxide sensors for the basement parking garage.

Thermostats and sensors tied into and communicating with the DDC control system are located throughout the facility spaces.

There are several miscellaneous exhaust fans throughout the facility serving restrooms, locker rooms, storage rooms, attics, kitchen hoods, mechanical rooms, electric rooms, etc.

Building space conditioning for the multi-zone air handling unit is accomplished through an Alerton IBEX DDC control system with a front-end located at the City Corporate Yard in Building 9. Building space conditioning for the three rooftop packaged units is provided by Alerton seven-day programmable thermostats that are standalone local control and are not tied into the DDC control system.

Lighting Systems

The predominant lighting used throughout the City Hall Building is 32-watt T8 recessed fixtures. Exterior lighting is primarily wall packs or pole lights that are high pressure sodium with some metal halide.

Plug Load Equipment

The building has a variety of plug load equipment. Front desks and offices generally have computers with flat screen monitors, printers, copying machines, fax machines, general office equipment, etc. The facility has a small lunch area and miscellaneous areas that include an electric stove, refrigerator, coffee machine and microwave oven. There are also vending machines throughout the facility.

Plumbing Systems

The plumbing systems and associated fixtures at the City Hall Building are of typical low-flow efficiency and consist of 1.6 GPF toilets and 1.0 GPF urinals. There are many faucets and drinking fountains located throughout the building with a variety of different flows.

Operational & Maintenance Issues

- The existing boiler is very old and approaching the end of its useful life expectancy. Replacement of this boiler is desired by Carson City facilities personnel.
- The current HVAC system is a seven-zone multi-zone unit with hot water heating and DX cooling. When the building was remodeled from a bank to City Hall, no adjustments were made to existing ceiling registers and diffusers or thermostat locations. Therefore, even with the thermostat temperature setpoints being correct, the registers, diffusers and thermostats are not currently in the correct locations.
- The existing Alerton IBEX controls are antiquated and are in need of an upgrade to newer hardware and software.
- Building energy management system schedules should be adjusted to actual hours of operation and City temperature setpoint standardization should be incorporated.
- The building has infiltration issues that are in need of repair.
- The current lighting consists of T8 lamps, compact fluorescents and metal halide fixtures. Due to maintenance and uniformity reasons, Carson City would like to upgrade all lighting to LED.

5.5 Community Center

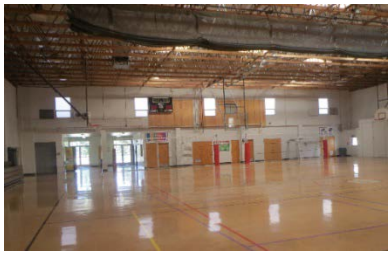
> Building Description

Year	1973
Square Feet	143,230
Floors	1

The Community Center is located at 851 E. William Street. It was constructed in approximately 1973 and is an estimated 143,230 square feet in size. The Community Center has undergone a number of remodels, additions and renovations over the years and serves as a focal point in the community. The Community Center houses a 10,000 square foot gymnasium, a large classroom, two meeting rooms, a commercial kitchen and the 783-seat Bob Boldrick Theater. The typical hours of operation for the Community Center building are Monday through Sunday from 8:00 AM to 5:00 PM with additional before or after hours work, performances, events or meetings. These before or after hour performances, events or meetings can often start earlier in the mornings and increase the Community Center's operating hours in the evenings from 5:00 PM to midnight Monday through Sunday, with the Community Center being utilized approximately 250 to 275 days per year.

Building Envelope

The Community Center is primarily a one-story facilitywith many elevations and ceiling heights. This is due to the gymnasium, as well as the auditorium, stage, stage storage lofts, and conference rooms on different elevations.



The building envelope consists of structural steel, wood, metal, exterior precast concrete, concrete block, brick, and stucco construction with various insulation types such as hard board, batt, blown-in and sprayed with furring strips and/or framing and gypsum board, concrete, wood or plaster on the face of the interior walls. The floors of the building are slab-on-grade, concrete or wood framed with carpet, tile, wood or vinyl finishes while the ceilings are lay-in acoustical tile in office areas and suspended drywall or plaster ceilings over metal channels in areas such as restrooms. The roof of the building is a flat, grey modified bitumen roofing system with perimeter capped parapet wall. The exterior windows the facility are either aluminum or hollow metal frames with tinted double-pane glass.

> Energy Using Systems

HVAC Systems

Space conditioning for the building at the Community Center consists of 12 Carrier rooftop self-contained gas heating and electric cooling units. These units have economizers and are located on the low exterior roof of the Community Center.

The gymnasium has four MasterCool swamp coolers located on the building roof for cooling and ventilation and Reznor heating units. The swamp coolers and Reznor heating units are divided by east and west sides of the gymnasium. Each side has a Honeywell thermistor box sending the temperature back to a local Honeywell control box with setpoint and schedule settings. This local control panel is located inside in an electrical closet on the east side of the gymnasium and is not tied in to the Alerton control system.

The kitchen area has a Kee, Inc. kitchen 100 percent make-up air unit with two Reznor natural gas-fired packaged heating units and an associated kitchen exhaust fan.

Domestic hot water is provided in the facility by two natural gas-fired water heaters. The first is located in the Mezzanine and the other is located in the gymnasium basketball court side room.

Thermostats and sensors tied into and communicating with the DDC control system are located throughout several conference room spaces.

There are also several miscellaneous exhaust fans throughout the facility serving restrooms, locker rooms, storage rooms, attics, kitchen hoods, mechanical rooms, electric rooms, etc.

HVAC control for the entire facility, as well as the 12 rooftop air conditioning units and the fan coil unit serving the light booth is accomplished through an Alerton BackTalk DDC control system with a front-end located at the City Corporate Yard in Building 9.

Lighting Systems

The predominant lighting used throughout the Community Center is 32-watt T8 recessed fixtures.

Exterior lighting is primarily wall packs or pole lights that are high pressure sodium with some metal halide.

The interior lighting in the gymnasium is hanging metal halide and T8 fluorescent.

The Bob Boldrick Theater appears to be a mixture of different types of lighting technologies including compact fluorescent, T8 lighting, quartz spots, incandescent, wall sconces, and other types with stage, performance, back and spot lighting on the stage.

There are lighting occupancy sensors located throughout the Community Center. The predominant areas for existing occupancy sensors include offices and restrooms. All sensors appear to be functional.

Plug Load Equipment

The building has a variety of plug load equipment. Front desks and offices generally have computers with flat screen monitors, printers, copying machines, fax machines and general office equipment.

The Gymnasium is used for voting with voting machines and associated equipment for events such as sports programs and summer camps.

The facility has meeting rooms and a classroom with plug loads such as audio visual equipment.

The Bob Boldrick Theater has the typical theater equipment such as audio equipment, spotlights, special effects equipment and stage lighting.

There is a commercial kitchen located in the Community Center and includes a large refrigerator, freezer, cooler, combination stove and oven and a large kitchen hood.

Plumbing Systems

The plumbing systems and associated fixtures at the Community Center are of typical low-flow efficiency and consist of 1.6 GPF toilets and 1.0 GPF urinals. There are many faucets and drinking fountains located throughout the facility with a variety of different flow rates.

Operational & Maintenance Issues

- Existing Alerton BACtalk controls are antiquated and are in need of an upgrade to newer hardware and software. Currently all but a few buildings are not connected to the City's EMS network server.
- Building energy management system schedules should be adjusted to actual hours of operation and City temperature setpoint standardization should be incorporated.
- The building has infiltration issues that are in need of repair.
- Current lighting consists of T8 lamps, compact fluorescents, incandescent, metal halide, and HPS. Due to maintenance and uniformity reasons, Carson City would like to upgrade all lighting to LED.

5.6 Corporate Yard Facility

The Carson City Corporate Yard Facility is located at 3303 Butti Way.It includes Public Works Building A & B; Building C; Building D; Building E; Building 2: Vehicle Maintenance or Fleet; Building 3: Sand Barn; Building 7: Police Motorcycle Shop and Vehicle Repair and Old Parks Office; Building 9: Parks Building; Building 11: Sheriff's Building; and Building 13: new Public Works Truck Warehouse and Supply Barn.

Year	Multiple Years
Square Feet	79,880
Floors	1 and 2

Public Works Buildings A&B

> Building Description

Public Works Buildings A & B are connected buildings, approximately 34,500 square feet in area and primarily a one-story building, although there are second-story mezzanine office and storage areas. Public Works Buildings A & B house the offices of the Public Works Department, as well as various shops and storage. Common areas within the facility include the lobby area, open cubicles, private offices, shops, conference rooms, restrooms and a warehouse area.

The typical hours of operation for the Public Works Buildings A & B are Monday through Thursday from 7:30 AM to 5:30 PM with occasional after hours work or meetings conducted.

Building Envelope

This is primarily a one-story facility where the building envelope consists of exterior precast concrete, concrete block, metal siding, structural steel, wood and stucco construction with insulation, furring strips and/or framing and gypsum board on the face of the interior walls. The floors of the building are slab-on-grade, concrete or wood with carpet, tile or vinyl finishes while the ceilings are lay-in acoustical tile in office areas and suspended drywall ceilings over metal channels in areas such as restrooms. The roof of the building consists of metal

standing seam roofing. The exterior windows the facility are either aluminum or hollow metal frames with laminated tinted double-pane glass.

There are several roll-up doors in the warehouse area of the facility.

> Energy Using Systems

HVAC Systems

Space conditioning for the Public Works Buildings A & B consists of 11 Day & Night residential upright natural gas/electric split-system heating, ventilating and air conditioning furnace units with DX air conditioning coils. The 11 associated Day & Night condensing units sit on the ground on concrete pads in the rear of the buildings.

The warehouse area of the facility has two Reznor unit heaters.

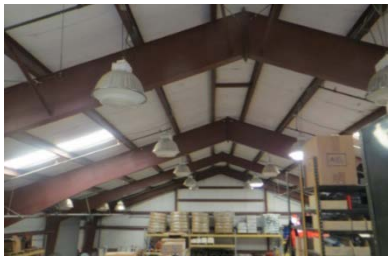
Domestic hot water is provided by one natural gas-fired water heater.

There are also several miscellaneous exhaust fans throughout the facility serving restrooms, locker rooms, storage rooms, attics, kitchen hoods, mechanical rooms, electric rooms, etc.

HVAC control is accomplished with Honeywell seven-day programmable thermostats with night setback for each of the 11 units. The Reznor unit heaters in the warehouse area have manual thermostats. There is currently no connection of this building to the city-wide Alerton DDC control system.

Lighting Systems

The predominant lighting used throughout the Public Works Buildings A & B is 32-watt T8 recessed fixtures and hanging fixtures, as well as hanging HID fixtures in the warehouse area of the facility. Exterior lighting is primarily wall packs or pole lights that are high pressure sodium with some metal halide.



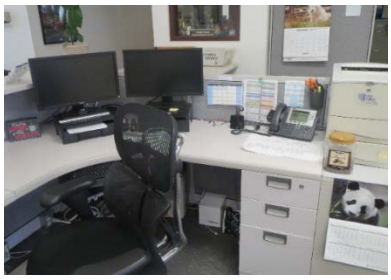
Plug Load Equipment

The building has a variety of plug load equipment. Front desks, cubicles and offices generally have computers with flat screen monitors, printers, copying machines, fax machines, telephones, radios, electric staplers, adding machines, general office equipment, etc.

Copy rooms have large copy machines, large printers, scanners, postage machines and plotters.

Miscellaneous equipment included radios, fans, wall-mounted televisions, conference rooms with ceiling projectors, small refrigerators and microwave ovens.

The facility has a break room with a refrigerator, two coffee machines, two microwave ovens, one toaster, and other small appliances.



Shop equipment included air compressors, grinders, drill presses, hand tools, electronic test equipment, and other small tools.

There is also a soda machine and a snack machine located in the break room of the facility.

Plumbing Systems

The plumbing systems and associated fixtures at the Public Works Buildings A & B are of typical low-flow efficiency and consist of 1.6 GPF toilets and 1.0 GPF urinals. There are many faucets and drinking fountains located throughout the building with a variety of different flows.

Operational & Maintenance Issues

- Existing EMS system is local to the facility. There is no connection to the City's EMS server.
- This facility has roll-up doors with no HVAC lockout when doors are open.
- Building energy management system schedules should be adjusted to actual hours of operation and City temperature setpoint standardization should be incorporated.
- The building has infiltration issues that are in need of repair.
- Current lighting consists of T8 lamps, compact fluorescents and metal halide fixtures. Due to maintenance and uniformity reasons, Carson City would like to upgrade all lighting to LED.

Public Works Building C

> Building Description

Public Works Building C is located at the Carson City Corporate Yard. Building C is primarily a one-story building although there are second-story mezzanine loft and storage areas. It houses several departments of the Public Works Department, as well as various shops and storage. Common areas within the facility include the locker room, Sewer Division, Water Division, Street Division, Sign Shop, Welding Shop and garage.

The typical hours of operation for the Public Works Building C are Monday through Friday from 7:00 AM to 3:30 PM with occasional after hours work or meetings conducted.

Building Envelope

This is primarily a one-story facility where the building envelope consists of exterior metal siding, structural steel and wood construction with plastic faced insulation, furring strips and/or framing and gypsum board on the face of the interior walls. The floors of the building are slab-on-grade with tile or vinyl finishes while the ceilings are lay-in acoustical tile in office areas and suspended drywall ceilings over metal channels in areas such as restrooms or exposed beams in the shop areas. The roof of the building consists of metal standing seam roofing. The exterior windows the facility are either aluminum or hollow metal frames with laminated tinted double-pane glass.

There are 10 roll-up doors in the shop area of the facility.

> Energy Using Systems

HVAC Systems

Space conditioning for the Public Works Building C general areas consists of four Bryant packaged natural gas/electric cooling heating, ventilating and air conditioning. These four Bryant packaged units sit on the ground on concrete pads around the perimeter of the building.

The warehouse area of the facility has two Reznor unit heaters.

Domestic hot water is provided by one natural gas-fired water heater.

There is one mini split- system air conditioning unit in the Sign Shop. The indoor unit is in the Sign Shop and the associated condensing unit sits on the ground on a concrete pad outside the building.

There are also several miscellaneous exhaust fans throughout the facility serving restrooms, locker rooms, storage rooms, attics, hoods, mechanical rooms, electric rooms, etc.

HVAC control is accomplished with Honeywell seven-day programmable thermostats with night setback for each of the four units. The Reznor units in the Shop Area have manual thermostats. There is currently no connection of this building to the city-wide Alerton DDC control system.

Lighting Systems

The predominant lighting used throughout the Public Works Building C is 32-watt T8 recessed fixtures and hanging fixtures in the Shop Area of the facility. Exterior lighting is primarily wall packs or pole lights that are high pressure sodium with some metal halide.

There are lighting occupancy sensors located throughout Building C. The predominant areas for existing lighting controls are in offices. All sensors appear to be functional.

Plug Load Equipment

The building has a variety of plug load equipment. Front desks, cubicles and offices generally have computers with flat screen monitors, printers, copying machines, fax machines, telephones, radios, electric staplers, adding machines and general office equipment.

Miscellaneous equipment includes radios, fans, wall televisions, conference room ceiling projector, small refrigerators, microwave ovens, ice machines and wall-mounted water fountains.

Shop equipment included miscellaneous small electric hand tools, welders, drill presses, air compressors, grinders and other small tools.

Plumbing Systems

The plumbing systems and associated fixtures at the Public Works Building C are of typical low-flow efficiency and consist of 1.6 GPF toilets and 1.0 GPF urinals. There are many faucets and drinking fountains located throughout the building with a variety of different flows.

Operational & Maintenance Issues

- Existing EMS system is local to the facility. There is no connection to the City's EMS server.
- This facility has roll-up doors with no HVAC lockout when doors are open.
- Building energy management system schedules should be adjusted to actual hours of operation and City temperature setpoint standardization should be incorporated.
- The building has infiltration issues that are in need of repair.
- Current lighting consists of T8 lamps, compact fluorescents and HPS fixtures. Due to maintenance and uniformity reasons, Carson City would like to upgrade all lighting to LED.

Public Works Building D

> Building Description

Public Works Building D is a one-story building and serves as the Truck Barn.

The typical hours of operation for Public Works Building D are Monday through Friday from 7:00 AM to 3:30 PM with occasional after hours work or meetings conducted.

Building Envelope

This is primarily a one-story facility where the building envelope consists of exterior metal siding, structural steel and wood construction with plastic faced insulation on the face of the interior walls. The floors of the building are slab-on-grade while the ceilings are exposed beams with plastic faced insulation in the shop areas. The roof of the building consists of metal standing seam roofing. There are no exterior windows on the building. There are 20 roll-up doors, ten on each side of the building, in the shop area of the facility.

> Energy Using Systems

HVAC Systems

The shop area of the facility has two Reznor unit heaters. The units have manual thermostats. There is currently no connection of this building to the city-wide Alerton DDC control system.

Lighting Systems

The predominant lighting used throughout the Public Works Building D is hanging 400-watt metal halide fixtures in the shop area of the facility. Exterior lighting is primarily wall packs or pole lights that are high pressure sodium with some metal halide.

Plug Load Equipment

The building has very few plug loads. Shop equipment includes miscellaneous small electric hand tools, welders, air compressors and other small tools.

Plumbing Systems

There are no plumbing systems in this building.

Operational & Maintenance Issues

- Existing EMS system is local to the facility. There is no connection to the City's EMS server.
- This facility has roll-up doors with no HVAC lockout when doors are open.
- Building energy management system schedules should be adjusted to actual hours of operation and City temperature setpoint standardization should be incorporated.
- The building has infiltration issues that are in need of repair.
- Current lighting consists of metal halide and HPS fixtures. Due to maintenance and uniformity reasons, Carson City would like to upgrade all lighting to LED.

Public Works Building E

> Building Description

Public Works Building E serves as the Open Truck Storage Barn. It is used for storing trucks as well as miscellaneous items.

The typical hours of operation for the Public Works Building E are Monday through Friday from 7:00 AM to 3:30 PM with occasional after hours work or meetings conducted.

Building Envelope

This is primarily a one-story facility where the building envelope consists of three exterior walls constructed of metal siding, structural steel and wood construction. The floors of the building are slab-on-grade while the ceilings are exposed beams. The roof of the building consists of metal standing seam roofing. There are no exterior windows on the building.

There are nine truck bays on the open side of the building.

> Energy Using Systems

HVAC Systems

There is no space conditioning equipment in this building.

Lighting Systems

The predominant lighting used throughout the Public Works Building E is hanging 96-watt T8 high output fixtures and hanging HPS fixtures in the shop area of the facility. Exterior lighting is primarily wall packs or pole lights that are high pressure sodium with some metal halide.

Plug Load Equipment

The building has very little plug loads. Shop equipment that might be in the building from time to time includes miscellaneous small electric hand tools, welders, air compressors, etc. The facility also has the electric switchgear, meters, inverters, etc. for the facility's solar system on the side of the building.

Plumbing Systems

There are no plumbing systems in this building.

Operational & Maintenance Issues

- Ameresco is unaware of any operational or maintenance issues at this building.

Building 2: Vehicle Maintenance or Fleet

> Building Description

Building 2 is located at the Carson City Corporate Yard a is 6,500 square feet in area and primarily a one-story building although there are second story mezzanine office and storage areas. Building 2 houses the Carson City Vehicle Maintenance or Fleet Department.

The typical hours of operation for Building 2 are Monday through Friday from 7:00 AM to 3:30 PM with occasional after hours work or meetings conducted.

Building Envelope

The building envelope consists of exterior metal siding, structural steel and wood construction with plastic faced insulation, furring strips and/or framing and gypsum board on the face of the interior walls. The floors of the building are slab-on-grade with tile or vinyl finishes while the ceilings are lay-in acoustical tile in office areas and suspended drywall ceilings over metal channels in areas such as restrooms or exposed beams in the shop areas. The roof of the building consists of metal standing seam roofing. The exterior windows the facility are either aluminum or hollow metal frames with laminated tinted double-pane glass.

There are six roll-up doors in the shop area of the facility.

> Energy Using Systems

HVAC Systems

Space conditioning for the building's general areas consists of two Greenheck make-up air units for the east and west common areas. There is also a Carrier packaged natural gas/electric cooling heating, ventilating and air conditioning unit for the Fleet Office. These three units sit on the ground on concrete pads around the perimeter of the building.

The Shop Area of the facility has two Reznor unit heaters and one Firelake unit heater.

Domestic hot water is provided by one electric water heater.

There are several miscellaneous exhaust fans throughout the facility serving restrooms, locker rooms, storage rooms, attics, hoods, mechanical rooms, electric rooms, etc. In addition, there is one welder exhaust system and seven vehicle exhaust systems.

HVAC control for the entire facility is accomplished through an Alerton BackTalk DDC control system with a front-end located at the City Corporate Yard in Building 9.

Lighting Systems

The predominant lighting used throughout the Fleet Services building is 32-watt T-8 recessed fixtures and hanging 54-watt T5HO fixtures in the shop area of the facility. Exterior lighting is primarily wall packs or pole lights that are high pressure sodium with some metal halide.

There are lighting occupancy sensors located throughout Fleet Services. The predominant areas for existing lighting controls include lobbies, locker rooms, offices and restrooms. All sensors appear to be functional.

Plug Load Equipment

The building has a variety of plug load equipment operating. Front desks, cubicles and offices generally have computers with flat screen monitors, printers, copying machines, fax machines, telephones, radios, electric staplers, adding machines, general office equipment, etc.

Miscellaneous equipment included a refrigerator, coffee machine, etc.

Shop equipment included miscellaneous small electric hand tools, welders, sheet metal tools, a lathe, drill press, air compressor, motor oil recovery systems, etc.

The facility also has a seven vehicle exhaust system.

Plumbing Systems

The plumbing systems and associated fixtures at Building 2 are of typical low-flow efficiency and consist of 1.6 GPF toilets and 1.0 GPF urinals. There are many faucets and drinking fountains located throughout the building with a variety of different flows.

Operational & Maintenance Issues

- Existing Alerton BACtalk controls are antiquated and are in need of an upgrade to newer hardware and software. Currently this facility is one of the few that is connected to the city-wide network server.
- Building energy management system schedules should be adjusted to actual hours of operation and City temperature setpoint standardization should be incorporated.
- Current lighting consists of T8 lamps, T5HO and compact fluorescents. Due to maintenance and uniformity reasons, Carson City would like to upgrade all lighting to LED.

Building 3: Sand Barn

> Building Description

Building 3 i serves as the Sand Barn, used for storing sand.

The typical hours of operation for the Building 3 are Monday through Friday from 7:00 AM to 3:30 PM with occasional after hours work or meetings conducted.

Building Envelope

This is primarily a one-story facility where the building envelope consists of three exterior walls constructed of metal siding and structural steel with a metal out building connected to the back side of the building. The floors of the building are slab-on-grade while the ceilings are exposed beams. The roof of the building consists of metal standing seam roofing. There are no exterior windows on the building.

> Energy Using Systems

HVAC Systems

There is no space conditioning equipment in this building.

The connected metal building has a wall-mounted exhaust fan.

There is also currently no connection of this building to the city-wide Alerton DDC control system.

Lighting Systems

The predominant lighting used throughout the Building 3 is hanging T8 and compact fluorescent fixtures. Exterior lighting is primarily wall packs or pole lights that are high pressure sodium with some metal halide.

Plug Load Equipment

The building has very few plug loads.

Plumbing Systems

There are no plumbing systems in this building.

Operational & Maintenance Issues

- The predominant lighting used throughout the building are T8, incandescent and compact fluorescent fixtures. Exterior lighting is primarily wall packs or pole lights that are high pressure sodium with some metal halide.

Building 7: Police Motorcycle Shop and Vehicle Repair, Old Parks Office

> Building Description

Building 7 is 12,700 square feet in area and primarily a one-story building although there are second story mezzanine office and storage areas. Building 7 houses the Carson City Police Motorcycle Repair Shop, Police Car Repair Shop and office areas.

The typical hours of operation for Building 7 are Monday through Friday from 7:00 AM to 3:30 PM with occasional after hours work or meetings conducted.

Building Envelope

The building envelope consists of exterior metal siding, structural steel and wood construction with plastic faced insulation, furring strips and/or framing and gypsum board on the face of the interior walls. The floors of the building are slab-on-grade with tile or vinyl finishes while the ceilings are lay-in acoustical tile in office areas and suspended drywall ceilings over metal channels in areas such as restrooms or exposed beams in the shop areas. The roof of the building consists of metal standing seam roofing. The exterior windows the facility are either aluminum or hollow metal frames with laminated tinted double-pane glass.

There are six roll-up doors in the shop area of the facility.

> Energy Using Systems

HVAC Systems

Space conditioning for the Building 7 general office areas consists of four natural gas/electric cooling heating, units with DX coils for air conditioning. The four associated condensing units for these furnaces sit on the ground on concrete pads around the perimeter of the building.

The shop area of the facility has three Reznor unit heaters operated by manual thermostats.

Domestic hot water is provided by electric water heaters.

There are also several miscellaneous exhaust fans throughout the facility serving restrooms, locker rooms, storage rooms, attics, hoods, mechanical rooms, electric rooms, etc.

There is currently no connection of this building to the city-wide Alerton DDC control system.

Lighting Systems

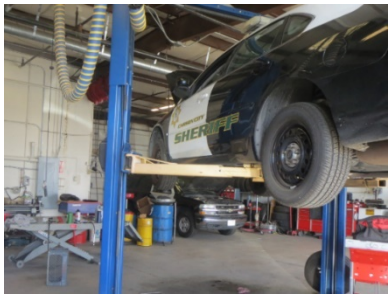
The predominant lighting used throughout Building 7 is 32-watt T8 recessed or surface-mount fixtures and hanging fixtures in the shop area of the facility. Exterior lighting is primarily wall packs or pole lights that are high pressure sodium with some metal halide.

There are lighting occupancy sensors located throughout the Building 7. The predominant areas for existing occupancy sensors are in offices. All sensors appear to be functional.

Plug Load Equipment

The building has a variety of plug load equipment. Front desks, cubicles and offices generally have computers with flat screen monitors, printers, copying machines, fax machines, telephones, radios, electric staplers, adding machines, general office equipment, etc.

There is a small kitchen area with a refrigerator, microwave oven, coffee maker, towel dispenser and toaster oven.



Miscellaneous equipment seen throughout the facility were a refrigerators, coffee machines, television, VCR and radios.

Shop equipment seen in the shop areas of the facility included miscellaneous small electric hand tools, welders, air compressor, car lifts and motor oil recovery systems.

The facility also has a vehicle exhaust system.

Plumbing Systems

The plumbing systems and associated fixtures at Building 7 are of typical low-flow efficiency and consist of 1.6 GPF toilets and 1.0 GPF urinals. There are many faucets and drinking fountains located throughout the building with a variety of different flows.

Operational & Maintenance Issues

- Existing EMS system is local to the facility. There is no connection to the City's EMS server.
- This facility has roll-up doors without any HVAC lockout when doors are open.
- Building energy management system schedules should be adjusted to actual hours of operation and City temperature setpoint standardization should be incorporated.
- The building has infiltration issues that are in need of repair.
- Current lighting consists of T8 lamps, compact fluorescents, incandescent, mercury vapor and HPS fixtures. Due to maintenance and uniformity reasons, Carson City would like to upgrade all lighting to LED.

Building 9: Parks Building

> Building Description

Building 9, also known as the Parks Building, is approximately 19,180 square feet in area and primarily a one-story building. Building 9 houses the offices of the Parks and Recreation Department Administration, Parks Division and Facilities Division, as well as various shops and storage. Common areas within the facility include the lobby area, open cubicles, private offices, shops, conference rooms, restrooms and a warehouse area.

The typical hours of operation for the Building 9 are Monday through Friday from 7:00 AM to 3:30 PM with occasional after hours work or meetings conducted.

Building Envelope

This is primarily a one-story facility where the building envelope consists of exterior metal siding, structural steel and wood construction with insulation, furring strips and/or framing and gypsum board on the face of the interior walls. The floors of the building are slab-on-grade, concrete or wood with carpet, tile or vinyl finishes while the ceilings are lay-in acoustical tile in office areas and suspended drywall ceilings over metal channels in areas such as restrooms. The roof of the building consists of metal standing seam roofing. The exterior windows the facility are either aluminum or hollow metal frames with laminated tinted double-pane glass.

There are eight roll-up doors in the maintenance, storage and warehouse areas of the facility that are all interlocked with the hanging heating units to turn them off when the doors are opened.

> Energy Using Systems

HVAC Systems

Space conditioning for the Building 9 consists of two Lennox and one Trane residential upright natural gas/electric split-system heating, ventilating and air conditioning furnace units with DX air conditioning coils. These units are located in furnace closets within the building. The three associated condensing units sit on the ground on concrete pads around the perimeter of the building.

There is also one Carrier natural gas heating and electric cooling packaged unit on the roof.

These four units have seven-day programmable thermostats with night setback.

The warehouse area of the facility has three Reznor unit heaters. The Reznor units are controlled by manual thermostats.

Domestic hot water is provided by a combination of electric and natural gas-fired water heaters.

There are also several miscellaneous exhaust fans throughout the facility serving restrooms, locker rooms, storage rooms, attics, kitchen hoods, mechanical rooms, electric rooms, etc.

HVAC control is accomplished with Honeywell seven-day programmable thermostats with night setback for each of the four units. The Reznor units in the warehouse area have manual thermostats. There is currently no connection of this building to the city-wide Alerton DDC control system.

Lighting Systems

The predominant lighting used throughout Building 9 is 32-watt T8 recessed fixtures and hanging fixtures. Exterior lighting is primarily wall packs or pole lights that are high pressure sodium with some metal halide.

Lighting occupancy sensors and timers are located throughout the Building 9. The predominant areas for existing lighting controls include locker rooms and private restrooms. All sensors appear to be functional.

Plug Load Equipment

The building has a variety of plug load equipment operating. Front desks, cubicles and offices generally have computers with flat screen monitors, printers, copying machines, fax machines, telephones, radios, electric staplers, adding machines and general office equipment.

Copy rooms have large copy machines, large printers, scanners, postage machines and plotters.

Miscellaneous equipment seen throughout the facility were radios, fans, wall televisions, conference rooms with white boards and ceiling projector, small refrigerators, microwave ovens, etc. The facility has a break room with a refrigerator, coffee machines, microwave oven and water cooler.

Shop equipment included welders, table saw, band saw, grinder and sander, dust collecting system, air compressors, grinders, drill presses, hand tools, electronic test equipment and vehicle lift.

Plumbing Systems

The plumbing systems and associated fixtures at Building 9 are of typical low-flow efficiency and consist of 1.6 GPF toilets and 1.0 GPF urinals. There are many faucets and drinking fountains located throughout the building with a variety of different flows.

Operational & Maintenance Issues

- Existing EMS system is local to the facility. There is no connection to the City's EMS server.
- Building energy management system schedules should be adjusted to actual hours of operation and City temperature setpoint standardization should be incorporated.
- The building has infiltration issues that are in need of repair.
- Current lighting consists of T8 lamps, compact fluorescents and HPS fixtures. Due to maintenance and uniformity reasons, Carson City would like to upgrade all lighting to LED.

Building 11: Sheriff's Building

> Building Description

Building 11 is currently unoccupied but will soon house the Carson City SWAT Team. The building is 1,000 square feet in area and primarily a one-story building although there are second-story mezzanine office and storage areas. Common areas within the building include the entrance, open space, private offices, conference room, restrooms and warehouse area.

The typical hours of operation for the Building 11 are not known at this time.

Building Envelope

This is primarily a one-story primarily a one story building, although there are second-story mezzanine office and storage areas where the building envelope consists of exterior metal siding, structural steel and wood construction with insulation, furring strips and/or framing and gypsum board on the face of the interior walls. The floors of the building are slab-on-grade, concrete or wood with carpet, tile or vinyl finishes while the ceilings are lay-in acoustical tile in office areas and suspended drywall ceilings over metal channels in areas such as restrooms. The roof of the building consists of composite tile or metal standing seam roofing. The exterior windows the facility are either aluminum or hollow metal frames with laminated tinted double-pane glass.

There are two roll-up doors and one sliding door in the warehouse areas of the building.

> Energy Using Systems

HVAC Systems

Space conditioning for the Building 11 consists of a natural gas wall furnace with a manual thermostat on the wall.

There is also one swamp cooler on the roof with a simple wall on and off switch to control it.

The warehouse area of the facility has two Reznor unit heaters. The Reznor units are controlled by manual thermostats.

Domestic hot water is provided by an AO Smith natural gas-fired water heater.

There are also several miscellaneous exhaust fans throughout the facility serving restrooms, etc.

HVAC control is by manual thermostats for all of the units. The Reznor units in the warehouse area have manual thermostats. There is currently no connection of this building to the city-wide Alerton DDC control system.

Lighting Systems

The predominant lighting used throughout the Building 11 is 96-watt T12 surface mount fixtures and hanging fixtures. Exterior lighting is primarily wall packs or pole lights that are high pressure sodium with some metal halide.

Plug Load Equipment

The building has no plug load equipment at this time as it is unoccupied.

Plumbing Systems

The plumbing systems and associated fixtures at building 11 are of typical low-flow efficiency and consist of 1.6 GPF toilets and 1.0 GPF urinals. There are many faucets and drinking fountains located throughout the building with a variety of different flows.

Operational & Maintenance Issues

- Existing EMS system is local to the facility. There is no connection to the City's EMS server.
- This facility has roll-up doors without any HVAC lockout when doors are open.
- Building energy management system schedules should be adjusted to actual hours of operation and City temperature setpoint standardization should be incorporated.
- The building has infiltration issues that are in need of repair.
- Current lighting consists of T12 lamps, compact fluorescents, incandescent and HPS fixtures. Due to maintenance and uniformity reasons, Carson City would like to upgrade all lighting to LED.

Building 13: Public Works Truck Warehouse and Supply Barn

> Building Description

Building 13 is a one-story building and will serve as the new Public Works Truck Warehouse and Supply Barn.

The typical hours of operation for the Building 13 D are Monday through Friday from 7:00 AM to 3:30 PM with occasional after hours work or meetings conducted.

Building Envelope

This is primarily a one-story facility where the building envelope consists of exterior metal siding, structural steel and wood construction with plastic faced insulation and plywood up eight-foot on the face of the interior walls. The floors of the building are slab-on-grade while the ceilings are exposed beams with plastic faced insulation in the shop areas. The roof of the building consists of metal standing seam roofing. There are no exterior windows on the building.

There are eight roll-up doors with four on each side of the building.

> Energy Using Systems

HVAC Systems

The shop area of the facility has two Reznor unit heaters.

The Reznor units in the shop area have manual thermostats.

The building has two exhaust fans with twist timer control.

There is currently no connection of this building to the city-wide Alerton DDC control system.

Lighting Systems

The predominant lighting used throughout Building 13 is hanging 96-watt T12 fixtures in the shop area of the facility. Exterior lighting is primarily wall packs or pole lights that are high pressure sodium with some metal halide.

Plug Load Equipment

The building has limited plug loads.

Plumbing Systems

There are no plumbing systems in this building.

Operational & Maintenance Issues

- Existing EMS system is local to the facility. There is no connection to the City's EMS server.
- This facility has roll-up doors without any HVAC lockout when doors are open.
- Building energy management system schedules should be adjusted to actual hours of operation and City temperature setpoint standardization should be incorporated.
- The building has infiltration issues that are in need of repair.
- Current lighting consists of T12 lamps and HPS fixtures. Due to maintenance and uniformity reasons, Carson City would like to upgrade all lighting to LED.

5.7 Courthouse Complex

> Building Description

Year	1999
Square Feet	131,772
Floors	3

The Courthouse Complex is located at 885 E. Musser Street, was constructed in 1999 and comprises approximately 131,772 square feet. The Court House Complex is approximately 60 percent offices and courtrooms and the remaining 40 percent is the Sheriff's Detention Center and various offices, rooms and jail facilities including Elections Office, District Attorney's Offices, Fines and Fees Office, men's and women's prisoner cells, men's and women's prisoner common areas, kitchen, laundry, etc., as well as the Justice, Municipal and Traffic/Small Claims Courtrooms.

The typical hours of operation for the Public Safety Complex are Monday through Friday from 8:00 AM to 5:00 PM with various after hour and weekend use. The Sheriff's Detention Center operates 24 hours-per-day and 365 days-per-year.

Building Envelope

This three-story facility envelope consists of structural steel, wood, metal, exterior precast concrete, concrete block, brick, and stucco construction with various insulation types such as hard board, batt, blown-in and sprayed with furring strips and/or framing and gypsum board, concrete, wood or plaster on the face of the interior walls. The floors of the building are slab-on-grade, concrete or wood framed with carpet, tile, wood or vinyl finishes while the ceilings are lay-in acoustical tile in office areas and suspended drywall or plaster ceilings over metal channels in areas, such as restrooms. The roof of the building is a flat, grey modified bitumen roofing system with perimeter capped parapet wall. The exterior windows the facility are either aluminum or hollow metal frames with tinted double-pane glass.

> Energy Using Systems

HVAC Systems

Space conditioning equipment located in the Public Safety Complex serves the Courthouse Building as well as the Sheriff's Detention Building. Space conditioning for the Courthouse consists of 12 air handling units (AHUs) having supply and return air fans with variable frequency drives. These 12 AHU's provide conditioned air to variable air volume boxes with and without reheat in the conditioned spaces. The AHUs also have hot water heating and chilled water cooling coils.

Chilled water is pumped from the Courthouse Building's Mechanical Room chillers to the HVAC systems using the building's chilled water pumps. There are primary and secondary chilled water pumps with variable speed drives (VFDs) to serve the chilled water coils throughout the facility. Chilled water for the building is produced by two water-cooled Carrier chillers located in building's main mechanical room. One induced draft BAC cooling tower provides heat rejection for the chillers. The chillers also have three constant volume condenser water pumps.

The primary source for heating at the Public Safety Complex is provided by two Cleaver Brooks gas-fired flexible water tube boilers and hot water pumps that service the building's hot water coils.

Domestic hot water is provided by two Lochinvar natural gas-fired boilers, a Lochinvar storage tank and associated domestic hot water pumps. There are additional natural gas-fired domestic hot water heaters in the facility.

The Sheriff's Detention Center has one air handling unit and one thermostat per section or zone in the cell blocks.

Snow melt is provided by one Teledyne Lars boiler and associated pumps.

Thermostats and sensors tied into and communicating with the DDC control system are located throughout the facility spaces.

There are also several miscellaneous exhaust fans throughout the facility serving restrooms, locker rooms, storage rooms, attics, kitchen hoods, mechanical rooms and electric rooms.

HVAC control is accomplished through an Alerton BackTalk DDC control system with a graphical front-end at the Courthouse Mechanical Room and at the City Corporate Yard in Building 9. The DDC system extends to the zone level for temperature control.

Lighting Systems

The predominant lighting used throughout the Public Safety Complex is 32-watt T8 recessed fixtures. In the Sheriff's Detention Center, there are 250-watt high pressure sodium installed at the ceiling in the prisoner population areas. Exterior lighting is primarily wall packs or pole lights that are high pressure sodium with some metal halide.

There are lighting occupancy sensors located throughout the Courthouse section of the Public Safety Complex. The predominant areas for existing lighting controls include offices, conference rooms, lounges, storage and restroom. All sensors appear to be functional.

Plug Load Equipment

The building has a variety of plug load equipment operating. Front counters, offices and courtrooms generally have computers with flat screen monitors and printers, as well as, in some instances, copy machines, fax machines, security equipment, cameras, television screens, video and communications equipment.

In lunch rooms, break rooms, etc., there are coffee makers, refrigerators, microwave ovens and miscellaneous kitchen equipment.

Vending machines are found throughout the Courthouse Complex.

Additionally, the Sheriff's Detention Center has a laundry with two front loaded washers and two front load dryers. There is also a full commercial kitchen with walk-in coolers and freezers, warmers, ovens, grilles, griddle, kitchen hood, ice machine and dishwasher.

Plumbing Systems

The plumbing systems and associated fixtures at the Public Safety Complex are of typical low-flow efficiency and consist of 1.6 GPF toilets and 1.0 GPF urinals. There are many faucets and drinking fountains located throughout the building with a variety of different flows.

The Sheriff's Detention Facility has stainless steel fixtures, both toilet and sinks, in the prisoner cells.

Operational & Maintenance Issues

- Existing hot water heating boilers are very old and approaching the end of their useful life expectancy. Replacement of these boilers is desired by Carson City facilities personnel.
- Existing snow melt boiler is very old and approaching the end of its useful life expectancy. Replacement of this boiler is desired by Carson City facilities personnel.
- The Courthouse portion of the facility was converted from its original design to a primary/secondary chilled water pumping system. During investigation, it was found that three-way valves were installed at each of the six air handlers that have variable volume boxes connected. The chilled water secondary pumps are a minimal 7.-HP and have variable frequency drives on two of the pumps. Two-way valves should have been installed on the six air handlers that serve variable volume boxes. During the survey it was noted that the Courthouse AHUs supply/return CHW temperature differential was 46°F/52°F and the Jail AHUs supply/return CHW temperature differential was 45°F/50°F. The design deltaT is 42°F/56°F.

- Existing Alerton BACtalk controls are antiquated and are in need of an upgrade to newer hardware and software. Currently, all but a few buildings are not connected to the City's network server.
- Building energy management system schedules should be adjusted to actual hours of operation and City temperature setpoint standardization should be incorporated.
- The building has infiltration issues that are in need of repair.
- Current lighting consists of T8 lamps, compact fluorescents, incandescent, metal halide and HPS fixtures. Due to maintenance and uniformity reasons, Carson City would like to upgrade all lighting to LED.

5.8 Fire Station 51

> Building Description

Year	1995
Square Feet	18,074
Floors	1

Fire Station 51, located at 777 Stewart Street, was constructed in 1995 and is approximately 18,074 square feet in area.

Station 51 is the main fire station for Carson City and houses the fire department administrative offices, Fire Museum and the Engine Company which responds to emergencies in central Carson City. The equipment located at Fire Station 51 are all command and administrative vehicles, one first-out Type I structure engine, one Type I reserve structure engine, one aerial ladder truck, one technical rescue unit, one Type III wild land brush engine, one active and two reserve ambulances.

Fire Station 51 is made up of a number of areas serving different functions. The department administrative areas include the main front desk, private offices, cubicle areas, conference rooms, common areas, restrooms, kitchen and break area and meeting rooms. The Fire Museum contains an area that contains old fire engines and historical displays.

The firefighting area of the facility houses the apparatus bays that include the firefighting and emergency vehicles in a five-door bay; doors front and back; take out room, laundry room, repair shop, custodian's area and paramedics supply room. The living quarters of the firemen on duty are adjacent to the equipment bays and include bedrooms, locker rooms, restrooms, shower areas, lounge and television room, gymnasium, computer room, kitchen and dining area and offices.

Fire Station 51 is operating as a primary public safety facility and its typical hours of operation are 24 hours-a-day and 365 days-a-year.

Building Envelope

The single-story building envelope consists of structural steel, steel, wood, precast concrete, colored concrete masonry unit and stucco construction with various insulation types such as hard board, batt, blown-in and sprayed with furring strips and/or framing and gypsum board, concrete, wood or plaster on the face of the interior walls. The floors of the building are slab-on-grade, concrete or wood framed with carpet, tile or vinyl finishes while the ceilings are lay-in acoustical

tile in office areas and suspended drywall or plaster ceilings over metal channels in areas such as restrooms. The roof of the building is a flat modified bitumen roofing system with perimeter capped parapet wall. The exterior windows the facility are either aluminum or hollow metal frames with tinted double-pane glass.

There are also 10 roll-up emergency vehicle doors in the main equipment bay as well as one roll-up door in the fire museum area of the facility.

> Energy Using Systems

HVAC Systems

Space conditioning is served primarily by a water source heat pump system. This system is comprised of 13 Snyder General water source heat pump units. This water source heat pump system has a PVI hot water boiler, a BAC cooling tower with variable frequency drive and all the associated pumps required by the system.

The pumping configuration for the water-source heat pump system at Fire Station 51 is comprised of: a primary heat pump loop with two pumps, one redundant, connected to 13 ceiling heat pumps and a plate and frame heat exchanger. The other side of the Hx is connected to the cooling tower loop and has two pumps, one redundant. Additionally, there is a boiler loop with two pumps, one redundant, connected to the primary heat pump loop.

Space conditioning for the apparatus bay is served by heat pumps for cooling and Space Ray natural gas-fired radiant infrared heaters for heating. All space conditioning equipment serving the apparatus bay is interlocked with the equipment bay doors and heating/cooling equipment is locked out and turned off when bay doors are opened.

Domestic hot water is provided by a 125-gallon PVI water heater.

Thermostats and sensors tied into and communicating with the DDC control system are located throughout the facility spaces.

There are also several miscellaneous exhaust fans throughout the facility serving restrooms, locker rooms, storage rooms, attics, kitchen hoods, mechanical rooms and electric rooms.

Building space conditioning for the entire facility is accomplished through an Alerton IBEX DDC control system with a front-end located at the City Corporate Yard in Building 9.

Lighting Systems

The predominant lighting used throughout Fire Station 51 is 32-watt T8 recessed fixtures in most of the facilities areas and hanging 32-watt T8 hanging fixtures in the emergency fire and safety equipment bay. Exterior lighting is primarily wall packs or pole lights that are high pressure sodium with some metal halide.

There are lighting occupancy timers located throughout Fire Station 51. The predominant area for existing lighting controls are located in the turn out room. All timers appear to be functional.

Plug Load Equipment

The building has a variety of plug load equipment. Offices and other areas of the facility have computers with a flat screen monitor, printers, copy machines, fax machines, communication equipment, laptops, televisions, VCR's, cable boxes, radios, treadmills and stair stepper.

The facility has a full kitchen and a break room which includes equipment including a stove, oven, refrigerator and freezer, microwave oven and coffee maker.

In the apparatus bay, there is a vehicle exhaust pipe system, as well as plug in systems for all fire and safety vehicles.

There are also repair tools, miscellaneous electric items, a front load washer and a front load dryer, air compressors, an ice making machine, breathing apparatus rechargers and firefighting and other equipment throughout the facility.

The facility has an emergency generator system powered by diesel fuel held in a large aboveground tank.

Plumbing Systems

The plumbing systems and associated fixtures at the Fire Station 51 are of typical low-flow efficiency and consist of 1.6 GPF toilets and 1.0 GPF urinals. There are many faucets, showers and drinking fountains located throughout the building with a variety of different flows.

Operational & Maintenance Issues

- The existing atmospheric boilers are very old and approaching the end of their useful life expectancy. Replacement of these boilers are desired by Carson City facilities personnel.
- The existing water heater is very old and approaching the end of its useful life expectancy. Replacement of this hot water heater is desired by Carson City facilities personnel.
- The mechanical room does not currently have a unit heater for freeze protection.
- The Alerton IBEX controls are antiquated and are in need of an upgrade to newer hardware and software. Currently, all but a few buildings are not connected to the City's network server.
- The building energy management system schedules should be adjusted to actual hours of operation and City temperature setpoint standardization should be incorporated.
- The building has infiltration issues that are in need of repair.
- Current lighting consists of T8 lamps, compact fluorescents, incandescent, metal halide, and HPS fixtures. Due to maintenance and uniformity reasons, Carson City would like to upgrade all lighting to LED.

5.9 Fire Station 52 and Fire Training Building

> Building Description

Year	1974
Square Feet	27,769
Floors	1

Fire Station 52, including the Fire Training Building, is located at 2400 College Parkway. It was constructed in 1974 and is approximately 27,769 square feet in area.

Fire Station 52 is a standard fire station for Carson City and houses the Engine Company which responds to emergencies in northern and northeastern Carson City. The equipment located at Fire Station 52 are one first-out Type I structure engine, one Type I reserve structure engine, one Type III wild land brush engine, one Hazardous material response unit, one utility truck with trailers and one active ambulance.

The Fire Station 52 grounds also contain the Carson City Fire Department Training Grounds. This training facility encompasses a classroom building and training towers to simulate a variety of rescue and firefighting scenarios. There are also props that simulate gas leaks, trench collapses, leaking hazardous materials as well as victim extrications.

Fire Station 52 is made up of a number of areas serving different functions. The firefighting area of the facility contains the apparatus bays that include the firefighting and emergency vehicles in a three door bay; doors front and back; take out room, laundry room, repair shop and custodian's area. The living quarters of the firemen on duty are adjacent to the equipment bays and include offices, communication room, bedrooms, locker rooms, restrooms, shower areas, lounge and television room, gymnasium, computer room, kitchen and dining area and offices.

The Fire Training Building is located across the parking lot from Fire Station 52 and is comprised of several areas including training classrooms, offices, restrooms and a mechanical room.

Fire Station 52 is operating as a primary public safety facility and its typical hours of operation are 24 hours-a-day and 365 days-a-year.

Building Envelope

> Fire Station 52

The single-story Fire Station 52 is 17,969 square feet in size and its building envelope consists of structural steel, steel, wood, precast concrete, colored concrete masonry unit and stucco construction with various insulation types such as hard board, batt, blown-in and sprayed with furring strips and/or framing and gypsum board, concrete, wood or plaster on the face of the interior walls. The floors of the building are slab-on-grade, concrete or wood framed with carpet, tile or vinyl finishes while the ceilings are lay-in acoustical tile in office areas and suspended drywall or plaster ceilings over metal channels in areas such as restrooms. The roof of the building is a flat modified bitumen roofing system with perimeter capped parapet wall. The exterior windows the facility are either aluminum or hollow metal frames with tinted double-pane glass.

There are also six roll-up emergency vehicle doors in the main equipment bay area of the facility.

> Fire Training Building

The single-story Fire Training Building is 9,800 square feet in size and its building envelope consists of structural steel, steel, wood, brick, metal siding construction with various insulation types such as hard board, batt, blown-in and sprayed with furring strips and/or framing and gypsum board, concrete, wood or plaster on the face of the interior walls. The floors of the building are slab-on-grade with tile or vinyl finishes while the ceilings are lay-in acoustical tile in office and classroom areas and suspended drywall or plaster ceilings over metal channels in areas such as restrooms. The roof of the building is a standing seam metal roofing system. The exterior windows of the building are either aluminum or hollow metal frames with tinted double-pane glass.

> Energy Using Systems

HVAC Systems

> Fire Station 52

Space conditioning for Fire Station 52's common areas is served by two Carrier rooftop natural gas heated, electric cooled packaged units with economizers.

Space conditioning for the apparatus bay is served by four Reznor natural gas-fired hanging radiant heaters. All space conditioning equipment serving the apparatus bay is not interlocked with the equipment bay doors and is not locked out or turned off when bay doors are opened.

Domestic hot water is provided by a 119-gallon Bradford White electric water heater.

Thermostats and sensors tied into and communicating with the DDC control system are located throughout the facility spaces.

There are also several miscellaneous exhaust fans throughout the facility serving restrooms, locker rooms, storage rooms, attics, kitchen hoods, mechanical rooms and electric rooms.

HVAC control for the entire facility is accomplished through an Alerton BackTalk DDC system with a front-end located at the City Corporate Yard in Building 9.

> Fire Training Building

Space conditioning for the Fire Training Building is served by two Rheem split-system heating and air conditioning units. The two Rheem upright residential natural gas-fired units with refrigeration coils are located in the buildings mechanical room. Their associated condensing units are located on concrete ground pads outside the building.

Domestic hot water is provided by a 75 gallon Bradford White natural gas-fired water heater also located in the mechanical room.

There are also several miscellaneous exhaust fans throughout the building serving restrooms, locker rooms, storage rooms, attics, mechanical rooms and electric rooms.

HVAC control is accomplished through local control via two Honeywell seven-day programmable thermostats with night setback. There is currently no connection of this building to the city-wide Alerton DDC control system.

Lighting Systems

The predominant lighting used throughout Fire Station 52 and the Fire Training Building is 32-watt T8 recessed fixtures in most of the facilities areas and hanging 32-watt T8 hanging fixtures in the emergency fire and safety equipment bay. Exterior lighting is primarily wall packs or pole lights that are high pressure sodium with some metal halide.

Plug Load Equipment

Both buildings have a variety of plug load equipment. Offices and other areas of the facility have computers with a flat screen monitor, printers, copy machines, fax machines, communication equipment, laptops, televisions, VCR's, cable boxes, radios, treadmills and stair stepper.

Fire Station 52 facility has a full kitchen and a break room which includes equipment including a stove, oven, refrigerator and freezer, microwave oven and coffee maker.

The Fire Training building also has a small kitchen that includes an electric range, refrigerator and microwave oven.

In the apparatus bay, there is a vehicle exhaust pipe system, as well as plug in systems for all fire and safety vehicles.

There are also repair tools, miscellaneous electric items, a front load washer and a front load dryer, air compressors, an ice making machine, breathing apparatus rechargers and other equipment throughout the facility.

The facility has an emergency generator system powered by diesel fuel held in a large above ground tank.

Plumbing Systems

The plumbing systems and associated fixtures at the Fire Station 52 and the Fire Training Building are of typical low-flow efficiency and consist of 1.6 GPF toilets and 1.0 GPF urinals. There are many faucets, showers and drinking fountains located throughout the building with a variety of different flows.

Operational & Maintenance Issues

- The Alerton BACtalk controls are antiquated and are in need of an upgrade to newer hardware and software. Currently, all but a few buildings are not connected to the City's network server.
- This facility has roll-up doors without any HVAC lockout when doors are open.
- The building energy management system schedules should be adjusted to actual hours of operation and City temperature setpoint standardization should be incorporated.
- The building has infiltration issues that are in need of repair.
- Current lighting consists of T8 lamps, compact fluorescents, incandescent and HPS fixtures. Due to maintenance and uniformity reasons, Carson City would like to upgrade all lighting to LED.

5.10 Fire Station 53

> Building Description

Year	1974
Square Feet	4,367
Floors	1

Fire Station 53 is located at 4649 Snyder Avenue. It was constructed in 1974 and is approximately 4,367 square feet in area.

Fire Station 53 is a standard fire station for Carson City and houses the Engine Company which responds to emergencies in southern Carson City. The equipment located at Fire Station 53 are one first-out Type I structure engine, one Type I reserve structure engine, one Type III wild land brush engine and one ambulance.

Fire Station 53 is made up of a number of areas serving different functions. The firefighting area of the facility contains the apparatus bays that include the firefighting and emergency vehicles in a two door bay; doors front and back; take-out room, laundry room, repair shop and custodians area. The living quarters of the firemen on duty are adjacent to the equipment bays and include offices, communication room, bedrooms, locker rooms, restrooms, shower areas, lounge and television room, gymnasium, computer room, kitchen and dining area and offices.

Fire Station 53 is operating as a primary public safety facility and its typical hours of operation are 24 hours-a day and 365 days-a-year.

Building Envelope

The single-story Fire Station 53 building envelope consists of structural steel, steel, metal siding, wood, precast concrete, colored concrete masonry unit and stucco construction with various insulation types such as hard board, batt, blown-in and sprayed with furring strips and/or framing and gypsum board, concrete, wood or plaster on the face of the interior walls. The floors of the building are slab-on-grade, concrete with carpet, tile or vinyl finishes while the ceilings are lay-in acoustical tile in office areas and suspended drywall or plaster ceilings over metal channels in areas such as restrooms. The roof of the building is a flat modified bitumen roofing system with perimeter capped parapet wall. The exterior windows the facility are either aluminum or hollow metal frames with tinted double-pane glass.

There are also four roll-up emergency vehicle doors in the main equipment bay area of the facility.

> Energy Using Systems

HVAC Systems

Space conditioning for Fire Station 53's common areas is served by one Carrier rooftop natural gas heated, electric cooled packaged unit with economizer. The dormitory area of the facility is served by a Bryant condensing split-system heating, ventilating and air conditioning unit. The Bryant upright residential natural gas-fired unit with refrigeration coil is located in the buildings mechanical closet. The associated condensing unit is located on a concrete ground pad outside the building.

Space conditioning for the equipment bay is served by three Reznor unit heaters. All space conditioning equipment apparatus bay is not interlocked with the equipment bay doors and is not locked out or not turned off when bay doors are opened.

Domestic hot water is provided by a 119-gallon Bradford White electric water heater.

Thermostats and sensors tied into and communicating with the DDC control system are located throughout the facility spaces.

There are also several miscellaneous exhaust fans throughout the facility serving restrooms, locker rooms, storage rooms, attics, kitchen hoods, mechanical rooms and electric rooms.

Building space conditioning for the entire facility is accomplished through an Alerton BackTalk DDC control system with a front-end located at the City Corporate Yard in Building 9.

Lighting Systems

The predominant lighting used throughout Fire Station 53 is 32-watt T8 recessed fixtures in most of the facilities areas and hanging 32-watt T8 hanging fixtures in the emergency fire and safety equipment bay. Exterior lighting is primarily wall packs or pole lights that are high pressure sodium with some metal halide.

Plug Load Equipment

The building has a variety of plug load equipment operating. Offices and other areas of the facility have computers with a flat screen monitor, printers, copy machines, fax machines, communication equipment, laptops, televisions, VCR's, cable boxes, radios, treadmills and stair stepper.

The Fire Station 53 facility has a full kitchen and a break room which includes equipment including a stove, oven, refrigerator and freezer, microwave oven and coffee maker.

In the apparatus bay there is a vehicle exhaust pipe system, as well as plug in systems for all fire and safety vehicles.

There are also repair tools, miscellaneous electric items, a front load washer and a front load dryer, air compressors, an ice making machine, breathing apparatus rechargers and firefighting and other equipment throughout the facility.

The facility also has an emergency generator system powered by diesel fuel held in a large aboveground tank.

Plumbing Systems

The plumbing systems and associated fixtures at the Fire Station 53 are of typical low-flow efficiency and consist of 1.6 GPF toilets and 1.0 GPF urinals. There are many faucets, showers and drinking fountains located throughout the building with a variety of different flows.

Operational & Maintenance Issues

- The Alerton BACtalk controls are antiquated and are in need of an upgrade to newer hardware and software. Currently all but a few buildings are not connected to the City's network server.
- This facility has roll-up doors without any HVAC lockout when doors are open.
- The building energy management system schedules should be adjusted to actual hours of operation and City temperature setpoint standardization should be incorporated.
- The building has infiltration issues that are in need of repair.
- Current lighting consists of T8 lamps, compact fluorescents, incandescent and HPS fixtures. Due to maintenance and uniformity reasons, Carson City would like to upgrade all lighting to LED.

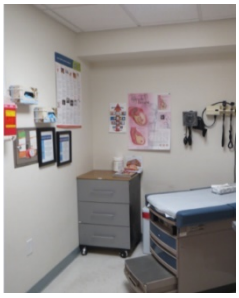
5.11 Health and Human Resources

> Building Description

The Health and Human Resources Building is located at 900 E. Long Street. It was originally constructed in 1991 as a Rehabilitation Hospital and is approximately 25,546 square feet in size. Carson City purchased and remodeled the facility in 2006 and turned it into the Carson City Health and Human Resources Building. The Health and Human Resources Building houses the Local Health Department and is comprised of Administration, Chronic Disease Prevention and Health Promotion, Clinical Services, Disease Control and Prevention, Human Services and the Public Health Preparedness Divisions that provide services to the community.

Year	1991
Square Feet	25,546
Floors	2

In addition to the Local Health Department, the Health and Human Resources Building also houses the Carson City Community Counseling Center, a drug and alcohol rehabilitation center with a primary focus on substance abuse treatment. The facility provides detoxification and halfway house services to the public. The treatment center provides residential short-term treatment and residential long-term treatment care. There are special groups and programs for persons with co-occurring mental and substance abuse disorders, pregnant and postpartum women, and criminal justice groups.

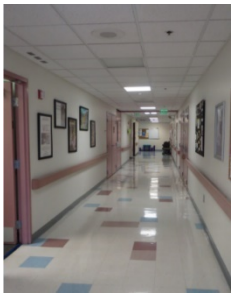


The typical hours of operation for the Health and Human Resources Building are Monday through Friday and Saturdays from 8:00 AM to 5:00 PM with occasional after hours work or meetings conducted.

The typical hours of operation for the Carson City Community Counseling Center are 24 hours-a-day and 365 days-a-year, as it is a medical detoxification and halfway house providing residential short-term treatment and residential long-term treatment care.

Building Envelope

This is primarily a two story facility. The building envelope consists of exterior precast concrete, steel, wood, concrete block, metal facia and stucco construction with insulation, furring strips and/or framing and gypsum board on the face of the interior walls. The floors of the building are slab-on-grade or concrete with carpet, tile or vinyl finishes while the ceilings are lay-in acoustical tile in office areas and suspended drywall ceilings over metal channels in areas such as restrooms. The roof of the building is a flat modified bitumen roofing system with perimeter



capped parapet wall. The exterior windows the facility are either aluminum or hollow metal frames with laminated tinted double-pane glass.

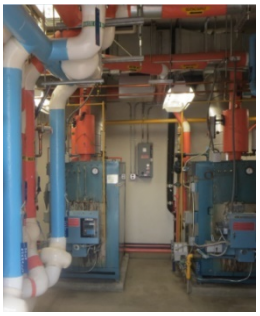
> Energy Using Systems

HVAC Systems

Space conditioning for the building at Health and Human Services consists of two Intellipak constant volume air conditioning air handling units located on the roof. The first air handling unit serves the north half of the building including the first and second floor and the second air handling unit serves the south half of the building including the first and second floor. Each of the units has integral DX air conditioning delivering 55F air and has constant volume reheat coil boxes downstream in the conditioned space along with space thermostats.

The heating water is supplied to the reheat coils by three Rite 760 Mbtu standard efficiency heating hot water boilers located in the Boiler Room. Two of these boilers are natural gas-fired and one is propane fired.

Heating hot water is piped and pumped from the boilers to the space reheat coils using associated hot water pumps that circulate the heating water throughout the building.



Domestic hot water is provided by two domestic hot water storage tanks with internal heat exchangers fed by the three Rite boilers. There are domestic hot water pumps to circulate the domestic hot water throughout the building,

Additionally, there is a medical vacuum air pumping system in the Boiler Room.

Thermostats and sensors tied into and communicating with the DDC control system are located throughout the facility spaces.

There are also several miscellaneous exhaust fans throughout the facility serving restrooms, locker rooms, storage rooms, attics, kitchen hoods, mechanical rooms and electric rooms.

Building space conditioning for the rooftop air handling units is accomplished through an Alerton DDC control system tied into the city-wide network with a front-end located at the City Corporate Yard in Building 9.

Lighting Systems

The predominant lighting used throughout the Health and Human Services Building is 32-watt T8 recessed fixtures. Exterior lighting is primarily wall packs or pole lights that are high pressure sodium with some metal halide.

There are lighting occupancy timers located throughout the Health and Human Services building. The predominant area for existing lighting controls are located in private restrooms. All timers appear to be functional.

Plug Load Equipment

The Health Department section of the building has a variety of plug load equipment. Front desks and offices generally have computers with flat screen monitors, printers, copying machines, fax machines, and general office equipment.

The front lobby has a large wall television, a large copying machine, computers, monitors, telephones, cash registers, printers, adding machines, etc. There are conference rooms with wall televisions, VCR's and audio visual equipment. There are also communications rooms with telephone equipment, Wi-Fi equipment, etc. Exam Rooms have laptops, televisions and miscellaneous medical equipment.

The facility has a Staff Lounge area and miscellaneous areas that include a refrigerator, coffee machine, microwave oven, toaster oven, etc. There are also many water machines throughout the facility.

The Carson City Community Counseling Center is comprised of a front reception area with computers with flat screen monitors, printers, copying machines, fax machines, general office equipment, etc. There is a Staff Lounge with a refrigerator, coffee machine, microwave oven, etc. and a general kitchen area with microwave ovens and other appliances.

The Carson City Community Counseling Center also has many multiple bedrooms, each with a restroom and shower as well as a Laundry Room with two top load washers and two front load dryers.

The facility has an emergency generator system powered by diesel fuel held in a large above ground tank.

Plumbing Systems

The plumbing systems and associated fixtures at the Health and Human Services Building are of typical low-flow efficiency and consist of 1.6 GPF toilets and 1.0 GPF urinals. There are many faucets and drinking fountains located throughout the building with a variety of different flows. Some common restrooms in the facility have waterless urinals.

Operational & Maintenance Issues

- The existing boilers are very old and approaching the end of their useful life expectancy. Replacement of these boilers is desired by Carson City facilities personnel.
- The Alerton BACtalk controls are antiquated and are in need of an upgrade to newer hardware and software. Currently this facility is one of the few that is connected to the city-wide network server.
- The building energy management system schedules should be adjusted to actual hours of operation and City temperature setpoint standardization should be incorporated.

- The building has infiltration issues that are in need of repair.
- Current lighting consists of T8 lamps, compact fluorescents, incandescent, metal halide and HPS fixtures. Due to maintenance and uniformity reasons, Carson City would like to upgrade all lighting to LED.

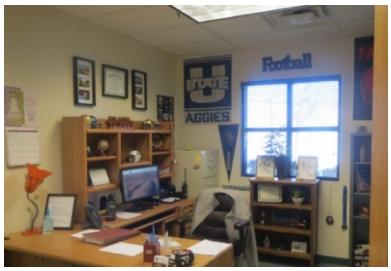
5.12 Juvenile Administration Building

> Building Description

Year	1999
Square Feet	4,196
Floors	1

The Juvenile Administration Building is located at 740 S. Saliman Road. It was constructed in 1999 and is approximately 4,196 square feet in size. The Juvenile Administration houses the Carson City Juvenile Probation Department. The building is comprised of a front lobby and desk, private offices, a classroom, a meeting room, a supply and copy room, restrooms and a lunch room. The typical hours of operation for the Juvenile Administration Building are Monday through Friday from 8:00 AM to 5:00 PM with occasional after hours work or meetings conducted.

Building Envelope



This is primarily a one-story facility. The building envelope consists of exterior precast concrete, concrete block, wood, steel and stucco construction with insulation, furring strips and/or framing and gypsum board on the face of the interior walls. The floors of the building are slab-on-grade or concrete with carpet, tile or vinyl finishes while the ceilings are lay-in acoustical tile in office areas and suspended drywall ceilings over metal channels in areas such as restrooms. The roof of the building is a flat modified bitumen roofing system with perimeter capped parapet wall. The exterior windows the facility are either aluminum or hollow metal frames with laminated tinted double-pane glass.

> Energy Using Systems

HVAC Systems

Space conditioning for the Juvenile Administration Building consists of three Carrier rooftop packaged natural gas heating and electric cooling units serving the entirety of the building. Each of the units sits on a factory curb and is equipped with an economizer.

Domestic hot water is provided by one natural gas-fired water heater located in a mechanical closet.

Thermostats and sensors tied into and communicating with the DDC control system are located throughout the facility spaces.

There are also several miscellaneous exhaust fans throughout the facility serving restrooms, storage rooms, mechanical rooms, electric rooms, etc.

HVAC control for the three rooftop packaged units is accomplished through an Alerton BackTalk DDC system with a front-end located at the City Corporate Yard in Building 9.

Lighting Systems

The predominant lighting used throughout the Juvenile Administration Building is 32-watt T8 recessed fixtures. Exterior lighting is primarily wall packs or pole lights that are high pressure sodium with some metal halide.

Plug Load Equipment

The building has a variety of plug load equipment operating. Front desks and offices generally have computers with flat screen monitors, printers, copying machines, fax machines, general office equipment, meeting rooms and classrooms with televisions and audio visual equipment, etc. The facility has a small lunch area and miscellaneous areas that include a refrigerator, coffee machine and microwave oven.

Plumbing Systems

The plumbing systems and associated fixtures at the Juvenile Probation Building are of typical low-flow efficiency and consist of 1.6 GPF toilets and 1.0 GPF urinals. There are many faucets and drinking fountains located throughout the building with a variety of different flows.

Operational & Maintenance Issues

- The Alerton BACtalk controls are antiquated and are in need of an upgrade to newer hardware and software. Currently all but a few buildings are not connected to the City's network server.
- The building energy management system schedules should be adjusted to actual hours of operation and City temperature setpoint standardization should be incorporated.
- The building has infiltration issues that are in need of repair.
- Current lighting consists of T8 lamps, compact fluorescents and HPS fixtures. Due to maintenance and uniformity reasons, Carson City would like to upgrade all lighting to LED.

5.13 Juvenile Annex

> Building Description

Year	2009
Square Feet	3,200
Floors	2

The Juvenile Annex Building is located at 1539 E. 5th Street. It was constructed in 2009 and is approximately 3,200 square feet in size. The Juvenile Annex Building houses the Wilderness Program Room, the CASA (Court Appointed Special Advocates) Offices and the Carson City Arsenic Water Treatment Plant.

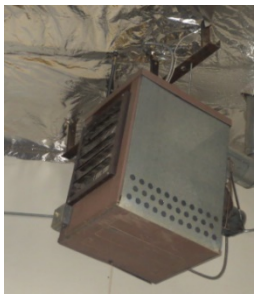
Building Envelope

This is primarily a two-story facility. The building envelope consists of exterior precast concrete, concrete block and steel construction with insulation, furring strips and/or framing and gypsum board on the face of the interior walls. The floors of the building are slab-on-grade or concrete with carpet, tile or vinyl finishes while the ceilings are lay-in acoustical tile in office areas and suspended drywall ceilings over metal channels in areas such as restrooms. The roof of the building is a flat, grey modified bitumen roofing system with perimeter capped parapet wall. The exterior windows the facility are either aluminum or hollow metal frames with laminated tinted double-pane glass.

The Carson City Arsenic Water Treatment Plant has four roll-up doors.

> Energy Using Systems

HVAC Systems



Space conditioning for the Juvenile Annex Building consists of Reznor unit heaters and evaporative coolers.

Domestic hot water is provided by one natural gas-fired water heater.

There are also several miscellaneous exhaust fans throughout the facility serving restrooms, storage rooms, attics, mechanical rooms and electric rooms.

HVAC control is accomplished with manual Honeywell thermostats. Cooling is controlled by wall switches. There is currently no connection of this building to the city-wide Alerton DDC control system.

Lighting Systems

The predominant lighting used throughout the Juvenile Administration Building is 32-watt T8 recessed fixtures. Exterior lighting is primarily wall packs or pole lights that are high pressure sodium with some metal halide.

Plug Load Equipment

The building has a variety of plug load equipment operating. Front desks and offices generally have computers with flat screen monitors, printers, copying machines, fax machines, general office equipment, meeting rooms and classrooms with televisions and audio visual equipment, etc. The facility has a small lunch area and miscellaneous areas that include a refrigerator, coffee machine and microwave oven.

Plumbing Systems

The plumbing systems and associated fixtures at the Juvenile Probation Building are of typical low-flow efficiency and consist of 1.6 GPF toilets and 1.0 GPF urinals. There are many faucets and drinking fountains located throughout the building with a variety of different flows.

Operational & Maintenance Issues

- The existing EMS system is local to the facility. There is no connection to the City's EMS server.
- The building has infiltration issues that are in need of repair.
- Current lighting consists of T8 lamps, compact fluorescents and HPS fixtures. Due to maintenance and uniformity reasons, Carson City would like to upgrade all lighting to LED.

5.14 Juvenile Detention Center and Juvenile Court

> Building Description

Year	1983
Square Feet	11,500
Floors	1

The Carson City Juvenile Detention Center and Juvenile Court is located at 1545 E. 5th Street. It was constructed in 1983. The facility has been remodeled several times and is approximately 11,500 square feet in size. The Juvenile Detention Facility and Juvenile Court is also known as the Murphy-Bernardini Regional Juvenile Detention Center. The Juvenile Detention Center is a regional facility serving Carson City and Storey County.

Business hours for the Juvenile Court are Monday through Friday 8:00 AM to 5:00 PM with occasional after hours work or meetings conducted.

Visitation hours for the Juvenile Detention Center are Sundays from 10:00 AM to 10:30 AM and 3:30 PM to 4:00 PM.

Building Envelope

This is primarily a one-story security facility. The building envelope consists of exterior precast concrete, concrete block, steel, wood, stucco and brick construction with insulation, furring strips and/or framing and gypsum board on the face of the interior walls. The floors of the building are slab-on-grade or concrete with carpet, tile or vinyl finishes while the ceilings are lay-in acoustical tile in office areas and suspended drywall ceilings over metal channels in areas such as restrooms. The roof of the building is a flat, grey modified bitumen roofing system with perimeter capped parapet wall. The exterior windows the facility are either aluminum or hollow metal frames with laminated tinted double-pane glass.

> Energy Using Systems

HVAC Systems

Space conditioning for the Juvenile Detention consists of two constant volume self-contained rooftop multi-zone air handling units and one rooftop packaged natural gas-fired heating and electric cooling unit.

The first multi-zone unit serves the detention area of the facility and has 12 zones while the second multi-zone unit serves the facility offices. The rooftop packaged unit serves the courtroom area of the facility. The multi-zone units are

natural gas-fired heating and electric cooling units with powered economizers on all the units including the rooftop packaged unit.

Domestic hot water is provided by one large natural gas-fired water heater.

There are also several miscellaneous exhaust fans throughout the facility serving restrooms, locker rooms, storage rooms, attics, kitchen hoods, mechanical rooms and electric rooms.

HVAC control for the multi-zone air handling units and the rooftop packaged unit is controlled by standalone local control and are not tied into the city-wide DDC control system.

Lighting Systems

The predominant lighting used throughout the Juvenile Detention Facility is 32-watt T8 recessed fixtures. Exterior lighting is primarily wall packs or pole lights that are high pressure sodium with some metal halide.

There is one lighting occupancy sensor located in the pantry area at the Juvenile Detention building. The sensor appeared to be functional.

Plug Load Equipment

The facility has a variety of plug load equipment operating. Front desks and offices generally have computers with flat screen monitors, printers, copying machines, fax machines, general office equipment and water coolers.

The front lobby has a walk-through metal detecting machine, large television and sound system.

The courtroom area has computers, monitors, televisions, printers and a sound system.

The facility has a break area and miscellaneous areas that include a refrigerator, coffee machine, microwave oven and other small appliances.

In the detention area, there is a large kitchen with two refrigerators, oven and grill, dishwasher, microwave oven, toaster, juice cooler and ice machine.

The detention area also has a security control room with cameras, door control, computers, monitors, and PA system. Additionally, there are televisions, stereos in the day rooms and a teaching classroom with 18 computers and monitors, two printers, telephone, and ceiling projector.

Plumbing Systems

The plumbing systems and associated fixtures at the Juvenile Detention and Courtroom facility are of typical low-flow efficiency and consist of 1.6 GPF toilets and 1.0 GPF urinals. There are many faucets and drinking fountains located throughout the building with a variety of different flows.

Operational & Maintenance Issues

- The existing EMS system is local to the facility. There is no connection to the City's EMS server.
- It has been noted that there are compressor issues, evaporator issues, solenoid valve issues, mercury switch issues with the rooftop air handlers. Carson City facility personnel would like to replace these units with new units, controls and terminal control devices.
- The building has infiltration issues that are in need of repair.
- Current lighting consists of T8 lamps, compact fluorescents and HPS fixtures. Due to maintenance and uniformity reasons, Carson City would like to upgrade all lighting to LED.

5.15 Carson City Library

> Building Description

Year	1970
Square Feet	21,024
Floors	2

The Carson City Library is located at 900 North Roop Street. The library was originally constructed in 1970 and is approximately 21,024 square feet in size. The facility has been remodeled and expanded several times over the years. The library complex is comprised of the front desk, offices, open stacks, children's section, the Two Collaboration Room, periodical section, computer centers and archives. The typical hours of operation for the Carson City Library are Monday from 11:00 AM to 6:30 PM, Tuesday through Thursday from 11:00 AM to 8:00 PM, Friday from 11:00 AM to 6:30 PM, and Saturday and Sunday from 10:00 AM to 5:00 PM, with occasional after hours work, events or meetings conducted.

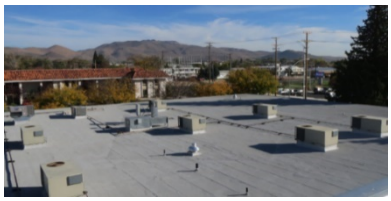
Building Envelope

The Carson City Library is primarily a two-story facility on one side and a one story facility on the other side. The building envelope consists of exterior precast concrete, concrete block, stucco and brick construction with hard board insulation, furring strips and/or framing and gypsum board on the face of the interior walls. The floors of the building are slab-on-grade, concrete or wood with carpet, tile or vinyl finishes while the ceilings are lay-in acoustical tile in office areas and suspended drywall ceilings over metal channels in areas such as restrooms. The roof of the building is a flat modified bitumen roofing system with perimeter capped parapet wall. The exterior windows the facility are either aluminum or hollow metal frames with laminated tinted double-pane glass.

> Energy Using Systems

HVAC Systems

Space conditioning for the Carson City Library consists of rooftop mechanical units. The two-story section of the facility is served by a large Lennox self-contained rooftop natural gas and electric five-zone multi-zone air handling unit. Zones 1, 2 and 3 serve the second floor and zones 4 and 5 serve the first floor of the small addition to the library. This unit has an economizer. The one-story section of the facility is served by nine Carrier rooftop self-contained natural gas and electric packaged units. These units have no economizer.



There is one dedicated OA unit that serves the one-story section at the library. This unit is a 100% air to air heat exchange unit and supplies OA for the entire one-story section. The unit is controlled locally by an electronic time clock which includes on/off operation dictated by building schedule. This unit is not controlled by the existing Alerton EMS system.

Thermostats and sensors tied into and communicating with the DDC control system are located throughout the facility spaces.

Domestic hot water is provided by natural gas water heaters.

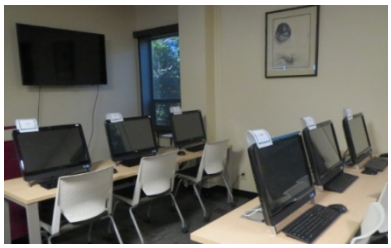
HVAC control for the entire facility is accomplished through an Alerton BackTalk DDC control system with a front-end located at the City Corporate Yard in Building 9.

Lighting Systems

The predominant lighting used throughout the Carson City Library is 32-watt T8 recessed fixtures. There is also some specialty lighting throughout the facility. Exterior lighting is primarily wall packs or pole lights that are high pressure sodium with some metal halide.

There are lighting occupancy sensors located throughout the Library. The predominant areas for existing lighting controls are located in restrooms. All sensors appear to be functional.

Plug Load Equipment



The facility has a variety of plug load equipment operating. Front desks and offices generally have computers with flat screen monitors, printers, copying machines, fax machines and general office equipment.

Meeting rooms have television screens and equipment for hooking up to a laptop.

There are many computers with flat screen monitors throughout the facility for the public's use.

The facility has a small lunch area and miscellaneous areas that include a refrigerator, coffee machine and microwave oven.

Plumbing Systems

The plumbing systems and associated fixtures at the Carson City Library are of typical low-flow efficiency and consist of 1.6 GPF toilets and 1.0 GPF urinals. There are many faucets and drinking fountains located throughout the building with a variety of different flows.

Operational & Maintenance Issues

- The existing Alerton BACtalk controls are antiquated and are in need of an upgrade to newer hardware and software. Currently all but a few buildings are not connected to the City's network server.
- Building energy management system schedules should be adjusted to actual hours of operation and City temperature setpoint standardization should be incorporated.
- The building has infiltration issues that are in need of repair.
- Current lighting consists of T8 lamps, compact fluorescents, incandescent, mercury vapor and HPS fixtures. Due to maintenance and uniformity reasons, Carson City would like to upgrade all lighting to LED.

5.16 Senior Center

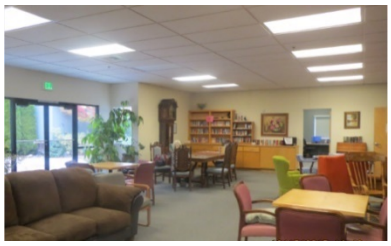
> Building Description

Year	1975
Square Feet	59,341
Floors	1

The Senior Center is located at 901 Beverly Drive. It is primarily a one-story building, although it has a mezzanine area that is utilized for storage and some miscellaneous mechanical equipment such as the water heater and refrigerated box compressors. The facility was constructed in 1975. There was a remodel and addition about 15 years ago, and the facility is approximately 59,341 square feet in size.

The typical hours of operation for the Senior Center building are Monday through Friday from 8:00 AM to 5:00 PM with occasional after hours work or meetings conducted.

Building Envelope



This is primarily a one-story facility where the building envelope consists of exterior precast concrete, concrete block, structural steel, wood, stucco and brick construction with insulation, furring strips and/or framing and gypsum board on the face of the interior walls. The floors of the building are slab-on-grade, concrete or wood with carpet, tile or vinyl finishes while the ceilings are lay-in acoustical tile in office areas and suspended drywall ceilings over metal channels in areas such as restrooms. The roof of the building consists of asphalt shingles or a flat modified bitumen roofing system with perimeter capped parapet wall. The exterior windows the facility are either aluminum or hollow metal frames with laminated tinted double-pane glass.

> Energy Using Systems

HVAC Systems

Space conditioning for the Senior Center building consists of a nine rooftop packaged natural gas/electric heating, ventilating and air conditioning units. These units are manufactured by Aaon, Trane or Reznor and all have economizers.

Domestic hot water is provided by one natural gas-fired Bradford White 100-gallon and 199,999 Btu/Hr water heater located in the attic area.

Additionally, there are kitchen refrigerated walk in cooler and freezer compressors in the attic area.

Thermostats and sensors tied into and communicating with the DDC control system are located throughout the facility spaces.

There are several miscellaneous exhaust fans throughout the facility serving restrooms, locker rooms, storage rooms, attics, kitchen hoods, mechanical rooms and electric rooms.

Building space conditioning for the rooftop heating, ventilating and air conditioning units is accomplished through an Alerton Backtalk DDC control system with a front-end located at the City Corporate Yard in Building 9.

Lighting Systems

The predominant lighting used throughout the Senior Center is 32-watt T8 recessed fixtures. Exterior lighting is primarily wall packs or pole lights that are high pressure sodium with some metal halide.

Plug Load Equipment

The building has a variety of plug load equipment. Front desks and offices generally have computers with flat screen monitors, printers, copying machines, fax machines, telephones, radios, adding machines and general office equipment.

The facility also has many rooms such as the Leisure Hour Club, Job's Peak Room, Cottam Library, Mt Rose Room, Tahoe Room, Pinon Pine Room, Pyramid Room, Joshua Room, Comstock Room, Zephyr Room, Topaz Room, Carson Room, Washoe Room and the Nevada Room, where activities take place such as pottery, sewing, rock finishing, ping pong, reading, game playing, sewing, pool, watching television, card playing as well as many others. These rooms have miscellaneous equipment such as rock polishers, sewing machines, televisions, portable fans and radios.

The facility has a large commercial kitchen that includes kitchen equipment such as a coffee machine, ice machine, electric dishwasher, mixers, ovens, warmers, soup kettle, gas griddle, gas ovens, gas burners, two rolling refrigerators, three freezers, two walk-in coolers and one walk-in freezer.

The Senior Center has a Computer Room with fourteen computers and monitors and three printers, Gift Shop with a cash register and a laundry room with a top load washer and a front load dryer.

Plumbing Systems

The plumbing systems and associated fixtures at the Senior Center are of typical low-flow efficiency and consist of 1.6 GPF toilets and 1.0 GPF urinals. There are many faucets and drinking fountains located throughout the building with a variety of different flows.

Operational & Maintenance Issues

- The existing Alerton BACtalk controls are antiquated and are in need of an upgrade to newer hardware and software. Currently all but a few buildings are not connected to the City's network server.
- Building energy management system schedules should be adjusted to actual hours of operation and City temperature setpoint standardization should be incorporated.
- The building has infiltration issues that are in need of repair.
- Current lighting consists of T8 and T12 lamps, compact fluorescents, incandescent and HPS fixtures. Due to maintenance and uniformity reasons, Carson City would like to upgrade all lighting to LED.

5.17 Sheriff's Administration Building

> Building Description

Year	2008
Square Feet	41,026
Floors	2

The Sheriff's Administration Building is located at 911 E. Musser Street. It was constructed in 2008 and is approximately 41,026 square feet in size. The Sheriff's Administration houses various offices related to the Carson City Sheriff's Department. The typical hours of operation for the Sheriff's Administration Building are Monday through Friday from 8:00 AM to 5:00 PM with occasional after hours work or meetings conducted. There are areas of the building that are occupied 24 hours-a-day and 365 days-per-year.

Building Envelope

This is primarily a two-story facility. The building envelope consists of exterior precast concrete, concrete block and brick and stucco construction with hard board insulation, furring strips and/or framing and gypsum board on the face of the interior walls. The floors of the building are slab-on-grade or concrete with carpet, tile or vinyl finishes while the ceilings are lay-in acoustical tile in office areas and suspended drywall ceilings over metal channels in areas such as restrooms. The roof of the building is a flat modified bitumen roofing system with a metal roofed entrance clearstory with perimeter capped parapet wall. The exterior windows the facility are either aluminum or hollow metal frames with laminated tinted double-pane glass.

> Energy Using Systems

HVAC Systems

Space conditioning for the Sheriffs Administration Building is provided by two large Carrier self-contained rooftop electric units on the roof. One unit supplies the first floor and the second unit supplies the second floor. Each unit has variable air boxes with reheat coils downstream. Heating hot water is supplied by two Laars Boilers and associated pumps located in the Mechanical Room.

There are two Carrier computer room split-system air conditioning units serving the IT Server Room.

Thermostats and sensors tied into and communicating with the DDC control system are located throughout the facility spaces.

The facility has a snow melt system.

Domestic hot water is provided by one heat exchanger type water heater.

HVAC control for the entire facility is accomplished through an Alerton BackTalk DDC control system with a front-end located at the City Corporate Yard in Building 9.

Lighting Systems

The predominant lighting used throughout the Sheriff's Administration Building are 32-watt T8 recessed fixtures and 26-watt compact fluorescents. Exterior lighting is primarily wall packs or pole lights that are high pressure sodium with some metal halide.

There are many lighting occupancy sensors located throughout the Sheriff's Administration building. The predominant areas for existing lighting controls are located in offices, locker rooms, restrooms, storage, closets, kitchen and labs. All sensors appear to be functional.

Plug Load Equipment

The building has a variety of plug load equipment. Front desks and offices generally have computers with flat screen monitors, printers, copying machines, fax machines, general office equipment, etc. The facility has a lunch area and miscellaneous areas that include a refrigerator, coffee machine and microwave oven.

There are soda and snack vending machines throughout the Sheriff's Administration Building.

The facility has an emergency generator system powered by diesel fuel held in a large aboveground tank.

Plumbing Systems

The plumbing systems and associated fixtures at the Sheriff's Administration Building are of typical low-flow efficiency and consist of 1.6 GPF toilets and 1.0 GPF urinals. There are many faucets and drinking fountains located throughout the building with a variety of different flows.

Operational & Maintenance Issues

- The existing Alerton BACtalk controls are antiquated and are in need of an upgrade to newer hardware and software. Currently, all but a few buildings are not connected to the City's network server.
- Building energy management system schedules should be adjusted to actual hours of operation and City temperature setpoint standardization should be incorporated.
- The building has infiltration issues that are in need of repair.
- Current lighting consists of T8 lamps, compact fluorescents, metal halide, T5HO and HPS fixtures. Due to maintenance and uniformity reasons, Carson City would like to upgrade all lighting to LED.

5.18 Sheriff's Dispatch

> Building Description

Year	1999
Square Feet	2,948
Floors	1

The Sheriff's Dispatch building is located at 4645 Snyder Avenue. It was constructed in 1999 and is approximately 2,948 square feet in size. Sheriff's Dispatch serves as the central Carson City 911 call center. The facility itself is comprised of private offices, open office areas, a five station main dispatch area, central server room, restrooms, and a radio and phone room.

The Sheriffs Dispatch building is operating as a primary public safety facility and its typical hours of operation are 24 hours-a-day and 365 days-a-year.

Building Envelope

This building is primarily a one-story facility and the envelope consists of exterior precast concrete, concrete block and steel construction with hard board insulation, furring strips and/or framing and gypsum board on the face of the interior walls. The floors of the building are slab-on-grade or concrete with carpet, tile or vinyl finishes while the ceilings are lay-in acoustical tile in office areas and suspended drywall ceilings over metal channels in areas such as restrooms. The roof of the building is a flat, grey modified bitumen roofing system with perimeter capped parapet wall. The exterior windows the facility are either aluminum or hollow metal frames with laminated tinted double-pane glass.

> Energy Using Systems

HVAC Systems

Space conditioning for this facility consists of four Carrier rooftop packaged gas/electric units serving the west offices, radio and phone room, server computer room and the dispatch areas to the building.

Thermostats and sensors tied into and communicating with the DDC control system are located throughout the facility spaces.

Domestic hot water is provided by one natural gas-fired water heater.

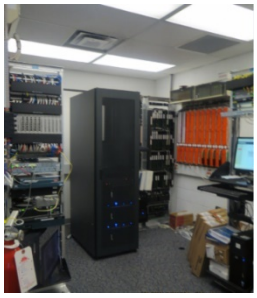
There are also several miscellaneous exhaust fans throughout the facility serving restrooms, storage rooms, attics, mechanical rooms and electric rooms.

HVAC control for the four rooftop packaged units is accomplished through an Alerton BackTalk DDC control system with a front-end located at the City Corporate Yard in Building 9. The Alerton control panel and BackTalk connection for both Fire Station 53 and the Sheriff's Dispatch is located in this building.

Lighting Systems

The predominant lighting used throughout the Sheriffs Dispatch is 32-watt T8 recessed fixtures. Exterior lighting is primarily wall packs or pole lights that are high pressure sodium with some metal halide.

Plug Load Equipment



The building has a variety of plug load equipment. Front desks and offices generally have computers with flat screen monitors, printers, copying machines, fax machines, general office equipment, etc. The five main dispatch stations each has six monitors, a printer, telephones, radios, computers, as well as additional monitor screens on the walls around the dispatch area. The facility has a break room and miscellaneous areas that include an electric stove and oven, refrigerator, coffee machine, microwave oven, water machine, etc.

The facility has an emergency generator system powered by diesel fuel held in a large aboveground tank.

There are also soda and snack vending machines throughout the facility.

Plumbing Systems

The plumbing systems and associated fixtures at the Sheriffs Dispatch building are of typical low-flow efficiency and consist of 1.6 GPF toilets and 1.0 GPF urinals. There are many faucets and drinking fountains located throughout the building with a variety of different flows.

Operational & Maintenance Issues

- Existing Alerton BACtalk controls are antiquated and are in need of an upgrade to newer hardware and software. Currently all but a few buildings are not connected to the City's network server.
- Building energy management system schedules should be adjusted to actual hours of operation and City temperature setpoint standardization should be incorporated.
- The building has infiltration issues that are in need of repair.
- Current lighting consists of T8 lamps, compact fluorescents and metal halide fixtures. Due to maintenance and uniformity reasons, Carson City would like to upgrade all lighting to LED.

5.19 Mills Park Complex

> Park Complex Description

Year	1978
Square Feet	N/A
Floors	N/A

The Mills Park Complex is located at 1111 E. William Street. The Park Complex includes three covered pavilions the Marv Teixeira Pavilion and restrooms.

Building Envelope

There are several individual structures throughout the Mills Park Complex. The first is the Marv Teixeira Pavilion which is an outdoor open air pavilion. The pavilion is constructed of structural steel with a standing seam metal roof. There are also two auxiliary buildings, one at each end of the pavilion. Both of these buildings are single-story buildings whose building envelope consists of exterior concrete block and wood construction with exposed concrete block or sheetrock on the face of the interior walls. The floors of the building are slab-on-grade with concrete or vinyl finishes while the ceilings are suspended drywall ceilings over framing in areas such as locker rooms, snack bars or restrooms. The roof of the building is a composite roof tile roofing system. There are no exterior windows in either of these buildings.

The second building is a railroad and restroom building. It is a single-story building whose building envelope consists of exterior concrete block and wood construction with exposed concrete block or sheetrock on the face of the interior walls. The floors of the building are slab-on-grade with concrete or vinyl finishes while the ceilings are suspended drywall ceilings over framing in areas such as snack bars, open areas or restrooms. The roof of the building is a standing seam metal roofing system. The exterior windows the facility are either aluminum or hollow metal frames with laminated tinted double-pane glass with steel security barring. There are also three storage buildings for the keeping of the trains and other equipment. These three buildings are of wood framed construction, plywood panel siding and corrugated metal roofs. The inside of these storage buildings is unfinished.

There are two additional restroom buildings at Mills Park. The first is a single-story building whose building envelope consists of structural steel framing with standing seam metal siding and with painted steel sheets on the face of the interior walls. The floors of the buildings are slab-on-grade with concrete

while the ceiling is finished with sheetrock. The roof of the buildings is a standing seam metal roofing system. There are no exterior windows in this building. The second is a single-story building whose building envelope consists of exterior concrete block and wood construction with exposed concrete block on the face of the interior walls. The floors of the buildings are slab-on-grade with concrete while the ceiling is finished with sheetrock. The roof of the buildings is a composite shingle roofing system. There are no exterior windows in this building.

> Energy Using Systems

HVAC Systems

Space conditioning for the two auxiliary buildings at the Marv Teixeira Pavilion is an upright natural gas residential furnace in a mechanical room with no air conditioning for each building. The thermostat controlling these furnaces are a simple non-programmable heating thermostat. Domestic hot water is supplied by an electric water heater in each building. There is a Reznor natural gas unit heater in a storage room controlled by a manual thermostat. Additionally, there is a natural gas-fired radiant heater hanging over the bleachers in the pavilion area.

Space conditioning for the railroad and restrooms buildings is furnished by is a horizontal natural gas residential furnace in a mechanical room with no air conditioning. A manual thermostat controlling this furnace. There is also a swamp cooling unit on the roof controlled by a simple wall on and off switch. Domestic hot water is supplied by an electric hot water heater in this building.

There is no heating, ventilating or air conditioning for the two restroom buildings.

There is currently no connection of this facility to the city-wide Alerton DDC Control System.

Lighting Systems

The predominant lighting used throughout the Mills Park buildings is 40-watt T12 surface-mounted or hanging fixtures. There are also compact fluorescent fixtures in the restroom buildings.

The pavilion lighting is hanging HID fixtures.

Tennis court lighting is sports complex HID lighting on poles.

Exterior lighting for the rest of the park is primarily wall packs or parking lot pole lights that are high pressure sodium with some metal halide.

Plug Load Equipment

Plug load equipment found in the Marv Teixeira Pavilion includes kitchen equipment such as two refrigerators, coffee maker, two microwave ovens, hot dog cooker, crock pots and other appliances.

Plug load equipment found in the railroad station and restroom buildings includes kitchen equipment such as a popcorn maker, microwave oven, ice maker, refrigerator, cash register, two coffee machines, sound system, big model train set and two ceiling fans. The office area has a computer, monitor, telephone, printer and a copier. The restrooms have electric hand dryers.

Plumbing Systems

The plumbing systems and associated fixtures at the Mills Park Complex are of typical low-flow efficiency and consist of 1.6 GPF toilets and 1.0 GPF urinals. There are many faucets and drinking fountains located throughout the facility with a variety of different flows.

Operational & Maintenance Issues

- Existing EMS system is local to this site. There is no connection to the City's server.
- The train station building has infiltration issues that are in need of repair.
- Current lighting consists of T12 lamps, HPS and metal halide fixtures. Due to maintenance and uniformity reasons, Carson City would like to upgrade all lighting to LED.

5.20 Centennial Park Complex

> Park Complex Description

Year	1989
Square Feet	N/A
Floors	N/A

The Centennial Park Sports Complex is located on Centennial Park Drive and was dedicated in 1989. The Sports Complex comprises two softball complexes with Softball Complex #1 having three softball fields, one soccer field and restrooms and Softball Complex #2 having four softball fields, field lights, playground equipment, a concession stand and restrooms. The Sports complex also has a tennis court area with eight tennis courts, covered pavilion, playground equipment and restrooms and an archery range.

Building Envelope

There are several individual buildings at this sports complex. The first is a Snack Bar building, with restrooms. It is a single-story building whose building envelope consists of exterior concrete block and wood construction with exposed concrete block or sheetrock on the face of the interior walls. The floors of the building are slab-on-grade with concrete or vinyl finishes while the ceilings are suspended drywall ceilings over framing in areas such as snack bars, kitchens or restrooms. The roof of the building is a composite roof tile roofing system. There are no exterior windows in this building.

The second building is a Maintenance Building. It is a single-story building whose building envelope consists of exterior concrete block and wood construction with exposed concrete block or sheetrock on the face of the interior walls. The floors of the building are slab-on-grade with concrete while the ceiling is finished with sheetrock. The roof of the building is a composite tile roofing system. There are no exterior windows in this building.

The tennis courts also have a storage building and a restroom building. Both buildings are single-story buildings whose building envelope consists of exterior concrete block and wood construction with exposed concrete block or sheetrock on the face of the interior walls. The floors of the building are slab-on-grade with concrete while the ceiling is finished with sheetrock. The roof of the building is a composite tile roofing system. There are no exterior windows in this building.

> Energy Using Systems

HVAC Systems

Space conditioning for the Snack Bar building is an upright natural gas residential furnace in a mechanical room with no air conditioning and a manual thermostat. There is also a swamp cooler on the roof of the building controlled by a wall switch. Domestic hot water is supplied by an electric water heater.

There is no heating, ventilating or air conditioning for the Maintenance Building or the tennis court buildings.

There is currently no connection of this facility to the city-wide Alerton DDC control system.

Lighting Systems

The predominant lighting used throughout the Centennial Park Sports Complex buildings is 32-watt T8 surface-mounted or hanging fixtures. There are also compact fluorescent fixtures in the restroom buildings.

Softball field lighting and tennis court lighting is sports complex metal halide HID lighting on poles.

Exterior lighting is primarily wall packs or parking lot pole lights that are high pressure sodium with some metal halide.

Plug Load Equipment

Plug load equipment found in the Snack Bar is kitchen equipment such as an ice machine, microwave oven, deep fryer, griddle, electric burners, kitchen hood with roof exhaust fan, beer cooler box and beer taps, two Icee machines, two cold drink coolers, a soft drink dispenser, three stand up drink coolers, one low box refrigerator, two ice cream freezers, a three door refrigerator, coffee machine, etc. The office area has computers, printer, telephone, radio and scoreboard controls. The restrooms have either an electric hand dryers.

Plug load equipment for the Maintenance Building is comprised of a refrigerator, microwave oven, radio and miscellaneous electric hand tools.

Plug load equipment for the two tennis court buildings consist of an electric hand dryer for each restroom.

Plumbing Systems

The plumbing systems and associated fixtures at the Centennial Park Sports Complex are of typical low-flow efficiency and consist of 1.6 GPF toilets and 1.0 GPF urinals. There are many faucets and drinking fountains located throughout the facility with a variety of different flows.

Operational & Maintenance Issues

- Existing EMS system is local to this site. There is no connection to the City's EMS server.
- The site has infiltration issues that are in need of repair.
- Current lighting consists of T8 and T12 lamps, metal halide and HPS fixtures. Due to maintenance and uniformity reasons, Carson City would like to upgrade all lighting to LED.

5.21 Pete Livermore Sports Complex

> Park Complex Description

Year	1990
Square Feet	N/A
Floors	N/A

The Pete Livermore Sports Complex; once known as the Edmonds Sports Complex; is located at 1555 Livermore Lane. The Sports Complex comprises four youth softball fields, ten soccer fields, a BMX bicycle racing track, Miniature Park with benches, picnic tables, and playground equipment, concession stands and restrooms.

Building Envelope

There are several individual buildings are this sports complex. The first is a Snack Bar with restrooms. It is a single-story building whose building envelope consists of exterior concrete block and wood construction with exposed concrete block on the face of the interior walls. The floors of the building are slab-on-grade with concrete or vinyl finishes while the ceilings are suspended drywall ceilings over framing in areas such as snack bars, kitchens or restrooms. The roof of the building is a composite roof tile roofing system. There are no exterior windows in this building.

The second building is an umpires, scorekeepers and announcers booths building. It is a single-story building whose building envelope consists of exterior concrete block and wood construction with exposed concrete block on the face of the interior walls. The floors of the building are slab-on-grade with concrete or vinyl finishes while the ceilings are suspended drywall ceilings over channels in areas such as snack bars, kitchens or restrooms. The roof of the building is a composite roof tile roofing system. The exterior windows the facility are either aluminum or hollow metal frames with laminated tinted double-pane glass with steel security barring.

The third building is a Maintenance Building. It is a single-story building whose building envelope consists of wood framing and insulation with exterior stained plywood and with plywood or sheetrock on the face of the interior walls. The floors of the building are slab-on-grade with concrete while the ceiling is finished with sheetrock. The roof of the building is a composite tile roofing system. There are no exterior windows in this building. The building has two roll-up doors.

The fourth and fifth buildings are restroom buildings. They are single-story buildings whose building envelope consists of structural steel framing with standing seam metal siding and with painted steel

sheets on the face of the interior walls. The floors of the buildings are slab-on-grade with concrete while the ceiling is finished with sheetrock. The roof of the buildings is a standing seam metal roofing system. There are no exterior windows in this building.

The sixth building is the BMX Building. It is a single \-story building whose building envelope consists of structural steel framing with standing seam metal siding and with exposed plastic faced insulation on the face of the interior walls. The floors of the buildings are slab-on-grade with concrete while the ceiling is unfinished. The roof of the buildings is a standing seam metal roofing system. The exterior windows the facility are either aluminum or hollow metal frames with laminated tinted double-pane glass with steel security barring.

> Energy Using Systems

HVAC Systems

Space conditioning for the Snack Bar is an upright natural gas residential furnace in a mechanical room with no air conditioning with a manual thermostat. There is also a swamp cooler on the roof of the building controlled by a wall switch. Domestic hot water is supplied by an electric water heater.

There is no heating, ventilating or air conditioning for the umpires, scorekeepers and announcers booths building.

Space conditioning for the Maintenance Building is furnished by two Reznor unit heaters with manual thermostats.

There is no heating, ventilating or air conditioning for the two restroom buildings or the BMX Building.

There is currently no connection of this facility to the city-wide Alerton DDC control system.

Lighting Systems

The predominant lighting used throughout the Pete Livermore Sports Complex buildings is 40-watt T12 surface-mounted or hanging fixtures. There are also compact fluorescent fixtures in the restroom buildings.

Softball field lighting and the BMX bicycle racing track lighting is sports complex metal halide HID lighting on poles.

Exterior lighting is primarily wall packs or parking lot pole lights that are high pressure sodium with some metal halide.

There is a lighting occupancy timers located in the private restroom at Pete Livermore Sports Complex. The timer appeared to be functional.

Plug Load Equipment

Plug load equipment found in the Snack Bar is kitchen equipment such as an ice machine, coffee machine, soda machine, slush machine, hot dog cooker, nacho heater, pretzel machine, Gatorade cooler, heated holding cabinet, deep fryer, griddle, kitchen hood with roof exhaust fan, drink cooler, microwave oven, freezer, large refrigerator, small refrigerator, etc. The restrooms have either an electric hand dryer or an electric towel dispenser.

Plug load equipment for the umpire's, scorekeepers and announcers booths building is limited to scorekeeper's controls for the scoreboards and announcers sound equipment.

Plug load equipment for the Maintenance Building is comprised of a refrigerator, microwave oven, radio electric towel dispenser, miscellaneous electric hand tools, ceramic floor heater and an air compressor.

Plug load equipment for the two restroom buildings is an electric hand dryer for each restroom for a total of four.

Plug load equipment for the BMX Building consists of two refrigerator freezers, one refrigerator, one freezer, two popcorn makers, four microwave ovens, one coffee maker, one radio and a portable fan.

Plumbing Systems

The plumbing systems and associated fixtures at the Pete Livermore Sports Complex are of typical low-flow efficiency and consist of 1.6 GPF toilets and 1.0 GPF urinals. There are many faucets and drinking fountains located throughout the facility with a variety of different flows.

Operational & Maintenance Issues

- Existing EMS system is local to this site. There is no connection to the City's server.
- The site has infiltration issues that are in need of repair.
- Current lighting consists of T8 & T12 lamps, metal halide and HPS fixtures. Due to maintenance and uniformity reasons, Carson City would like to upgrade all lighting to LED.

5.22 Fairview Drive Street Lighting

> Description

Fairview Drive is a four-lane arterial road.

Year	2010
Square Feet	N/A
Floors	N/A

Building Envelope

Not applicable.

> Energy Using Systems

HVAC Systems

Not applicable.

Lighting Systems

The street lighting on Fairview Drive consists of decorative lighting poles and lighting fixtures. There are approximately 80 street lights that are owned and maintained by Carson City.

The predominant exterior street lighting utilized on these poles on Fairview Drive is currently 200-watt metal halide. The streetlights are controlled by photocells located on the fixtures.

Plug Load Equipment

Not applicable.

Plumbing Systems

Not applicable.

Operational & Maintenance Issues

Current lighting consists of metal halide fixtures. Due to maintenance and uniformity reasons, Carson City would like to upgrade all lighting to LED

This page is intentionally left blank.

6.0 Savings Analysis

The savings analysis for the proposed energy conservation measures employed two methods: calibrated energy modeling using eQUEST building energy simulation software and spreadsheet analysis. The energy models were used to calculate the interactive savings associated with measures which reduce HVAC loads or increase HVAC system efficiency. Spreadsheet calculations were employed for measures where the savings primarily come from the reduction of run-time hours for non-HVAC equipment. The savings analysis for each method and the associated measures are described below.

6.1 Energy Models

The Carson City modeling scope consisted of six municipal facilities:

1. Aquatic Center
2. City Hall
3. Fire Station 51
4. Library
5. Public Safety Complex (Courthouse & Jail)
6. Senior Center

> Modeling Methodology

These facilities were modeled using eQUEST (Quick Energy Simulation Tool) version 3.65, which is a graphical front end for the DOE2.2 building simulation engine. This software commonly used in the building and construction industry to evaluate different envelope, lighting, and mechanical (HVAC) systems with regards to their impact on energy consumption. The software simulates each of these systems on an hourly basis for the given simulation year (8760 hours per year), while taking into account thermal mass effects, occupancy and operating schedules, temperature setpoints, weather data, equipment efficiency, etc. These are all components necessary to follow ASHRAE Guideline 14 section 4.3.2.4, which characterizes the *Whole-Building Calibrated Simulation Performance Path* for calculating energy savings measures.

Each model was based on architectural and MEP drawings provided by Carson City, as well as photos, staff interviews, and site inspection reports completed by AMERESCO:

- Walls, windows, and roofs were placed in accordance with architectural plans, photos, and satellite imagery (Google Maps/Earth) in order to accurately reflect the buildings' appearance. Constructions (e.g. brick walls with rigid insulation) for these components were based on wall and roof sections or details included in the plans.

- Lighting systems were, for the most part, modeled with a whole building approach utilizing the total interior lighting power as determined during the lighting audit. This value was then used to calculate an overall lighting power density (LPD) in Watts per square foot (W/ft^2) and applied to each space in the model. Exterior lighting was added directly the models' building meters.
- The HVAC systems for each building were added based on mechanical schedules while zones were assigned to each system according to duct layouts and floor plans. Modifications were made as necessary to account for changes to the facilities that may not be reflected in the plans. HVAC equipment efficiencies were based on field measurements, nameplate data, or the mechanical plans. Industry standards were used if the above information was not available.
- Equipment and occupancy operating schedules and temperature setpoints were input according to site observation, staff interviews, and/or data/trend logs.

Calibration

Calibration is the process of reducing uncertainly of a model so that it may more accurately represent the building and its systems. Most commonly, a model is calibrated to metered utility data (electricity, natural gas, district heating/cooling, etc.) on a monthly or hourly basis. System level components may also be calibrated if data is available (e.g. data and trend logs).

According to ASHRAE 14, models or their systems are considered to be calibrated if "they produce MBEs within ±10% and CV(RMSE)s within ±30% when using hourly data or 5% MBE and 15% CV(RMSE) with monthly data." ASHRAE 14 provides detailed information on calculating the MBE (mean bias error) and the CV(RSME) (coefficient of variation of the root-mean-square error). In short, MBE measures how closely the model matches utility data on a monthly or annual basis while CV(RSME) describes how well the model's output "fits" the data. MBE can be influenced by offsetting errors (i.e. a high and low value average out), so CV(RSME) is added as an additional index. A simple (albeit not perfect) analogy for MBE and CV(RSME) would be comparing two handheld objects to each other: their size and shape differences would be the MBE and CV(RSME), respectively.

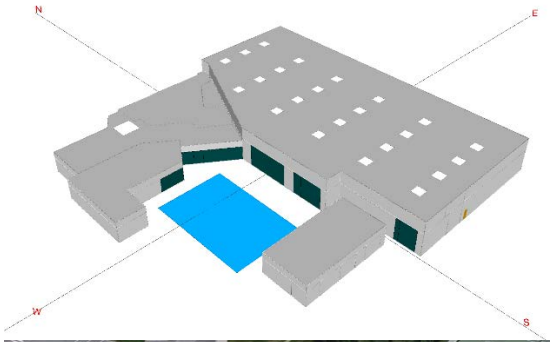
Calibrating the models was an iterative process as changes to system parameters have impacts on electric demand (kW) and energy (kWh), as well as gas consumption (Therms). After the initial inputs were put into each model, they were simulated and the results compared to available utility data. The interpretation of the results dictated which inputs were refined or adjusted. Usually, the focus was centered on inputs with relatively higher uncertainty where data may not be available. The adjustments made to each input were based on experience, engineering judgement, and discussions with the audit team.

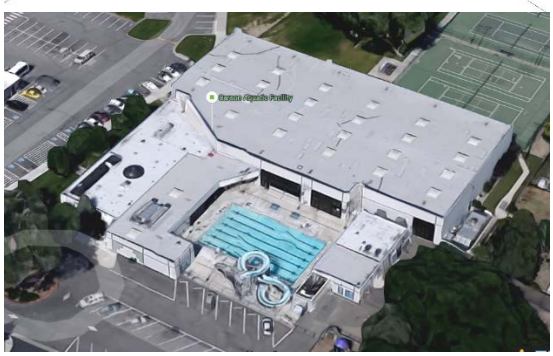
The Carson City models were calibrated using monthly electric and natural gas data as provided by the utility. Per ASHRAE 14, tolerances were ±5% MBE and ±15% annually. It should be noted that while these tolerances were used to quantify the final calibration of the model, a graphical approach was used as the primary tool in determining what components, systems, or other end-uses were adjusted during the calibration process (see graphs below).

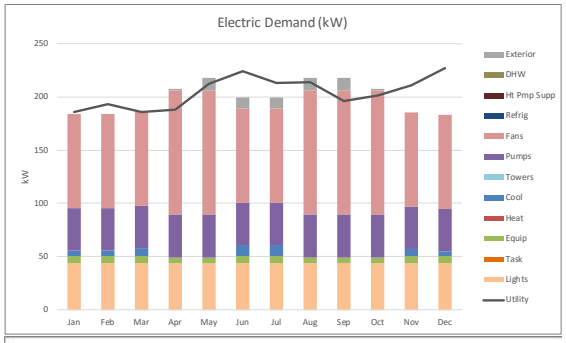
Calibration Results

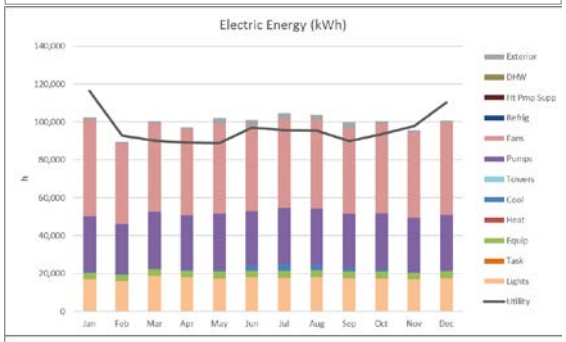
> Aquatic Center

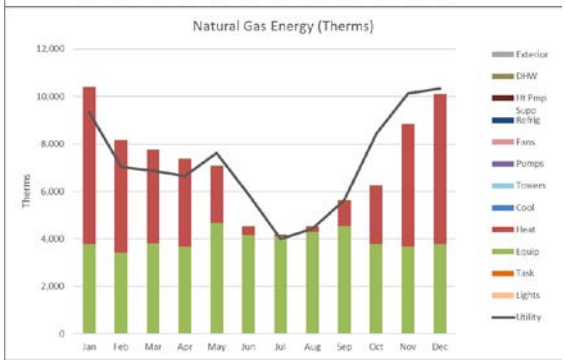
Utility	Units	Annual Total			
		Meter	Model	MBE	CV(RSME)
Electric Demand	Avg. kW	204	199	-2.4%	9.4%
Electric Energy	kWh	1,157,333	1,197,606	3.5%	9.3%
Gas Energy	Therms	86,300	84,950	-1.6%	14.1%







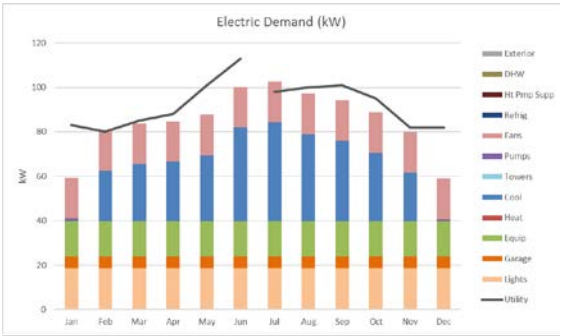


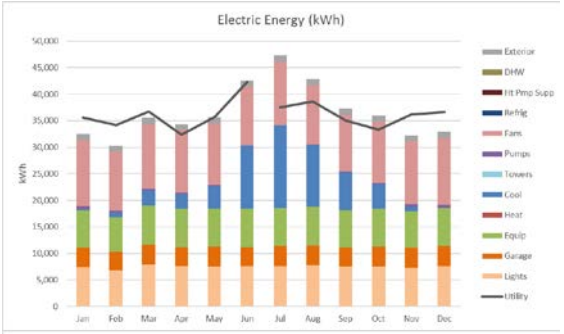


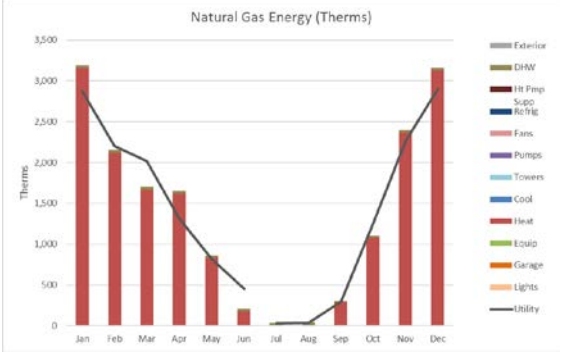
> City Hall

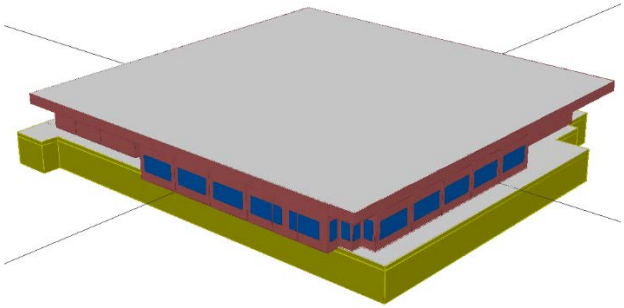
Utility	Units	Annual Total			
		Meter	Model	MBE	CV(RSME)
Electric Demand	Avg. kW	113	103	-10.7%	12.4%
Electric Energy	kWh	434,200	439,502	1.2%	10.9%
Gas Energy	Therms	16,479	16,798	1.9%	14.7%

Average demand MBE is slightly above tolerance. However, further inspection found that this was due to abnormal Dec-Jan cooling opertion. This short term demand difference is considered negligible as the energy use is well within tolerance.





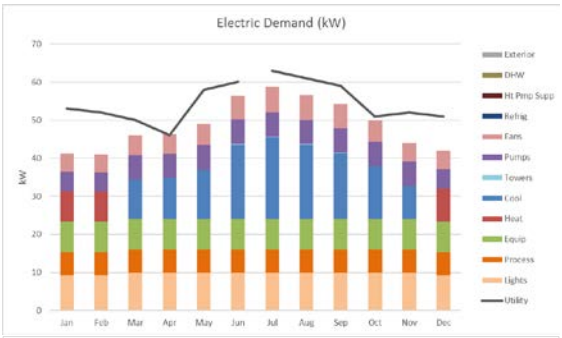


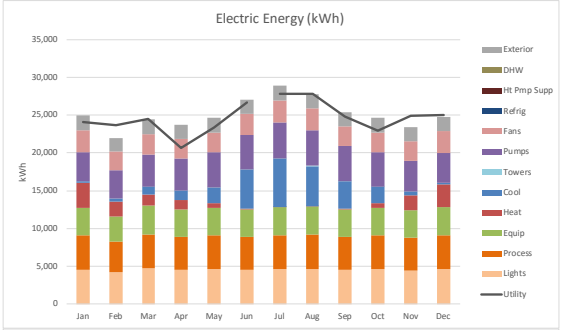


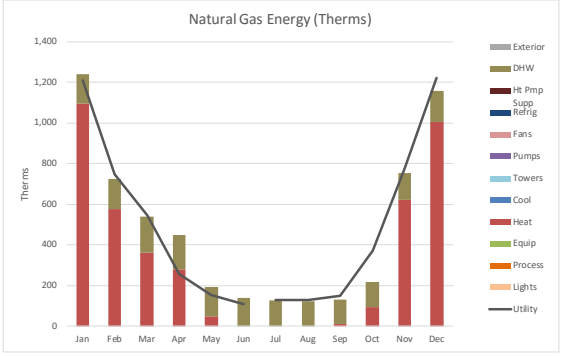
> Fire Station #51

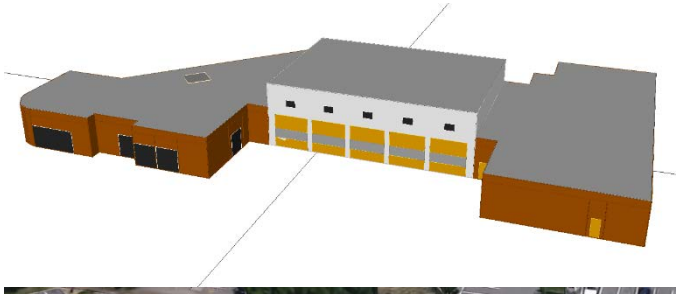
Utility	Units	Annual Total			
		Meter	Model	MBE	CV(RSME)
Electric Demand	Avg. kW	63	59	-10.7%	12.6%
Electric Energy	kWh	296,059	301,482	1.8%	5.4%
Gas Energy	Therms	5,787	5,789	0.0%	15.9%

The average demand MBE is slightly above toterance. This may be due to differences in coincident demand of the electric heat pump systems and also affects the Gas CV(RSME) in April and October consumption. This would not materially alter the savings analysis.



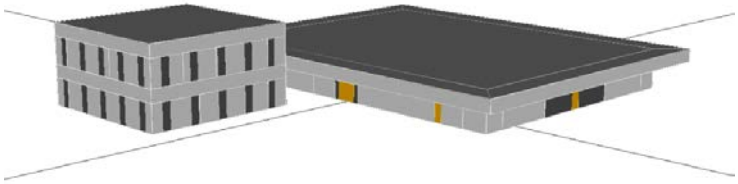


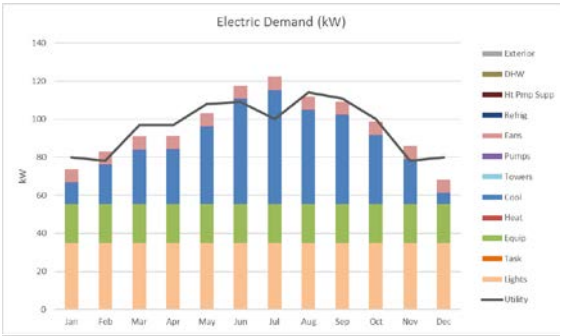


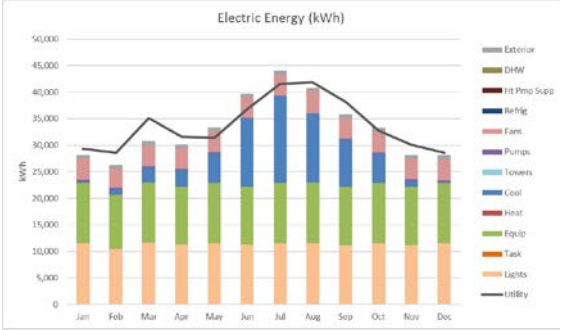


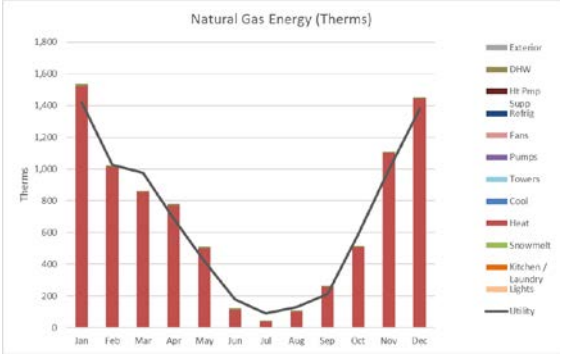
> Library

		Annual Total			
Utility	Units	Meter	Model	MBE	CV(RSME)
Electric Demand	Avg. kW	96	96	0.4%	9.2%
Electric Energy	kWh	406,080	398,784	-1.8%	6.5%
Gas Energy	Therms	8,108	8,331	2.8%	11.6%



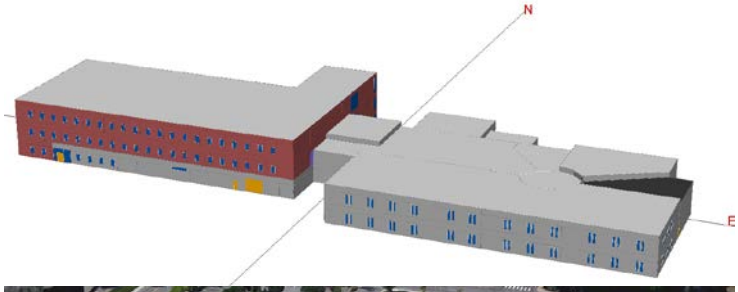


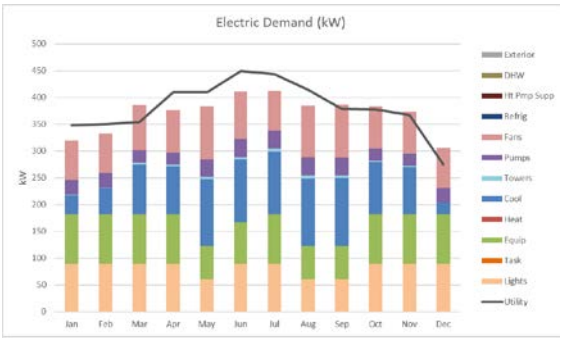


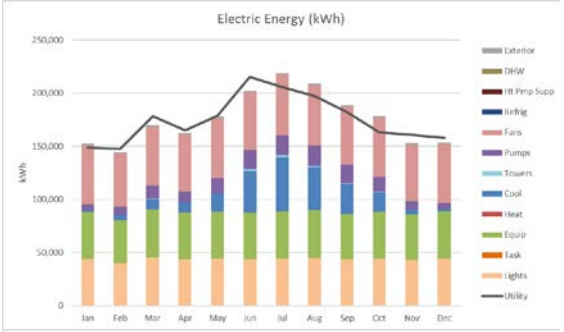


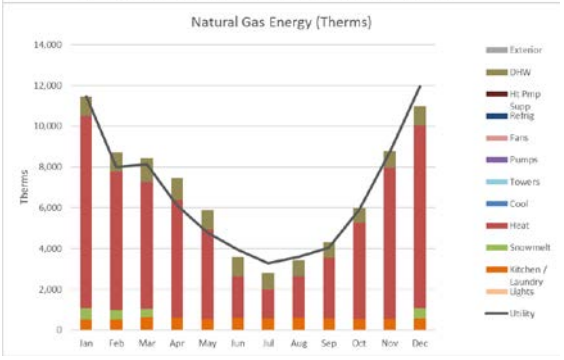
> Public Safety Complex (Courthouse & Jail)

Utility	Units	Annual Total			
		Meter	Model	MBE	CV(RSME)
Electric Demand	Avg. kW	382	371	-2.7%	6.9%
Electric Energy	kWh	2,101,400	2,111,169	0.5%	5.0%
Gas Energy	Therms	80,082	81,845	2.2%	9.8%



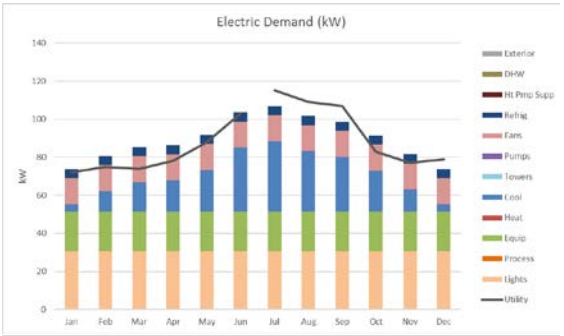


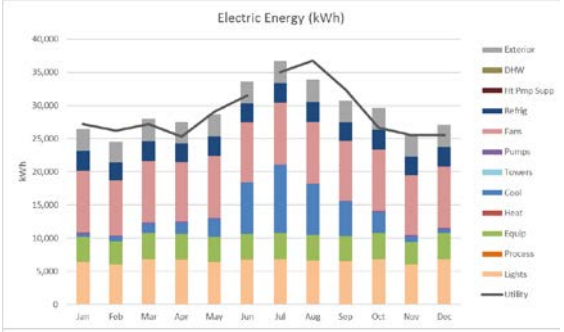


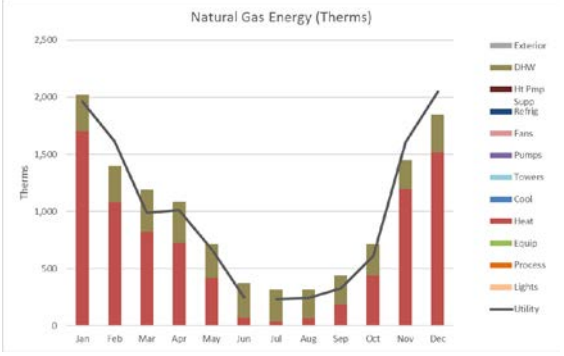


> Senior Center

Utility	Units	Annual Total			
		Meter	Model	MBE	CV(RSME)
Electric Demand	Avg. kW	88	90	1.5%	7.7%
Electric Energy	kWh	348,267	352,443	1.2%	6.2%
Gas Energy	Therms	11,568	11,885	2.7%	13.9%







6.2 Spreadsheet Calculations

Spreadsheet calculations were performed for measures with a relatively small interactive effect on other ECMs. Among the proposed measures this includes ECM 1 Interior Lighting and Exterior Lighting.

6.2.1 ECM 1 Interior Lighting and Exterior Lighting

The lighting audit conducted during the course of the FGOA revealed a large variety of fixture, lamp, and ballast combinations and applications. Nearly all of these fixtures will be retrofitted with LED lamps for the interior fixtures and with new fixtures for the exterior fixtures. Spreadsheet calculation of the savings associated with all of these fixtures requires a room-by-room survey and calculations based on existing fixture burn-hours, existing fixture input watts, upgraded fixture input watts, and upgraded burn-hours.

The energy savings calculations are:

Lighting Savings =

((Existing Hours (per hour code)) X (Input Watts (Existing System))) – ((Upgraded Hours (per hour code)) X (Input Watts(Upgraded System)))

Existing and upgraded fixture burn hours are document in Appendix D. These burn hours based on the logger data also shown in Appendix D.

There are a large number of existing and upgraded input watts according to the wide variety of fixture types. A sample of a line item savings calculation is shown in Table 6.2, which includes both existing and upgraded fixture watts for the sample retrofits.

Table 6.2. Sample Lighting Retrofit Savings Lines

Project Phase	Facility Name or Code	Room Type and Number	Lighting Burn Hour Code	Lighting Description (Existing System)	Lighting Description (Upgraded System)	Quantity Of Luminaires (Existing System)	Input Watts (Existing System)	Quantity Of Luminaires (Upgraded System)	Input Watts (Upgraded System)	Total Kw Saved	Total Kwh Saved (W/O Occupancy Sensors)	Total Kwh Saved
Interior	Courthouse	Courtroom-Small Claims	CRT	Existing (2) Lamp F32t8 Luminaire, Air Handling Fixture	Retrofit: Retrofit with LED T8 Lamps and Driver	24	58.00	24	28.00	0.68	2,214.00	2,214.00
Exterior	Sheriff's Administration	Parking Lot	X	Existing (2) Lamp 250 Watt High Pressure Sodium Luminaire	New: LED Luminaire	8	550.00	8	62.00	0.39	17,098.74	17,098.74
Interior	City Hall	Lobby	Hall	Existing (6) Lamp F32t8 Luminaire	Retrofit: Retrofit with LED T8 Lamps and Driver	6	172.00	6	84.00	0.50	2,452.56	2,452.56
Exterior	City Hall	Exterior Canopy	X	Existing (1) Lamp 32 Watt Compact Fluorescent Luminaire	LED: Screw-In LED Lamp	16	32.00	16	11.00	0.03	1,471.61	1,471.61
Interior	Aquatic Facility	Lobby	LO	Existing (2) Lamp 50 Watt Incandescent Luminaire	LED: Screw-In LED Lamp	8	100.00	8	28.00	0.55	2,224.97	2,224.97

7.0 Energy Conservation Measures

Ameresco has developed a self-funding project consisting of a number of potential energy conservation measures (ECMs) as listed in Table 7.0. These proposed measures will provide an improved working environment and reduced facility operating costs, combined with operations and maintenance improvements. These measures include interior and exterior lighting retrofits, boiler replacements, energy management upgrades and retro-commissioning, building envelope, HVAC retrofit at City Hall, and Building Dynamics. The proposed measures are recommended for implementation in an energy performance contract (EPC) within the 20-year term requested by Carson City.

The ECM summary table shows the electric cost savings and maintenance savings associated with the proposed measures.

Table 7.0. Financial Grade Operational Audit 100 Percent ECM Summary Table

ECM No.	Energy Conservation Measure	Annual Electric Demand Savings (kW)	Annual Electric Energy Savings (kWh)	Annual Electric Savings ($)	Annual Natural Gas Savings (Therms)	Annual Natural Gas Savings ($)	Operations & Maintenance Savings ($)	Total Savings ($)	Total Implementation Cost	Simple Payback
1	Interior & Exterior Lighting Retrofits	3,189	1,325,714	$97,076	-	-	$15,189	$112,265	$2,029,545	16
2	Boiler Replacements	(10)	(6,729)	-$435	15,018	$9,267	-	$8,832	$522,905	53.5
3	Energy Management System Upgrades & Retro-Commissioning	411	533,198	$29,946	33,426	$21,022	-	$50,968	$760,888	13.6
4	Building Envelope	-	88,802	$4,320	12,239	$8,113	-	$12,433	$183,519	13.6
5	City Hall HVAC Retrofit	111	98,056	$5,888	4,424	$3,073	-	$8,961	$619,882	Capital Project
7	Building Dynamics	-	-	-	-	-	-	-	$12,915	-
	Total:	**3,700**	**2,039,040**	**$136,795**	**65,108**	**$41,474**	**$15,189**	**$193,459**	**$4,129,654**	**19.2**

Table 7.1. ECM Applicability

Facility	Energy Conservation Measure					
	1	2	3	4	5	7
	Interior & Exterior Lighting Retrofits	Boiler Replacements	EMS Upgrades & Retro-Commissioning	Building Envelope	City Hall HVAC Retrofit	Building Dynamics
Aquatic Facility	X	X	X	X		X
Building Resource Innovation Center	X					X
Cemetery	X					X
City Hall	X	X	X	X	X	X
Community Center	X		X	X		X
Corporate Yard: Public Works A-D	X					X
Corporate Yard: Building 2 (Fleet)						X
Corporate Yard: Building 3 (Sand Barn)						X
Corporate Yard: Building 7						X
Corporate Yard: Building 9						X
Corporate Yard: Building 11						X
Corporate Yard: Building 13	X					X
Court House Complex	X		X			X
Fire Station 51	X		X			X
Fire Station 52 and Fire Training Building	X		X	X		X
Fire Station 53	X		X			X
Health and Human Resources	X		X			X
Juvenile Administration Building	X		X			X
Juvenile Annex	X					X
Juvenile Detention Center and Juvenile Court	X			X		X
Carson City Library	X		X			X
Senior Center	X		X			X
Sheriff's Administration Building	X		X			X
Sheriff's Dispatch			X	X		X
Mills Park Complex / Marv Teixeira Pavilion	X					X
Centennial Park Complex	X					X
Pete Livermore Sports Complex	X					X
Fairview Drive Street Lighting						X
MAC			X			X

ECM 1. Interior & Exterior Lighting Retrofit

> Interior Lighting Retrofit

ECM Summary

Ameresco proposes to retrofit selected existing lighting systems with new high efficiency LED lamps. Retrofitting the existing fixtures with new LED lamps will reduce peak demand and electricity consumption. The retrofit will also reduce cooling requirements by reducing heat gain from the lighting equipment. Conversely, there will be some increased heating required during the winter.

This measure is applied to sites where its application meets the financial requirements of the project. Conversely, some sites are excluded for this measure. See Table 7.1 for measure applicability by site.

At the applicable sites, the existing ballasted linear fluorescent T8 and T5 lamps will be replaced with LED T8 lamps with direct wiring bypassing the existing ballasts. See Figure 7.0 for the wiring diagram associated with the linear lamp LED retrofits. Existing incandescent lamps will be replaced with screw-in LED lamps. Existing HID fixtures rated at 175 and above will be replaced with new LED fixtures. The new LED lamps are DLC qualified with a minimum of a 50,000 hour rated life. The retrofitted lighting system will substantially match the existing lighting levels, and meet the City's minimum guidelines for lighting within the spaces.

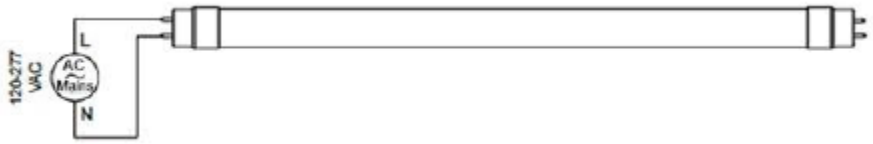


Figure 7.0. ECM 1 Interior Lighting Retrofit, Direct Wire LED T8 Wiring Diagram

The retrofit of existing lighting fixtures will have a major positive impact on the interior and exterior aesthetics of the Carson City facilities. Upgrading the lighting fixtures to LED will provide considerable cost savings and contribute to a higher quality working environment. These measures will significantly reduce kW and kWh usage, lower anticipated HVAC costs and provide an improved lighting quality to enhance the overall appearance of the facilities.

LED technologies have a rated life of up to 25 times longer than that of existing lighting types found throughout the facilities. This upgrade will significantly reduce labor and material maintenance costs over the life of the products. Maintenance savings shown in the project cash flow reflect the savings on lighting materials. No maintenance labor savings are claimed per the project agreement.

The following factors will be taken into consideration for the interior lighting ECM:

- Room type and usage
- Hours of operation
- Existing lighting technology
- Age and condition of fixture

This page is intentionally left blank.

Table 7.2. ECM 1. Interior Lighting Retrofit Measures

	Aquatic Facility	Building Resource Innovation Center	Cemetery	City Hall	Community Center	Corporate Yard: Public Works A-D	Corporate Yard: Building 2 (Fleet)	Corporate Yard: Building 3 (Sand Barn)	Corporate Yard: Building 7	Corporate Yard: Building 9	Corporate Yard: Building 11	Corporate Yard: Building 13	Court House Complex	Fire Station 51	Fire Station 52 and Fire Training Building	Fire Station 53	Health and Human Resources	Juvenile Administration Building	Juvenile Annex	Juvenile Detention Center and Juvenile Court	Carson City Library	Senior Center	Sheriff's Administration Building	Sheriff's Dispatch	Mills Park Complex / Marv Teixeira Pavilion	Centennial Park Complex	Pete Livermore Sports Complex	Fairview Drive Street Lighting	MAC
ECM 1. Interior Lighting Retrofits																													
Interior LED Lighting and Controls	X	X	X	X	X	X							X	X	X	X	X	X	X	X	X	X	X		X	X	X		
Can Lighting LED Retrofit													X																

This page is intentionally left blank.

Recommended Modifications

Ameresco's approach is to continue the City's policy of a standardized lighting system and present to the City the most appropriate "next generation" lighting scenario. Retrofitting from 32-watt T8 lamps to premium efficiency 25-watt T8 lamps and high efficiency electronic ballasts was given serious consideration, but the incremental savings and minimal maintenance benefit does not justify a city-wide retrofit.

LED retrofit options are in a positive state of flux and prices are decreasing. In order to properly design LED lighting systems to replace the mixture of technologies, a detailed lighting study was performed including layouts and light level design of the new fixtures to ensure proper illumination and photometrics. Sample results of this lighting audit are provided in Appendix G.

Many LED retrofit options were evaluated with prime consideration given to low installed cost, and reduced maintenance. Based on these considerations an interior lighting retrofit consisting largely of direct-wire linear LED tube lamp retrofits is recommend.

The common specification of the direct-wire linear LED tube lamps proposed are the following:

- Direct-wire input voltage 120-277
- 115 lm/w
- 50,000 lamp life
- 4,000 K color temperature
- CRI: 83
- 325-degree beam angle
- Non-shunted tombstone wiring

The scope of the retrofit includes the following:

- Remove, recycle existing T12 and T8 florescent lamps
- Remove, replace, and re-center existing fluorescent lamp tombstone
- Bypass wiring for existing electronic ballasts, ballasts to remain
- For de-lamped fixtures, provide photo-metric correcting reflector
- Clean existing fixtures
- Install direct-wire LED Lamps with internal drivers
- Replace existing compact florescent plug-in lamps with LED can kits (Courthouse only)
- Replace or retrofit existing incandescent, halogen, and CFL screw-in lamps with screw-in LED lamps or new LED fixtures
- Replace existing HID (metal-halide and high pressure sodium) fixtures with new LED fixtures
- Existing dimming controls will be maintained in areas where it currently exists

- Occupancy sensors will be replaced in a limited number of areas within the facilities that provide the greatest opportunity for lighting controls and energy savings.
- ***Note that any existing fluorescent fixtures that contain an emergency battery backup will remain. The battery backup is not compatible with the LED lamp.***

In addition to improved light levels and energy efficiency, ongoing expenses should be considered for each type of lighting system. LED lighting provides longer service life, and lamps rated at a minimum of 50,000 hours of service life. The O&M material savings associated with an LED option is captured in the proposed savings analysis and this represents an additional benefit to the City. In all, 6,823 interior luminaires are to be upgraded.

> Exterior Lighting Retrofit

ECM Summary

The intent of this upgrade is to replace the existing building-mounted and pole-mounted area lighting as shown in the recommended modifications below. The exterior building mount lighting scope includes wall-mount fixtures, flood fixtures, surface-mount fixtures and recessed cans. Site lighting and parking lot lighting consist of bollards, pole lighting (shoeboxes, floods and post tops). Special considerations will be given to dark skies, color of existing fixtures, existing controls (if any) and age and condition of the existing fixtures.

This measure is applied to sites where its application meets the financial requirements of the project. Conversely, some sites are excluded for this measure. See Table 7.3 for measure applicability by site.

> Existing Conditions

The existing site lighting fixtures include a variety of lighting technologies throughout each facility. Existing lighting technologies include HID sources (metal halide, mercury vapor and high pressure sodium), compact fluorescent, incandescent and linear fluorescent. Lighting covers building perimeters, walkways and parking areas. Sports field lighting is not included.

Table 7.3. ECM 1. Exterior Lighting Retrofit Measures

	Aquatic Facility	Building Resource Innovation Center	Cemetery	City Hall	Community Center	Corporate Yard: Public Works A-D	Corporate Yard: Building 2 (Fleet)	Corporate Yard: Building 3 (Sand Barn)	Corporate Yard: Building 7	Corporate Yard: Building 9	Corporate Yard: Building 11	Corporate Yard: Building 13	Court House Complex	Fire Station 51	Fire Station 52 and Fire Training Building	Fire Station 53	Health and Human Resources	Juvenile Administration Building	Juvenile Annex	Juvenile Detention Center and Juvenile Court	Carson City Library	Senior Center	Sheriff's Administration Building	Sheriff's Dispatch	Mills Park Complex / Marv Teixeira Pavilion	Centennial Park Complex	Pete Livermore Sports Complex	Fairview Drive Street Lighting	MAC
ECM 1. Exterior Lighting Retrofits																													
Exterior Lighting LED and Controls	X	X	X	X	X	X						X	X	X	X	X	X	X	X	X	X	X	X		X	X	X		

This page is intentionally left blank.

Recommended Modifications

Fixtures will be upgraded at facilities where the lighting retrofits fit into the project's financial constraints. Facilities with older, less efficient systems are to be targeted first while facilities with newer, more efficient lighting are excluded. At the selected sites, all exterior lighting will be retrofitted to new LED fixtures of a similar type and style. By going from HID, CFL or fluorescent to LED, the rated life of the lamps increase from 20,000 (HID), 10,000 (CFL) and 24,000 (fluorescent) to a minimum of 50,000 hours with many manufacturers and fixture types in excess of 100,000 hours. Tables 7.3 details a matrix for ECM application to the Ameresco's assigned portfolio of buildings. In all, 635 exterior luminaires are to be upgraded.

Proposed Exterior Upgrades

- Incandescent, halogen and CFL screw-in lamps will be retrofitted or replaced with screw-in LED lamps or new LED fixtures.
- All exterior HID (mercury vapor, metal halide or high pressure sodium) fixtures will be replaced with new LED fixtures. This will apply to existing wall-pack fixtures, flood fixtures, canopy fixtures, and pole-mount fixtures. Controls such as photocells or time clocks will also be considered. This upgrade will result in significantly longer life products and provide instant 'on' lighting.
- All exterior Incandescent or linear fluorescent fixtures will also be replaced with new LED fixtures.

The proposed solution will help standardize the use of LEDs for exterior lighting and reduce maintenance. Ameresco recommends replacing fixtures where cost effective, such as surface mounting façade fixtures, and retrofitting fixtures for LED lamps at capital intensive fixtures.

> Proposed Savings

Energy savings will result from the operation of more efficient fixtures with reduced demand and usage. See Section 6.0 for a description of the lighting savings calculations.

The currently estimated annual savings for this measure are the following:

Table 7.4. ECM 1 Guaranteed Annual Savings

ECM Sites	Energy Conservation Measure	Annual kW Savings	Annual kWh Savings	Annual Electric Cost Savings	Annual Natural Gas Savings (Therm)	Annual Natural Gas Cost Savings	Operation & Maintenance Savings	Total Implementation Cost	Estimated Utility Rebate	Simple Payback
21	ECM 1. Interior & Exterior Lighting Retrofit	3,189	1,325,714	$97,076	-	-	$15,189	$2,029,545	$113,089	16.0

Direct electricity savings are associated with the reduced lamp wattages for both electrical demand and usage charges. Indirect savings are generated through interaction with the HVAC systems. This ECM will reduce the cooling load at the facility by lowering the heat gains in the space from the light fixtures. The measure carries a heating load penalty during the heating season due to the loss of that heat gain.

There are also maintenance savings associated with the LED retrofits. Although there is both a maintenance labor and material savings, only the material savings is factored into the overall retrofit savings calculations. The calculations for the maintenance benefits are described in Appendix D.

ECM 2. Boiler Replacements

> ECM Summary

The intent of this measure is to replace existing heating boilers that are beyond or nearing the end of their useful life that no longer provide reliable and/or efficient operation. Replacing this equipment as a part of this project will result in avoided future capital costs, energy cost savings, and maintain a comfortable working environment.

Existing Conditions

The existing heating equipment considered within this measure includes hot water boilers for space and pool heating.

In the facilities inspected, the existing hot water boilers provide heat for buildings and swimming pool systems, and in some cases, to domestic hot water tanks via heat exchangers. The main systems provide heat for air handlers and fan coils. Several of the existing boilers are inefficient non-condensing units. The majority of the existing boilers are also nearing the end of their useful lives. They are atmospheric with efficiencies of 80 percent or less.

Recommended Modifications

Ameresco recommends the replacement of these non-condensing boilers with new Lochinvar condensing boilers. The proposed condensing boilers operate with AHRI thermal efficiencies of up to 97 percent. Additionally, with up to 10:1 modulation turndown, the burner automatically changes its firing rate as heat loads vary. The proposed boilers fire at the maximum rate when heat load is highest, then gradually "turn down" to as low as 10 percent as load decreases. These modulating systems run smoothly and efficiently, without frequent on/off cycling. The new condensing boilers also include new computerized control logic as an integral part of their normal operating system.

The following table lists the existing boiler equipment to be replaced with this measure. Table 7.7 details a matrix for the measure application to Ameresco's assigned portfolio of buildings.

Table 7.5. ECM 2 – Existing Boiler Equipment

Facility	Unit Designation	Unit Location	Unit Manufacturer	Unit Model #	Unit Serial #	Unit Description	BTU Input
Aquatic Center	Boiler #1	Pool Mechanical Room	Ray Pak	H-3001A-CECRCDA	589103525	Standard Natural Gas	2.5 MMBTU
Aquatic Center	Boiler #2	Pool Mechanical Room	Ray Pak	H-3001A-CECRCDA	589103526	Standard Natural Gas	2.5 MMBTU
City Hall	Boiler #1	Mechanical Room	Kewanee	KF-0330600-60	608231	Standard Natural Gas	990 MBTU

Replacement with condensing boilers requires the following implementation steps:

- Mechanical engineering and electrical engineering for the installation of the new boilers.
- Demolition, removal, and disposal of the existing boilers and unnecessary piping.
- Aquatic Center
  - Installation of four (4) Lochinvar FTXL 850 high efficient natural gas fired boilers with an 850,000 btu/hr input rating. Three boilers will carry the load on the coldest day.
    - The boilers have 316 stainless steel heat exchangers.
    - The boilers have the ability to modulate down to a minimum firing rate of 10 percent (85,000 btu/hr).
    - The boilers will operate with efficiencies in the 91 percent to 92 percent depending on return water temperature and firing rate.
    - The boilers will rotate and sequence themselves to maximize efficiency and meet the required load.
    - The boilers will be supplied with BacNet Cards, all CSD1 controls, and Con-X-US for remote connectivity.
  - Installation of four (4) Lochinvar / Grundfos Variable Speed – Primary Loop Boiler Pumps that will be modulated and controlled by the Boilers to provide a specific temperature rise across each boiler
- City Hall
  - Installation of two (2) Lochinvar Crest FTXL 500 natural gas fired boilers with a 500,000 btu/hr input rating.
    - The boilers have 316 stainless steel heat exchangers.
    - The boilers have the ability to modulate down to a minimum firing rate of 10 percent (50,000 btu/hr).
    - The boilers will operate with efficiencies in the 88 percent to 92 percent range depending on return water temperature and firing rate.
    - The boilers will rotate and sequence themselves to maximize efficiency and meet the required load.
    - The boilers will be supplied with BacNet Cards, all CSD1 controls, and Con-X-US for remote connectivity.
  - Installation of two (2) Lochinvar / Grundfos Variable Speed – Primary Loop Boiler Pumps that will be modulated and controlled by the Boilers to provide a specific temperature rise across each boiler.

  - Installation of one (1) new Spirotherm air/dirt separator
  - Installation of one (1) new ASME expansion tank
  - Installation of two (2) new Grundfos ECM self-sensing variable speed secondary loop pumps with BacNet cards
- Installation of PVC boiler flue piping
- Installation of PVC combustion air piping
- Routing of copper pressure relief valve piping to nearby floor drain
- Installation of condensate neutralizers and all necessary PVC condensate piping
- Installation of fiberglass pipe insulation on all new piping
- Installation of all necessary wiring and electrical for new boilers
- Installation of a 1" port in boiler flue pipes for measurement of stack air velocities
- Meetings with the Inspectors for all Inspections.
- Start-up and tuning of the boilers
- Includes one year workmanship warranty and 12-year limited warranty on boilers

Energy Savings Calculations

Calibrated eQUEST building energy simulation models provide the basis for determining the savings associated with this measure. See Section 6.0 Savings Analysis for details.

> Proposed Savings

The currently estimated annual savings for this measure are the following:

Table 7.6. ECM 2 – Boiler Replacements

ECM Sites	Energy Conservation Measure	Annual Electric Demand Savings (kW)	Annual Electric Energy Savings (kWh)	Annual Electric Savings	Annual Natural Gas Savings (Therms)	Annual Natural Gas Savings	Total Savings	Total Implementation Cost	Estimated Utility Rebate	Simple Payback
2	ECM 2. Boiler Replacements	-10	(6,729)	-$435	15,018	$9,267	$8,832	$522,905	$14,052	53.5

The boiler replacements will result in natural gas cost savings, due to increased full load or part-load boiler efficiency.

It is important to note that these boiler replacements have a simple payback well above the average for the other proposed ECMs. It is included in the package to demonstrate how desirable building improvements that require significant funding can be facilitated by being included in a package of measures with lower payback periods.

Table 7.7. ECM 2 Boiler Replacements for Ameresco's Assigned Portfolio

	Aquatic Facility	Building Resource Innovation Center	Cemetery	City Hall	Community Center	Corporate Yard: Public Works A-D	Corporate Yard: Building 2 (Fleet)	Corporate Yard: Building 3 (Sand Barn)	Corporate Yard: Building 7	Corporate Yard: Building 9	Corporate Yard: Building 11	Corporate Yard: Building 13	Court House Complex	Fire Station 51	Fire Station 52 and Fire Training Building	Fire Station 53	Health and Human Resources	Juvenile Administration Building	Juvenile Annex	Juvenile Detention Center and Juvenile Court	Carson City Library	Senior Center	Sheriff's Administration Building	Sheriff's Dispatch	Mills Park Complex / Marv Teixeira Pavilion	Centennial Park Complex	Pete Livermore Sports Complex	Fairview Drive Street Lighting	MAC
ECM 2. Boiler Replacements																													
Install High-Efficiency Condensing Boilers	X			X																									

ECM 3. Energy Management System Upgrades & Retro-Commissioning

> ECM Summary

The intent of this measure is to repair or replace obsolete controls and make programing and operational adjustments to the existing systems for maximum efficiency. This includes steps to correct and improve existing control sequences and to repair/replace or upgrade control components associated with the current Energy Management System (EMS). Opportunities for improved controls were found for many facets of the air handler operations, including unit scheduling and space temperature setbacks.

Existing Conditions

During the course of the site auditing, a number of HVAC operating inefficiencies were found. These include the following:

- EMS System not upgraded to latest version of Allerton DDC Compass software
- Buildings still using antiquated IBEX controllers
- Buildings still using BACtalk without DDC network connection
- Buildings with no DDC network connection
- Economizer function not maximized
- Building heating and cooling not running on schedules – programmed for 24-hour operation
- Thermostat set points not consistent with City policy

Generally, the air handlers, heating and cooling equipment operate according to facility working hours. A few facilities have varying schedules, with some equipment operating 24 hours-a-day, 7-days-a-week. For example, Carson City Library operates two rooftop packaged units 24-hours-a-day, 7 days-a-week. It is not necessary to run all of these units all day. Figure 7.1 and Table 7.8 show an example of a rooftop air conditioning unit at Carson City Library that is scheduled on the building EMS to operate 16 hours-a-day, but truly operates 24 hours-a-day, 7 days-a-week as indicated by trend data of the same unit. Based on the actual operating hours of Library, all heating/cooling equipment should effectively only run between 11-12 hours Monday – Friday and 10 hours on the weekend.

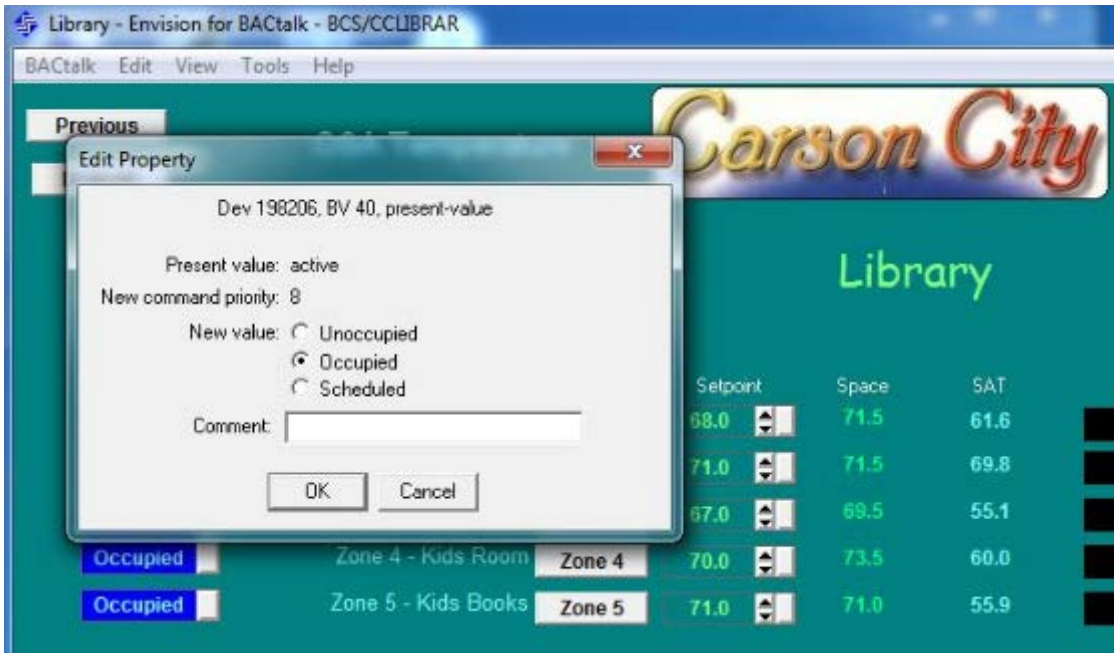


Figure 7.1. AC-6 Schedule at Carson City Library

Table 7.8. Carson City Library AC-6 Fan Status Trend Data

Time	AC-6 Fan Start Stop	Time	AC-6 Fan Start Stop
2/4/2016 0:00	Active	2/4/2016 12:00	Active
2/4/2016 1:00	Active	2/4/2016 13:00	Active
2/4/2016 2:00	Active	2/4/2016 14:00	Active
2/4/2016 3:00	Active	2/4/2016 15:00	Active
2/4/2016 4:00	Active	2/4/2016 16:00	Active
2/4/2016 5:00	Active	2/4/2016 17:00	Active
2/4/2016 6:00	Active	2/4/2016 18:00	Active
2/4/2016 7:00	Active	2/4/2016 19:00	Active
2/4/2016 8:00	Active	2/4/2016 20:00	Active
2/4/2016 9:00	Active	2/4/2016 21:00	Active
2/4/2016 9:58	Active	2/4/2016 22:00	Active
2/4/2016 10:00	Active	2/4/2016 23:00	Active
2/4/2016 11:00	Active	2/5/2016 0:00	Active

Recommended Modifications

The retro-commissioning (RCx) process as recommended by Ameresco is a systematic means of investigating, analyzing and optimizing the building system control sequences to ensure their conformance with the original design intent and the City's operational needs.

It is recommended that these and other issues not listed are addressed in the context of a comprehensive retro-commissioning effort. Most of the issues can be addressed by restoring the

original design intent/function to the existing equipment through controls component repairs, replacements and/or upgrades. Depending on the site, the upgrades may require extensive retrofit and upgrade of the existing control system with new DDC control components, and upgrades to more recent versions of the existing control software. In some cases, optimizing the scheduling of heating and cooling equipment is recommended. This involves reviewing the operating schedule of all equipment, removing overrides of equipment schedules and ensuring that the equipment does not operate when it is not needed. Table 7.10 details a matrix for the measure application to Ameresco's assigned portfolio of buildings.

> Proposed Savings

The proposed savings result from reduced loads, increased part load efficiency and optimized scheduling. This includes electric energy costs and natural gas energy costs savings.

The guaranteed annual savings for this measure are the following:

Table 7.9. ECM 3 – Energy Management System Upgrades & Retro-Commissioning

ECM Sites	Energy Conservation Measure	Annual kW Savings	Annual Electric Energy Savings (kWh)	Annual Electric Savings	Annual Natural Gas Savings (Therms)	Annual Natural Gas Savings	Total Savings	Total Implementation Cost	Estimated Utility Rebate	Simple Payback
14	ECM 3. Energy Management System Upgrades & Retro-Commissioning	411	533,198	$29,946	33,426	$21,022	$50,968	$760,888	$16,522	13.6

The calibrated eQUEST building energy models were used as a baseline for determining the savings associated with this measure. Typical meteorological year (TMY) weather data for the Carson City area was used to estimate the proposed savings while the actual meteorological weather (AMY) data that was used to calibrate each eQUEST model. Individual parametric simulations within eQUEST were used to determine the estimated savings associated with each measure. See Section 6.0 Savings Analysis for details.

Table 7.10. ECM 3. EMS Upgrades & Retro-Commissioning for Ameresco's Assigned Portfolio

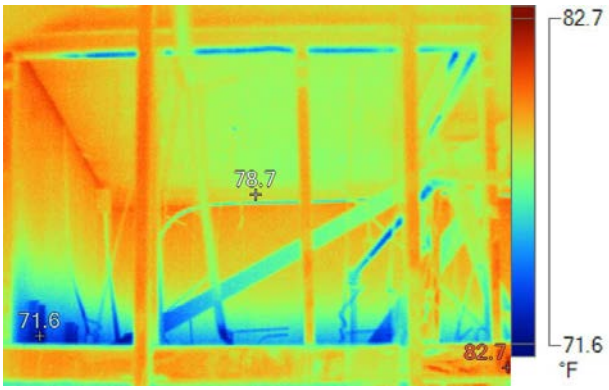
	Aquatic Facility	Building Resource Innovation Center	Cemetery	City Hall	Community Center	Corporate Yard: Public Works A-D	Corporate Yard: Building 2 (Fleet)	Corporate Yard: Building 3 (Sand Barn)	Corporate Yard: Building 7	Corporate Yard: Building 9	Corporate Yard: Building 11	Corporate Yard: Building 13	Court House Complex	Fire Station 51	Fire Station 52 and Fire Training Building	Fire Station 53	Health and Human Resources	Juvenile Administration Building	Juvenile Annex	Juvenile Detention Center and Juvenile Court	Carson City Library	Senior Center	Sheriff's Administration Building	Sheriff's Dispatch	Mills Park Complex / Marv Teixeira Pavilion	Centennial Park Complex	Pete Livermore Sports Complex	Fairview Drive Street Lighting	MAC
ECM 3. Energy Management System Upgrades & Retro-Commissioning																													
3.1. Upgrade Existing IBEX Controllers to BACtalk	X			X										X															
3.2. Global Controller Upgrade and Network Connection	X			X	X								X	X	X	X		X			X			X					
3.3. Upgrade network EMS software	X			X	X								X	X	X	X	X	X			X	X	X	X					
3.4. EMS Front-End Re-Commissioning	X			X	X								X	X	X	X	X	X			X	X	X	X					
3.5. Install DDC EMS Control System and Connect to Citywide Network																													X
3.6. EMS Controls for New Boilers	X			X																									
3.7. EMS Controls for New HVAC				X																									

ECM 4. Building Envelope Measures

> ECM Summary

Air movement in these types of buildings can be very complex due to the numerous entrances and exits, numerous mechanical rooms, stairwells, pipe and vertical chases as well as interconnecting hallways. Some of these factors allow air leakage and energy losses to occur from air gaps in the building envelope. Repairing these air gaps results in improved thermal comfort, increased energy efficiency and better utilization of heating and cooling equipment.

Air leakage inspections were completed utilizing visual inspection techniques that were enhanced by the use of an infra-red thermal imaging camera and air current testers. Ameresco conducted field calibration of the camera immediately prior to starting the daily inspections. The assessment included looking at building exterior facades, roofs, fenestration, exterior doors and all pertinent interior spaces that may allow air leakage from the exterior or may assist air leakage to move to other remote parts of the building. Ameresco was able to identify numerous air leakage paths between the interior and exterior and evaluate the possible air-sealing measures and their effectiveness to limit the uncontrolled air leakage. Weather conditions were documented for the sole purpose of properly evaluating the anomalies that were discovered with the thermal imaging camera. The camera was instrumental in identifying otherwise unidentifiable energy losses. The image to the right demonstrates the varying degrees of temperature between a drop ceiling and roof deck.



City Hall Thermal Image

This ECM is divided into sub-measures that more clearly define the scope of work for each measure, which are summarized below.

Measure 4.1 includes repairing air leakage at building envelope penetrations
Measure 4.2 includes repairing air leakage at building windows
Measure 4.3 includes the installation of weather-stripping at building doors
Measure 4.4 includes the installation of destratification fans

Table 7.12 details a matrix for the measure application to Ameresco's assigned portfolio of buildings.

> ECM 4.1. Air Leakage/Penetrations

Air leakage through the building envelope most often occurs where building envelope elements are connected together. Leakage is typically a result of either improper design or construction, lack of maintenance, or normal degradation over the life of the building.

Existing Conditions

Numerous penetrations were identified in many of the building envelopes. These consisted mainly of cracks or openings at building connection points, holes, pipe/mechanical penetrations and improper venting below the thermal envelope. The images below show an example of a facility area where improper venting below the thermal envelope is occurring, as well as an example where soffit vents in a facility are allowing improper venting in the building envelope.

City Hall Improper Venting

Juvenile Detention Soffit Vents

Recommended Modifications

Openings in the building envelope need to be sealed to reduce air leakage and energy losses. Ameresco proposes to insulate, if appropriate, and seal all identified penetrations and openings with the appropriate polyurethane spray foam product and premium urethanized elastomeric sealants to minimize or eliminate these sources of air leakage. In some instances, the openings in the building envelope are large enough to require drywall or an energy wall (consisting of insulation and drywall) to be constructed.

Proposed Savings

By replacing or repairing degraded or improper barriers and seals, energy savings can be realized due to reduced infiltration and thus, reduced load on the building HVAC equipment.

> ECM 4.2. Air Leakage/Windows

Air leakage around window openings most often occurs through small openings that result from improper design or construction, lack of maintenance, or normal degradation over the life of the building. Air movement is generated by the difference in pressures inside and out.

Existing Conditions

The existing windows on most of the buildings are a double-pane glass that is fairly energy inefficient. The window seals are generally in good condition overall. However, Ameresco observed air leakage between the window frames and the walls in numerous locations and also several areas where seals have failed and need to be resealed. The photos below show examples where numerous windows were found to have damaged, worn or missing areas of gasket seal.

Aquatic Center Windows

Aquatic Center Windows

Recommended Modifications

Window seals should be repaired by caulking windows and frames, as identified using premium urethanized elastomeric sealants to minimize these sources of air leakage. In some locations, the only remedy is to caulk the windows.

Proposed Savings

By replacing or repairing degraded or improper window seals, energy savings can be realized due to reduced infiltration and thus, reduced load on the building HVAC equipment.

> ECM 4.3. Weather-Stripping

Air leakage around and between door openings most often occurs through small openings that result from improper design or construction, lack of maintenance, or normal degradation over the life of the components. Air movement is generated by the difference in pressures inside and out.

Existing Conditions

Existing weather-stripping, including door sweeps, vertical sweeps on exterior doors, and in some locations, overhead doors, are damaged and in disrepair. This allows air infiltration into the space between doors and the frame. Over time this weather-stripping develops gaps due to normal wear and tear. The photos on the following page show examples where daylight can be seen due to worn or damaged door seals.

Community Center Damaged Vertical Sweep

Fire Station 52 damaged Weather-Stripping

Recommended Modifications

Insufficient weather-stripping should be corrected to stop significant amounts of air leakage and energy losses. In some instances, weather-stripping appears to be in good condition but it is still not effective enough to prevent air leakage as it is intended. Weather-stripping, door sweeps and vertical sweeps, as identified, should be repaired or replaced in order to minimize the amount of air leakage.

Proposed Savings

Over time, weather-stripping develops gaps due to normal wear and tear. By replacing worn out weather-stripping, energy savings can be realized due to reduced infiltration and thus, reduced load on the building HVAC equipment.

> ECM 4.7. Destratification Fans

Thermal destratification is the process mixing facilities' internal air to eliminate stratified layers and ultimately achieving temperature equalization. Destratification fans continuously mix the air, balancing temperatures from ceiling to floor which helps HVAC systems maintain desired temperatures. As a result, increased occupant comfort can be expected.

Existing Conditions

Several areas in buildings were identified that would be ideal locations for destratification fan installations. These areas have tall ceilings where warm conditioned air rises and tends to stay at the top of the ceiling spaces instead of where the occupants can benefit from it. Ameresco measured temperature differences greater than four degrees in these areas.

Recommended Modifications

The installation of Thermal Equalizer destratification fans are recommended in building areas where there are tall volume ceilings. Each unit sends a gentle column of air from the ceiling to the floor in an area creating a "Torus Effect". The system blends and normalizes the air within a space maintaining a temperature difference from floor to ceiling between one to three degrees Fahrenheit. The smaller this temperature difference, the more efficiently HVAC systems operate.

Proposed Savings

The Thermal Equalizer destratification fans conserve energy by managing energy loads and optimizing HVAC output resulting in reduced run times and greater efficiency. Additionally, destratification fans deliver a more comfortable even temperature where energy savings of 15 percent to 20 percent on heating and cooling costs can be realized.

> Proposed Savings

Energy savings will result from improving energy losses in building areas where air leakages occur. See Section 6.0 for a description of the building envelope savings calculations.

The guaranteed annual savings for this measure are the following:

Table 7.11. ECM 4. Building Envelope

ECM Sites	Energy Conservation Measure	Annual Electric Energy Savings (kWh)	Annual Electric Savings	Annual Natural Gas Savings (Therms)	Annual Natural Gas Savings	Total Savings	Total Implementation Cost	Estimated Utility Rebate	Simple Payback
6	ECM 4. Building Envelope	88,802	$4,320	12,239	$8,113	$12,433	$183,519	$1,501	13.6

Table 7.12. ECM 4. Building Envelope for Ameresco's Assigned Portfolio

	Aquatic Facility	Building Resource Innovation Center	Cemetery	City Hall	Community Center	Corporate Yard: Public Works A-D	Corporate Yard: Building 2 (Fleet)	Corporate Yard: Building 3 (Sand Barn)	Corporate Yard: Building 7	Corporate Yard: Building 9	Corporate Yard: Building 11	Corporate Yard: Building 13	Court House Complex	Fire Station 51	Fire Station 52 and Fire Training Building	Fire Station 53	Health and Human Resources	Juvenile Administration Building	Juvenile Annex	Juvenile Detention Center and Juvenile Court	Carson City Library	Senior Center	Sheriff's Administration Building	Sheriff's Dispatch	Mills Park Complex / Marv Teixeira Pavilion	Centennial Park Complex	Pete Livermore Sports Complex	Fairview Drive Street Lighting	MAC
ECM 4. Building Envelope																													
4.1. Repair Air Leakage at Building Envelope Penetrations				X	X										X					X									
4.2. Repair Air Leakage at Building Windows	X				X										X														
4.3. Install Weather-Stripping at Building Doors	X			X	X										X					X				X					
4.4. Install Destratification Fans	X																												

ECM 5. City Hall HVAC Retrofit

> ECM Summary

Ameresco proposes to replace the existing multizone air handler and convert it from a constant volume air handling system to a variable air volume (VAV) system. This measure will include the installation of new VAV mixing boxes in the building spaces. The installation of a new air conditioning unit will result in more efficient operating equipment with a decrease in energy consumption. The optimization of the air distribution system and control strategies will result in lower thermal and fan electric energy consumption and power demand. Minimization of mixing cold and warm airstreams and supplying only the needed quantity of air (CFM) to the spaces served achieves occupant comfort during off-peak load periods of time.

Existing Conditions

Historically, Carson City purchased the City Hall building approximately 20 years ago with the original building being constructed in the early 1980's. The building was previously a bank and was remodeled by Carson City. During the remodel, the outside of the building was aesthetically enhanced and the inside of the building was gutted. New departments, offices and walls were added. Unfortunately, upgrading the HVAC equipment was not addressed and ductwork, diffusers, registers, thermostats, etc. were not moved to accommodate the new office layout and wall locations. Thus, existing thermostats are located in areas serving incorrect spaces and causing occupancy discomfort and other problems.

The existing HVAC equipment at City Hall consists of a seven-zone Mammoth multi-zone air handling unit which is original to the building and is located in a mechanical well on the roof. This multi-zone unit has hot water heating coils and DX cooling coils. Hot water is supplied to the heating coils in the multi-zone unit by a Kewanee 990 Mbtu natural gas-fired standard efficiency boiler in the basement and cooling is supplied by a Carrier air cooled condensing unit located on the roof.

Recommended Modifications

Table 7.15 details a matrix for the measure application to Ameresco's assigned portfolio of buildings.

Ameresco recommends replacing the existing 7-zone constant volume penthouse multi-zone unit with a variable volume air conditioning unit with variable frequency drives. The new unit will include 100% outside air economizer capability. Downstream the existing ductwork would be retrofitted to the current office layout. Additionally, Ameresco recommends the new ductwork configuration to include approximately 20 variable air volume zone boxes with hot water reheat coils to accurately control individual zone temperatures. Thermostats will be relocated to correct locations within the building and connected to appropriate variable air volume zone boxes. New Alerton smart EMS controls will be installed to control all areas within the building.

Installation of a new variable volume air conditioning unit with hot water reheat coils will include the following detailed scope of work:

- All design and engineering including correct equipment sizing, blueprints, specifications, inspections, etc., as required by all codes, laws, and jurisdictional authorities.
  - Includes design checks, permit application and approval, etc., by applicable jurisdictional authorities.
- Removal of existing multizone unit and installation of a new variable air volume (VAV) air conditioning unit including 100% outside air capability, compressors, condensing units, etc., in the rooftop mechanical well.
- Installation of twenty new VAV boxes, VAV and air handler piping, VAV and air handler coil kits, ducting, taping, sealing, hangers, seismic restraints, balancing etc., to approximately 20 VAV boxes with hot water reheat coils located throughout the facility.
- Demolition, removal, and proper disposal of the existing HVAC equipment in the rooftop mechanical well and throughout the building including ductwork, insulation, electrical feeds, fittings, and miscellaneous HVAC accessories.
  - Demolition will include the termination of all open ductwork with proper new ductwork with sealing and capping to occur while construction is taking place.
- New HVAC equipment will be properly placed and restrained as recommended by the manufacturer.
- Installation of new ducting between existing ducting and new VAV boxes with hot water reheat coils, and connect to existing distribution system.
- Installation of new electrical disconnects and feeds for new HVAC equipment if required.
- Installation of new DDC controls as required for complete control of the new HVAC equipment.
  - Programming of controls to sequence all HVAC equipment to meet space conditioning design loads, etc.
- Start-up and testing of new mechanical equipment.
- Pre-construction supply and return air reading and post construction air balancing on new system.
- Provide instruction to Carson City maintenance staff in the operation and maintenance of the new system.
- Provide Carson City with project O&M manuals and as built documentation.

Energy Savings Calculations

Calibrated eQUEST building energy simulation models provide the basis for determining the savings associated with this measure. See Section 6.0 Savings Analysis for details.

> Proposed Savings

The currently estimated annual savings for this measure are the following:

Table 7.14. ECM 5. City Hall HVAC Retrofit

ECM Sites	Energy Conservation Measure	Annual Electric Demand Savings (kW)	Annual Electric Energy Savings (kWh)	Annual Electric Savings	Annual Natural Gas Savings (Therms)	Annual Natural Gas Savings	Total Savings	Total Implementation Cost	Estimated Utility Rebate	Simple Payback
1	City Hall HVAC Retrofit	111	98,056	$5,888	4,424	$3,073	$8,961	$619,882	$4,763	Capital Project

The savings for this measure are a result of the reduction in the amount of thermal and electrical fan energy to maintain the space temperatures at setpoint. Savings are also achieved by elimination or minimizing of the amount of mixing (simultaneous heating and cooling) of the heating and cooling airstreams. Savings are also achieved by utilizing new HVAC equipment with an increased energy efficiency ratio (EER) rating.

Although this measure will produce some energy savings, it is predominantly a capital improvement project. It is included in the package to demonstrate how necessary building improvements that require significant funding can be facilitated by being included in a package of measures with lower payback periods.

Table 7.15. ECM 5. City Hall HVAC Retrofit Ameresco's Assigned Portfolio

	Aquatic Facility	Building Resource Innovation Center	Cemetery	City Hall	Community Center	Corporate Yard: Public Works A-D	Corporate Yard: Building 2 (Fleet)	Corporate Yard: Building 3 (Sand Barn)	Corporate Yard: Building 7	Corporate Yard: Building 9	Corporate Yard: Building 11	Corporate Yard: Building 13	Court House Complex	Fire Station 51	Fire Station 52 and Fire Training Building	Fire Station 53	Health and Human Resources	Juvenile Administration Building	Juvenile Annex	Juvenile Detention Center and Juvenile Court	Carson City Library	Senior Center	Sheriff's Administration Building	Sheriff's Dispatch	Mills Park Complex / Marv Teixeira Pavilion	Centennial Park Complex	Pete Livermore Sports Complex	Fairview Drive Street Lighting	MAC
ECM 5. City Hall HVAC Retrofit																													
5.1. Install new VAV AC Supply Unit with Reheat System				X																									

ECM 7. Building Dynamics Analytics Package

> Monitoring and Reporting Module

The Monitoring and Reporting Module consolidates commodity consumption and monthly billing data into a single central repository, reducing the time needed to aggregate and analyze building energy use. Buildings are organized into a hierarchy of groups similar to a computer file system. Figure 7.2 below demonstrates how groups can be organized by facilities, locations, campuses, cities, districts, usage or other customized options to fit Carson City's needs. Figure 7.3 shows how a user can also easily locate and compare buildings searching by group name, address and/or customizable tags.

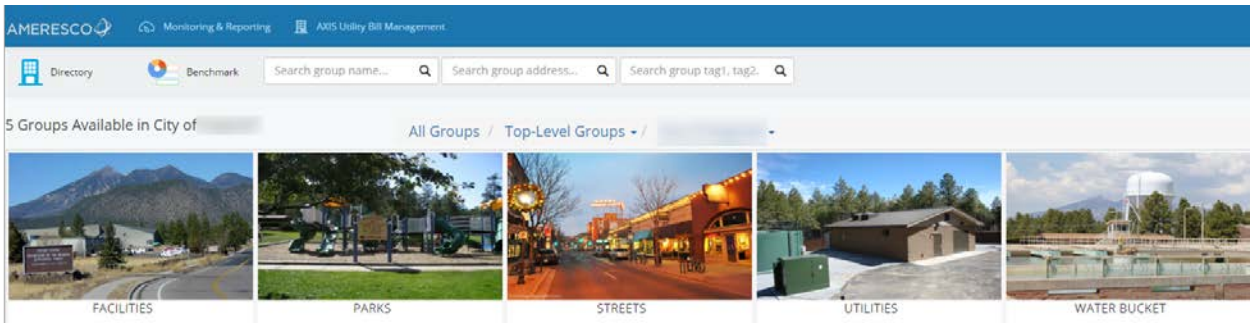


Figure 7.2. Groups Organized by Categories

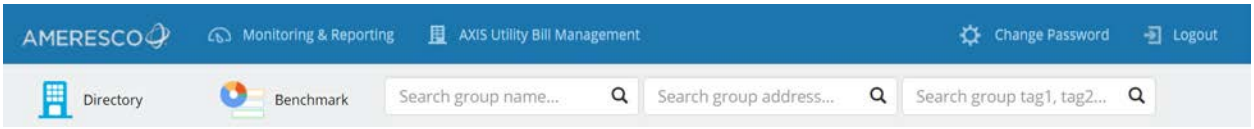


Figure 7.3. Locate and Compare Building Using Searchable Fields

The Monitoring and Reporting Module analyzes commodity consumption across the portfolio using the building level monthly data. The analysis allows benchmarking comparisons across buildings of the same type allowing the user to drill down from the portfolio level down to individual electric and gas meters. See Figure 7.4 for an example energy intensity comparison used to rank the energy performance of each building and identify underperforming buildings in the portfolio.

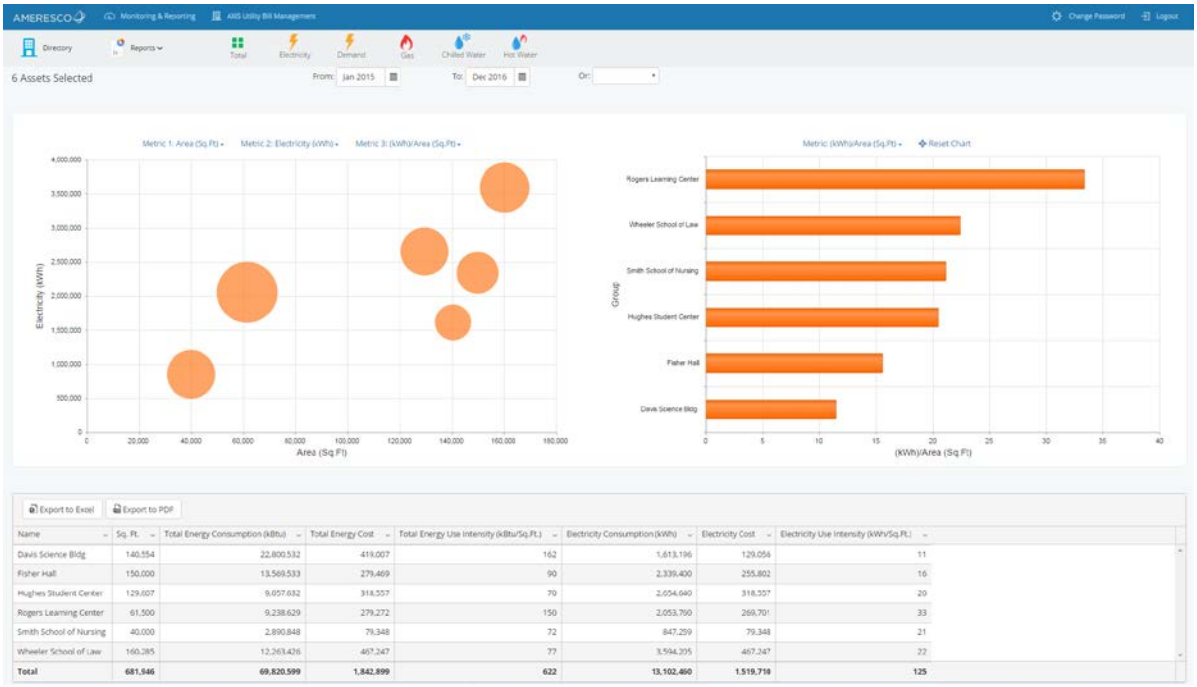


Figure 7.4. Energy Comparison Example

The commodities consumption of each building is individually tracked and displayed on a dedicated commodity summary view. See Figure 7.5 for an example of how commodity usage (electric, gas, water, etc.) is tracked on a dedicated view that also combines usage into BTUs and provides a relative cost comparison with respect to commodity cost and demand charges.

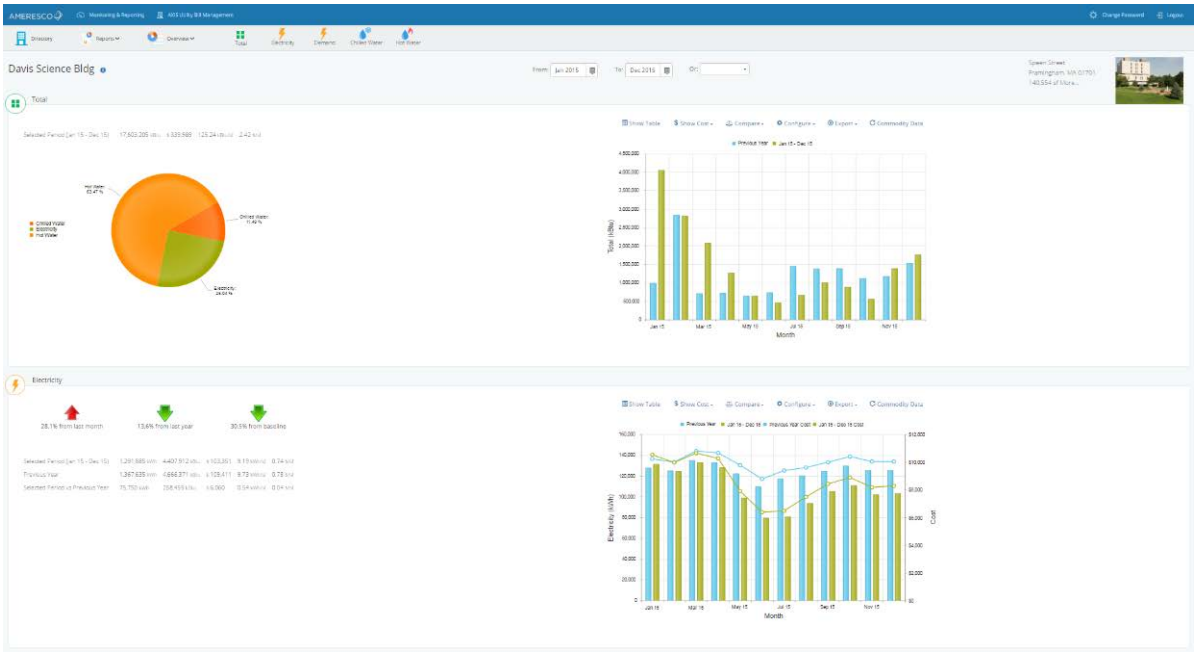


Figure 7.5. Commodity Usage Example

Building performance is tracked against and expected performance curve through the software. The software performs weather normalized comparisons across the building's baseline to track the savings achieved. The software provides access to baseline information and normalized data for a facility or group of facilities. Users can create or update existing baselines, and they can access tables and graphs providing a comparison of energy performance for a selected time period against the baseline. Additionally, the system provides a comparison of the independent variables (e.g., weather) between the currently selected period and the baseline period. Data from individual facilities can be rolled up to track the performance of a portfolio of buildings. All normalized data and graphs can be exported to other software programs. See Figure 7.6 for an example of how performance is tracked. Figure 7.7 demonstrates how goal progress is tracked alongside the weather-normalized baseline.

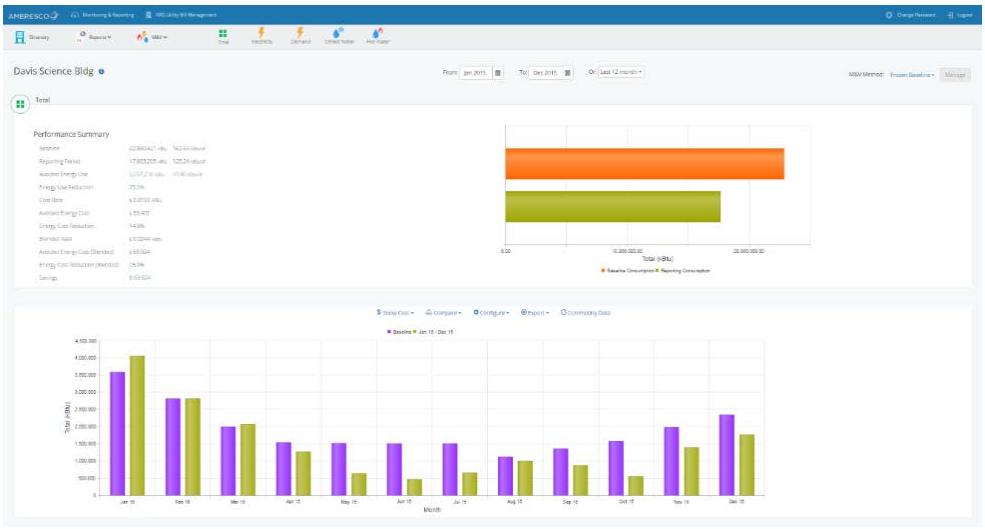


Figure 7.6. Building Performance Tracked On-line

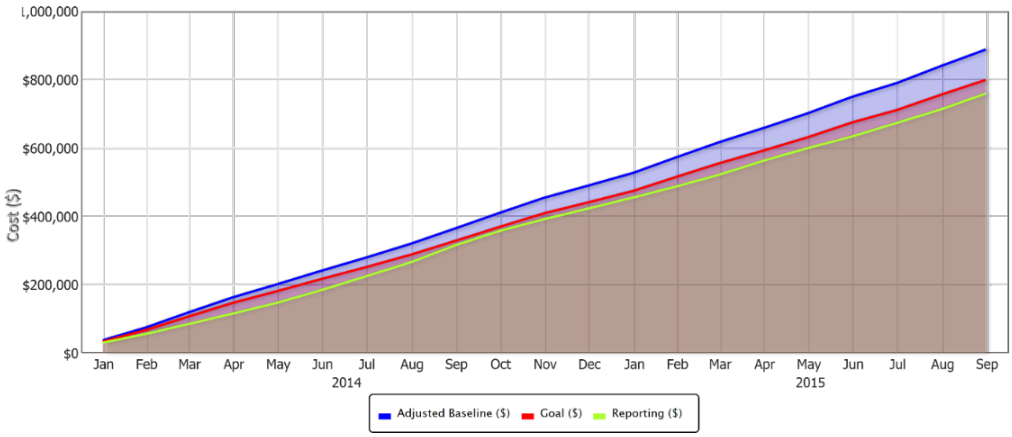


Figure 7.7. Goal Progress Tracking

Table 7.16 represents facility electric and natural gas meters that will be included with Building Dynamics.

Table 7.16. Carson City Facility Electric and Natural Gas Meters

Facility Name	Building Square Footage	Facility Address	Utility Type	Utility Account	Utility Meter
Aquatic Facility	32,498				
		841 N Roop Street	E	75351102955164	200610
		841 N Roop Street	NG	241-0096788-022	03326698
Building Department	10,000				
		108 E Proctor Street	E	38886202887854	AA015802451
		108 E Proctor Street	E	38886204969213	CC031683785
		108 E Proctor Street	NG	241-0078259-024	0L852859
Cemetery	3,000				
		1044 Beverly Drive	E	75351104573783	AA015589653
		1044 Beverly Drive	NG	241-1194212-002	02905980
City Hall	34,097				
		201 N Carson Street	E	39563802955618	AA015604620
		201 N Carson Street	NG	241-00784180-220	06586715
Community Center	43,230				
		851 E William Street	E	75351102955065	202599
		851 E William Street	NG	241-0096793-021	12481512
		851 E William Street	NG	241-0096806-021	5473838
Corporate Yard					
	6,500	3303 Butti Way Fleet	E	35906902905831	AA015597836
		3303 Butti Way Fleet	NG	241-0092825-021	06332252
	19,180	3303 Butti Way #9	E	75351102905854	206484
		3303 Butti Way #9	NG	241-0092839-021	00862058
	1,000	3303 Butti Way #11	E	75351102688567	AA015802242
		3303 Butti Way #11	NG	241-0172122-021	8104312
	12,700	3303 Butti Way #7	E	3464430266680	AA15604661
		3303 Butti Way #7	NG	241-0092788-022	9015627
	6,000	3303 Butti Way #13	E	34644302726447	AA015920937
		3303 Butti Way #13	NG	241-1040258-001	785274
		3303 Butti Way #3	E	34644302772979	AA015920938
Court House	131,772				
		885 E Musser Street	E	35254602669799	199699
		885 E Musser Street	NG	2411138528004	08915810
Fire Station 51	18,074				
		777 S Stewart Street	E	37195902655152	CI265515
		777 S Stewart Street	NG	241-1060228-002	01192535
Fire Station 52	27,769				
		2400 College Parkway	E	3719590277714	CI277714
		2400 College Parkway	NG	241-1157622-002	785591
Fire Station 53	4,367				
		4649 Snyder Avenue	E	37195902921562	CI292156
		4649 Snyder Avenue	NG	241-0043995-022	3573982

Facility Name	Building Square Footage	Facility Address	Utility Type	Utility Account	Utility Meter
Health & Human Resources	25,546				
		900 E Long Street	E	36678502779655	AA015654263
		900 E Long Street	NG	241-1124279-003	07650880
Juvenile Administration	4,196				
		740 S Saliman Rd	E	37119002792400	AA015922691
		740 S Saliman Rd	NG	241-1171207-003	1377863
Juvenile Annex	3,200				
		1539 E 5th Street	E	37119002896862	AA015802240
		1539 E 5th Street	E	34584302896875	AA015655666
		1539 E 5th Street	NG	241-0092084-021	56389519
Juvenile Detention	11,500				
		1545 E 5th Street	E	37119002956328	AA015588309
		1545 E 5th Street	NG	241-0092098-021	07650932
Library	21,024				
		900 N Roop Street	E	37113502955120	AA015604633
		900 N Roop Street	NG	241-0102614-022	5475795
Public Works	34,500				
		3505 Butti Way	E	34584302771185	AA015867989
		3505 Butti Way	NG	241-1105742-002	08922020
		3505 Butti Way	NG	241-1184972-002	2629912
Senior Center	59,341				
		901 Beverly Drive	E	35599502693319	AA015589651
		901 Beverly Drive	NG	241-0110959-021	8916814
Sheriff's Administration	41,026				
		911 E Musser Street	E	35021002955999	AA015589560
		911 E Musser Street	NG	241-1250494-002	07881592
Sheriff's Dispatch	2,948				
		4645 Snyder Avenue	E	3502100279198	AA015597363
Mill's Park / Marv Texeira Pavilion					
		1111 E William Street	E	7535110265498	CC031427426
		800 N Roop Street	E	7535110288152	CC031670222
		1111 E US HWY 50	E	7535110273005	AA015604635
		888 N Saliman Road	NG	241-1041847-001	857707
Centennial Park Complex Lighting					
		5300 Arrowhead Drive	E	75351102917792	AA015920835
		5100 Heritage Way	E	7535110267982	AA015593542
Pete Livermore Sports Complex Lighting					
		1555 Livermore Ln	E	735110265131	AA015597854
		1583 Livermore Ln	E	735110291998	AA015597856
Fairview Street Lighting					
		367 Fairview Drive	E	34644305234209	CC031669439
		1086 Fairview Drive	E	34644305198271	CC031684013
		1875 Fairview Drive	E	34644305244075	BB111486675

Facility Name	Building Square Footage	Facility Address	Utility Type	Utility Account	Utility Meter
MAC	41,500				
		1860 E Russell Way	E	TBD	TBD
		1860 E Russell Way	NG	TBD	TBD

8.0 Measurement and Verification Plan

The long-term success of any comprehensive energy efficiency program depends on the development of an accurate, successful Measurement and Verification (M&V) Plan. The main objective is to develop a cost-effective plan that quantifies and verifies the performance results of the energy conservation measures (ECMs). Ameresco applies industry standard M&V protocols that have been developed in response to the need for reliable and consistent measurement practices.

> Annual Measurement and Verification Reconciliation Report

Ameresco will prepare an annual report, for each year of the contract term, on the anniversary date of the Final Commissioning Report. The annual report will outline the condition(s) of all ECMs implemented. The report will be supplied within 60 calendar days after the annual anniversary of the Final Commissioning Report, and delivery of all utility billing information to Ameresco.

The Annual Report is intended to provide Carson City with a status update of the ECMs installed with respect to their condition, their expectation to provide energy savings and documentation of any ECMs that have been altered in nature or operation. The Annual Report will contain the results of the inspection(s) and measurements including whether the ECMs were observed to be in place, the measured value was consistent, the ECMs were observed to be operating properly, and defining any deficiencies observed during the inspection(s) and measurement process. Carson City will have 30 days to review and accept the report from the date of submittal by Ameresco.

> M&V Procedures

The following reference was used for the development of M&V procedures for this project:

- Efficiency Valuation Organization. International Performance Measurement & Verification Protocol (IPMVP) (September 2010).

The protocols also help to allocate various risks associated with achieving energy cost savings and allowing risk reduction and better risk management. The M&V options description, provided herein, were developed by summarizing the IPMVP and contains excerpts taken from that document. The benefits of the protocols include:

- Defining the role of verification in energy contracts and implementation
- Discussing procedures, with varying levels of accuracy and cost, for verifying:
  - Baseline and project installation conditions and
  - Long-term energy savings performance.

- Providing techniques for calculating "whole-facility" savings, individual technology savings and stipulated savings
- Providing procedures that are consistent, industry accepted, impartial and reliable
- Providing procedures for the investigation and resolution of disagreements related to performance issues

The general approach to determining energy savings in these plans involves comparing the energy use of the retrofitted system before installation of the ECM (baseline) and after installation of the ECM (post-retrofit). In general:

Energy Savings = Baseline Energy Use – Post-Retrofit Energy Use

The IPMVP protocols have defined four M&V options (Options A through D) that meet the needs of a wide range of performance contracts and provide suggested procedures for baseline development and post-retrofit verification. These M&V options are flexible and reflect the considerations previously mentioned. The options are summarized in Table 8.0 on the following page.

Table 8.0. Measurement and Verification Options

M&V Option	How Savings Are Calculated	Typical Applications
Option A: Partially Measured Retrofit Isolation		
Savings are determined by partial field measurement of the energy use of the system(s) to which an ECM was applied; separate from the energy use of the rest of the facility. Measurements may be either short-term or continuous of the error they may introduce. Partial measurement means that some but not all parameter(s) may be stipulated, if the total impact of possible stipulation error(s) is not significant to the resultant savings. Careful review of ECM design and installation will ensure that stipulated values fairly represent the probable actual value. Stipulations should be shown in the M&V Plan along with analysis of the significance of the error they may introduce.	Engineering calculations using short-term or continuous post-retrofit measurements and stipulations.	Lighting retrofit where power draw is measured periodically. Operating hours of the lights are stipulated.
Option B: Retrofit Isolation		
Savings are determined by field measurement of the energy use of the systems to which the ECM was applied; separate from the energy use of the rest of the facility. Short-term or continuous measurements are taken throughout the post-retrofit period.	Engineering calculations using short-term or continuous measurements	Application of controls to vary the load on a constant speed pump using a variable speed drive. Electricity use is measured by a kWh meter installed on the electrical supply to the pump motor. In the base year, this meter is in place for a week to verify constant loading. The meter is in place throughout the post-retrofit period to track variations in energy use.
Option C: Whole Facility (Bill Comparison)		
Savings are determined by measuring energy use at the whole facility level. Short-term or continuous measurements are taken throughout the post-retrofit period.	Analysis of whole facility utility meter or sub-meter data using techniques from simple comparison to regression analysis.	Multifaceted energy management program affecting many systems in a building. Energy use is measured by the gas and electric utility meters for a 12-month base year period and throughout the post-retrofit period.
Option D: Calibrated Simulation (Calibrated Building Modeling)		
Savings are determined through simulation of the energy use of components or the whole facility. Simulation routines must be demonstrated to adequately model actual energy performance measured in the facility. This option usually requires considerable skill in calibrated simulation.	Energy use simulation, calibrated with hourly or monthly utility billing data and/or end-use metering.	Multifaceted energy management program affecting many systems in a building, but where no base year data are available. Post-retrofit period energy use is measured by the gas and electric utility meters. Base year energy use is determined by simulation using a model calibrated by the post-retrofit period utility data.

> Utility Rates

The utility rates used for determining energy savings are provided in Tables 8.1 and 8.2. The rates will be escalated at a rate of 2.944% over the prior year for each year of the measurement and verification period.

Table 8.1. NV Energy Electric Energy Utility Rates

Rate Schedule	Demand Charge ($/kW-month)	Facilities Charge ($/kW-month)	Energy Rate ($/kWh/month)	Notes
GS-1	$0.00	$0.00	$0.07434	
GS-2	$4.04	$6.10	$ 0.04864	
OGS-1 TOU	$0.00	$0.00	$0.37576 $0.17873 $0.04196 $0.06031 $0.04196	Summer On-Peak Summer Mid-Peak Summer Off-Peak Winter On-Peak Winter Off-Peak
OGS-2 TOU	$7.90 $4.05 $0.00 $1.24 $1.20 $0.00	$6.09	$0.10588 $0.06712 $0.04328 $0.04810 $0.04230 $0.03808	Summer On-Peak Summer Mid-Peak Summer Off-Peak Winter On-Peak Winter Mid-Peak Winter Off-Peak

Note – Rates were based on 4/6/16 NV Energy Statement of Rates

Natural gas is supplied by Southwest Gas and charged according the SG-G1, SG-G2 and SG-G3 rates depending on maximum annual consumption. A summary of the rates is provided in Table 8.2.

Table 8.2. Natural Gas Utility Rates

Rate Schedule	Rate	Billing Unit
NG-G1	$0.90858	therm
NG-G2	$0.69451	therm
NG-G3	$0.59285	therm

Operations and maintenance savings of $15,189 are stipulated and will be escalated 3.0% per year.

Energy savings are stipulated to be the same as those in the most recently prepared measurement and verification report in years where no measurement and verification report is prepared.

> Summary of Guaranteed Energy Savings

The guaranteed energy savings for each of the recommended energy conservation measures are identified in Table 8.3.

Table 8.3. Financial Grade Operational Audit Savings Summary

ECM No.	Energy Conservation Measure	Annual Electric Demand Savings (kW)	Annual Electric Energy Savings (kWh)	Annual Electric Savings ($)	Annual Natural Gas Savings (Therms)	Annual Natural Gas Savings ($)	Operations & Maintenance Savings ($)	Total Savings ($)
1	Interior & Exterior Lighting Retrofits	3,189	1,325,714	$97,076	-	-	$15,189	$112,265
2	Boiler Replacements	(10)	(6,729)	($435)	15,018	$9,267	-	$8,832
3	Energy Management System Upgrades & Retro-Commissioning	411	533,198	$29,946	33,426	$21,022	-	$50,968
4	Building Envelope	-	88,802	$4,320	12,239	$8,113	-	$12,433
5	City Hall HVAC Retrofit	111	98,056	$5,888	4,424	$3,073	-	$8,961
7	Building Dynamics	-	-	-	-	-	-	-
	Total:	**3,700**	**2,039,040**	**$136,795**	**65,108**	**$41,474**	**$15,189**	**$193,459**

Table 8.4 provides a summary of the proposed M&V plans for the project. Detailed description of the plan for each ECM subsequently follows. The results of the M&V services will be reported to Carson City on an annual basis. All specific protocols in the plans must be explained to and accepted by Carson City before construction on the project can begin. If Carson City does not agree with the protocols used to verify the savings, there is potential for significant disagreement once verification efforts begin.

Generally, the M&V approach utilized is Option A. For ECMs that include modifications to the mechanical or HVAC systems, the M&V approach utilizes calibrated baseline building and plant models created during the Financial Grade Operational Audit (FGOA) to provide the baseline operating data. The same buildings modeled during the FGOA will be the buildings sampled via EMS trends during post-retrofit M&V. This will allow a valid performance comparison to be made with the baseline operating data available from the baseline models.

This page is intentionally left blank.

Table 8.4. Measurement and Verification Summary Matrix

Energy Conservation Measure	IPMVP Option	Baseline M&V Requirements	Post Retrofit M&V Requirements	Measurement and Metering	Stipulated Variables	Performance Period M&V Requirements
ECM 1. Interior & Exterior Lighting Retrofits	A	Measurement of input power of select existing light fixtures. Measurement of run hours of select existing light fixtures. Document baseline HVAC load from ECM 1 baseline lighting spreadsheet model.	Measurement of input power of select new light fixtures.	Spot measurements of power consumption on select light fixtures. Short-term metering of select fixtures run hours. Number of selected fixtures must be statistically significant.	Baseline and post-retrofit fixture power draw. Baseline and post-retrofit fixture run hours. Post-Retrofit HVAC load from ECM 1 lighting spreadsheets.	Annual inspection on a percentage of retrofitted light fixtures.
ECM 2. Boiler Replacement	A	Measurement of combustion efficiency. Document baseline building operating parameters from the ECM 2 baseline model. See detailed description for parameter list.	Measurement of combustion efficiency. EMS trending of boiler load and boiler electric demand. See detailed description for parameter list.	Measurement of combustion efficiency. Configure EMS for 15-minute trending and monthly archiving of selected equipment parameters.	Modeled baseline parameter values, and measure isolation parameters. See detailed description for parameter list.	Annual sample inspection of modified components. Bin-analysis calculation of energy savings. See detailed description for calculation procedure.
ECM 3. Energy Management System Upgrades & Retro-Commissioning	A	Document baseline building operating parameters from the ECM 3 baseline model. See detailed description for parameter list.	EMS trending of specified parameters. See detailed description for parameter list.	Configure EMS for 15-minute trending and monthly archiving of selected equipment parameters.	Modeled baseline parameter values, and measure isolation parameters. See detailed description for parameter list.	Annual inspection of installed systems to identify ability to maintain persistence of savings.
ECM 4. Building Envelope	S	Document baseline building envelope operating parameters from the ECM 4 baseline model.	Visual inspection and documentation (photographs) of building envelope improvements.	None	Document post-retrofit building envelope operating parameters from the ECM 4 parametric model.	Annual inspection of installed systems to identify ability to maintain persistence of savings.
ECM 5. City Hall HVAC Retrofit	A	Measurement of AHU motor fan power. Document baseline AHU operating parameters from the ECM 5 calibrated baseline model. See detailed description for parameter list.	EMS trending of AHU operation parameters. See detailed description for parameter list.	Measurement of AHU motor fan power through the variable speed drive. Configure EMS for 15-minute trending and monthly archiving of selected equipment parameters.	Modeled baseline parameter values, and measure isolation parameters. See detailed description for parameter list.	Annual sample inspection of modified components and review of the trend logs from the energy management to verify proper operation. Bin-analysis calculation of energy savings. See detailed description for calculation procedure.
ECM 7. Building Dynamics	N/A	None. There are no savings associated with this measure.	None	None	None	None

This page is intentionally left blank.

ECM 1.1. Interior Lighting Retrofits

> ECM Summary

Ameresco proposes to retrofit selected existing interior lighting systems with new high efficiency LED lamps and controls. Retrofitting the existing fixtures with new LED lamps will reduce peak demand and electricity consumption.

> M&V Summary

The M&V protocol for this measure is based on IPMVP Option A. Option A includes engineering calculations with one-time representative measured values, resulting in measured verification of performance. With the chosen method, hours of operation are agreed to prior to the installation. Post-installation fixture wattages will be determined from one-time, spot measurements of representative fixture types.

Under this measurement plan, Ameresco assumes performance risk for the operation of the new fixtures. Ameresco will perform equipment measurements to verify that the performance of the installed equipment will operate at the levels defined in the FGOA (power output at stated conditions). This will be established by measuring a percentage of fixtures (either individual fixtures or on a given lighting circuit) of the same lamp/ballast combination. If the lighting systems do not perform as proposed, a reconciliation will be provided per the terms of the Energy Services Agreement. For the site operating hours, Ameresco has no control over the hours of operation of the facility and cannot be reasonably requested to assume the risk for this variable. Therefore, the City and Ameresco will agree to the run hours for the life of the contract as shown for the existing and proposed hour codes identified in Appendix H.

ECM Assumptions for M&V

The M&V plan for ECM 1.1 Interior Lighting Retrofits assumes that both the baseline and post-retrofit operating hours are as established under the existing and upgraded hours identified in the lighting hour analysis provided in Appendix D. This assumption is supported by logged baseline operating hours for a sample of the spaces during the audit.

Cooling savings and heating penalty from the lighting retrofit will be verified through the lamp/ballast electricity reduction. The cooling benefit and heating penalty were derived from the HVAC savings calculations provided in Appendix G. The impact of lighting on HVAC is provided in the HVAC/Lighting Impact Table which estimates the impact based on HDDs and CDDs utilizing a degree day cooling or heating savings or penalty factor.

> Metering Plan: Interior Lighting Retrofit

Pre-Installation

During the audit, Ameresco installed data collection devices to survey room occupancy and lighting fixture operating hours. The occupancy data and a summary of the annual lighting system operating hours (based on room occupancy) is provided in Appendix D. Prior to construction, Ameresco will conduct pre-installation kW measurements on a sample of the existing fixtures based on FEMP methodology described in Appendix B, Sampling Guidelines in the FEMP M&V Guidelines (V 3.0, 2008 Appendix B, Appendix G [cf V 2.2, 2000, Appendix D]). The number of samples will consist of the quantity required to achieve 80 percent confidence, with 20 percent precision and an assumed coefficient of variation of 0.2. The population will include fixtures which represent a minimum of 70 percent of the total retrofits savings.

Post-Installation

Ameresco will conduct post installation M&V demand measurements on the lamp and ballast groups which make up at least 75 percent of the kW savings as shown in the Project Specific M&V Plan Criteria.

Achieving the 75 percent kW savings by lamp and ballast group value will take priority over any individual facility value. This means that 75 percent of the kW savings will be represented by the measured groups for the retrofit over the entire portfolio of buildings included in the ECM.

Annual Inspection

Ameresco will perform a yearly site inspection of ECM 1.1. The observations during this inspection will be made part of the Annual Reconciliation Report. No long-term monitoring or inspections are included as part of ECM 1.1.

Energy Savings Calculation Methodology

The initial M&V report will include a calculation of the savings based on the pre- and post-installation measurements and the stipulated run hours. The energy savings will be calculated as follows:

$$Savings = LightingSavings - Heat + Cool$$

$$LightingSavings = DemandSavings + EnergySavings$$

$$DemandSavings = BaselineDemand - PostDemand$$

$$EnergySavings = BaselineEnergy - PostEnergy$$

$$BaselineDemand = \sum_{buildings} \sum_{fixtures} \left(kW_{Base} \times Months \times {}^{\$}/_{kW} \right)$$

$$PostDemand = \sum_{buildings} \sum_{fixtures} \left(kW_{retro} \times Months \times {}^{\$}/_{kW} \right)$$

$$BaselineEnergy = \sum_{buildings} \sum_{fixtures} \left(kW_{Base} \times Hrs_{Base} \times {}^{\$}/_{kWh} \right)$$

$$PostEnergy = \sum_{buildings} \sum_{fixtures} \left(kW_{\mathrm{Re}tro} \times Hrs_{Base} + {}^{\$}/_{kWh} \right)$$

Where:

kW_{Base}	=	Baseline fixture kW
kW_{Retro}	=	Post-retrofit fixture kW
Hrs	=	Baseline fixture operating hours
$/kW	=	Unit cost of electric demand, per baseline
$/kWh	=	Unit cost of electric energy, per baseline

Performance Period Activities and Reporting

Ameresco will conduct an annual inspection of statistically significant sample of the installed fixtures based on the IPMVP 80/20 table. In this inspection, Ameresco will verify the continued operation of the installed fixtures. The inspection results will be a part of the Annual M&V Reconciliation Report, along with a summary of services provided under the operations and maintenance contract associated with this measure.

> Metering Plan: Interior Lighting Controls

Interior lighting controls are included within the ECM 1.1 scope. The M&V protocol for interior lighting controls is based on the recommendations of IPMVP Option A. Option A includes engineering calculations with one-time representative measured values, resulting in a quantified confirmation of energy/resource savings. Under this M&V Plan, fixture wattages will be determined from the one-time, spot measurements obtained for ECM 1. Baseline operating hours of the fixtures will be stipulated, but post-retrofit operating hours will be verified with short-term data collection. There will be no demand savings associated with the interior lighting controls.

Cooling savings and heating penalty from lighting retrofit will be verified through the kWh electricity reduction also. As with ECM 1, the ventilation rates, cooling/heating periods and cooling/heating equipment efficiencies will be stipulated.

Metering Plan

Power consumption measurements of the fixtures are determined by ECM 1. The fixture wattage used will be the wattage after lamp/ballast retrofit to avoid duplication. Fixtures run hours after lighting controls installation will be trended with short-term loggers.

Annual Inspection

As part of the services provided under the measurement and verification agreement, Ameresco will conduct an annual inspection of a statistically significant number of lighting control devices to ensure the equipment is correctly installed, properly maintained and operating per the intention of the measure. The observations made during the inspection will be documented in the Annual Reconciliation Report.

Energy Savings Calculation Methodology

$$Savings = EnergySavings - Heat + Cool$$

$$EnergySavings = BaselineEnergy - PostEnergy$$

$$BaselineEnergy = \sum_{buildings} \sum_{fixtures} \left(kW_{Retro} \times Hrs_{Base} \times {\$}/{kWh} \right)$$

$$PostEnergy = \sum_{buildings} \sum_{fixtures} \left(kW_{Retro} \times Hrs_{Retro} + {\$}/{kWh} \right)$$

Where:

kWBase	=	Baseline fixture kW
kWRetro	=	Post-retrofit fixture kW
HrsBase	=	Baseline fixture operating hours
HrsRetro	=	Post-retrofit fixture operating hours
$/kW	=	Unit cost of electric demand, per baseline
$/kWh	=	Unit cost of electric energy, per baseline

ECM 1.2. Exterior Lighting Retrofits

> ECM Summary

The intent of this upgrade is to replace the existing building-mounted and pole mounted area lighting as shown in the recommended modifications below. The exterior building-mount lighting scope includes wall-mount fixtures, flood fixtures, surface-mount fixtures and recessed cans. Site lighting and parking lot lighting consist of bollards, pole lighting (shoeboxes, floods and post tops).

> M&V Summary

The M&V protocol for these measures is based on IPMVP Option A. Option A includes engineering calculations with one-time representative measured values, resulting in measured verification of performance. With the chosen method, hours of operation are agreed to. Post-installation fixture wattages will be determined from one-time after spot measurements of representative fixture types.

Under this measurement plan, Ameresco assumes performance risk for the operation of the new fixtures. We will perform equipment measurements to verify that the performance of the installed equipment will operate at the levels defined in the FGOA (power output at stated conditions). This will be established by measuring a percentage of fixtures (either individual fixtures or on a given lighting circuit) of the same lamp/ballast combination. If the lighting systems do not perform as proposed, a reconciliation will be provided according to the terms of the Energy Services Agreement. For the site operating hours, Ameresco has no control over the hours of operation of the facility and cannot be reasonably requested to assume the risk for this variable. Therefore, the customer and Ameresco will agree to the run hours for the life of the contract as shown for the existing and proposed hour codes identified in Appendix H.

ECM Assumptions for M&V

The M&V plan for ECM 1.2 Exterior Lighting Retrofit assumes that both the baseline and post-retrofit operating hours are equal to those shown in the Appendix H.

> Metering Plan

Pre-Installation

During the facility audits, Ameresco observed exterior lighting schedules were programed into the control systems and regulated by manual time-clocks. A summary of the annual operating hours for exterior lighting are shown in the Appendix D.

Ameresco will conduct pre-installation kW measurements on a sample of the existing fixtures based on FEMP methodology described in Appendix B, Sampling Guidelines in the FEMP M&V Guidelines (V 3.0, 2008 Appendix B, Appendix G [cf V 2.2, 2000, Appendix D]). The number of samples will be the quantity required to achieve 80 percent confidence, with 20 percent precision and an assumed coefficient of

variation of 0.2. The population will include fixtures which represent a minimum of 75 percent of the total retrofits savings.

Post-Installation

Ameresco will conduct post installation M&V demand measurements on the lamp and ballast groups which make up at least 75 percent of the kW savings.

Achieving the 75 percent kW savings by lamp and ballast group value will take priority over any individual facility value. This means that 75 percent of the kW savings will be represented by the measured groups for the retrofit over the entire portfolio of buildings included in the ECM.

Annual Inspection

Ameresco will perform a yearly site inspection of ECM 1.2. The observations during this inspection will be made part of the Annual Reconciliation Report. No long-term monitoring or inspections are included as part of ECM 1.2.

> Performance Period Activities and Reporting

Ameresco will conduct an annual inspection of statistically significant sample of the installed fixtures based on the IPMVP 80/20 table. In this inspection, Ameresco will verify the continued operation of the installed fixtures. The inspection results will be a part of the Annual M&V Reconciliation Report, along with a summary of services provided under the operations and maintenance contract associated with this measure.

Energy Savings Calculation Methodology

The initial M&V report will include a calculation of the savings based on the pre- and post-installation measurements, and the stipulated run hours. The energy savings will be calculated as follows:

$$Savings = LightingSavings - Heat + Cool$$

$$LightingSavings = DemandSavings + EnergySavings$$

$$DemandSavings = BaselineDemand - PostDemand$$

$$EnergySavings = BaselineEnergy - PostEnergy$$

$$BaselineDemand = \sum_{buildings} \sum_{fixtures} \left(kW_{Base} \times Months \times {}^{\$}/_{kW} \right)$$

$$PostDemand = \sum_{buildings} \sum_{fixtures} \left(kW_{retro} \times Months \times {}^{\$}/_{kW} \right)$$

$$BaselineEnergy = \sum_{buildings} \sum_{fixtures} \left(kW_{Base} \times Hrs_{Base} \times {}^{\$}/_{kWh} \right)$$

$$PostEnergy = \sum_{buildings} \sum_{fixtures} \left(kW_{\mathrm{Re}tro} \times Hrs_{Post} + {}^{\$}/_{kWh} \right)$$

Where:

kW_{Base}	=	Baseline fixture kW
kW_{Retro}	=	Post-retrofit fixture kW
Hrs	=	Baseline fixture operating hours
$/kW	=	Unit cost of electric demand, per baseline
$/kWh	=	Unit cost of electric energy, per baseline

ECM 2. Boiler Replacement

> ECM Summary

The intent of this measure is to replace the existing boilers at the Aquatic Facility and City Hall with new, multiple-staged, high efficiency condensing boilers. Replacing this equipment as a part of this project will result in avoided future capital costs, energy cost savings and improved comfort.

> M&V Summary

The M&V protocol for this measure is based on IPMVP Option A. Option A includes engineering calculations of energy consumption of modified systems based on both measurement and stipulation of system input variables. Stipulated input variables are chosen to account and correct for interaction with concurrent implemented measures.

Under this measurement plan, Ameresco assumes performance risk for modified system components and their associated sequences of operation. Ameresco will perform equipment measurements and implement energy management system trends to verify that the performance of the installed equipment will operate per the measure descriptions. If the installed systems do not perform as proposed, a reconciliation will be provided per the terms of the Energy Services Agreement.

For boiler energy savings, electric energy consumption and natural gas savings will be based on stipulated pre-retrofit values from the calibrated energy models, pre- and post-measured boiler efficiency, and stipulated operating hours.

The calculated energy savings will be normalized to account for weather variations between the weather file used for the stipulated baseline consumption and weather concurrent to the evaluation period.

ECM Assumptions for M&V

The M&V Plan for this ECM assumes that both the baseline and post-retrofit operating hours and heating loads are equal.

> Metering Plan

Pre-Installation

All pre-retrofit baseline performance parameters are defined by the building energy simulation model. Output parameters from the model used to define the baseline performance for this measure include the following:

A. Hourly boiler load (Btuh)
B. Hourly boiler fuel consumption
C. Hourly outdoor air temperature

Parameter A will be further defined as functions of parameter C (i.e., A_{pre}(OAT) = baseline boiler load) for use in bin analysis.

Parameter B will be further defined as functions of the pre-retrofit combustion efficiency and parameter A (i.e., B_{pre}(Hourly boiler load) = baseline boiler fuel consumption) for use in bin analysis.

The boiler electrical energy use is considered negligible and is stipulated by the building energy simulation model.

Post-Installation

The following post-retrofit performance parameters are defined by EMS trend data (15-minute interval) and the ECM 2 parametric energy model:

D. Boiler Load (trend data)

E. Boiler Efficiency (post-retrofit combustion test and trend data)

Parameter B will be further defined as functions of the post-retrofit combustion efficiency and parameter A (i.e., B_{POST}(Hourly boiler load) for use in bin analysis.

Annual Inspection

As part of the services provided under the measurement and verification agreement, Ameresco will conduct an annual inspection of the boiler system to ensure the equipment is correctly installed, properly maintained and operating per the intention of the measure. The observations made during the inspection will be documented in the Annual Reconciliation Report.

> Performance Period Activities and Reporting

As part of the monitoring services under this agreement, Ameresco will require continuing access to Carson City's energy management system for the purpose of initiating and intermittent download of data trends for the post-installation parameters defined above. Carson City will be required to maintain the trends established by Ameresco for the purposes of measurement and verification. Additional associated parameters, not used in the measured savings calculation, may also be trended for diagnostic purposes. Ameresco will periodically download and archive the data off-site throughout the evaluation period of each evaluation year.

Carson City will be required to maintain the trends established by Ameresco for the purposes of measurement and verification. In addition, Carson City will be required to notify Ameresco of any prolonged EMS outages that may result in trend data loss.

Energy Savings Calculation Methodology

The post retrofit energy savings will be calculated using a modified bin analysis method. Weather bins based on the base model weather file, with a maximum of three-degree weather bins will be compiled. The weather bins will be segregated into on-and off-peak hours. For both the pre-implemenation and

post-retrofit conditions, the base model weather bins will be used to normalize the energy savings calculations relative to weather.

For each weather bin, boiler energy consumption will be calculated on a pre- and post-retrofit basis using the following equations:

Pre Boiler (therms) D: = Bpre(Apre(OAT)) x bin hours

Post Boiler (therms) F: = Bpost(Apre(OAT)) x bin hours

The energy savings will be the following:

Annual Energy Savings = D-F

> Metering Plan

Pre- and post-boiler combustion efficiency measurements will be provided by Ameresco. EMS trend logs will be configured to capture all applicable parameters needed for M&V purposes. The post retrofit combustion tests will be only performed at the time of commissioning and will be stipulated from that time throughout the M&V term.

ECM 3. Energy Management System Upgrades & Retro-Commissioning

> ECM Summary

Ameresco proposes to make significant upgrades the City's energy management systems. These improvements include the upgrade of obsolete Alerton IBEX controllers to BACtalk, global controller upgrades, EMS software upgrades, front-end re-commissioning, installation of the EMS to the citywide network and the installation of new controls on the proposed boiler systems.

> M&V Summary

The M&V protocol for this measure is based on IPMVP Option A. Option A includes engineering calculations of energy consumption of modified systems based on both measurement and stipulation of system input variables. Stipulated input variables are chosen to account and correct for interaction with concurrent implemented measures.

Under this measurement plan, Ameresco assumes performance risk for modified system components and their associated sequences of operation. Ameresco will perform equipment measurements and implement energy management system trends to verify that the performance of the installed equipment will operate according to the measure descriptions. If the installed systems do not perform as proposed, a reconciliation will be provided per the terms of the Energy Services Agreement.

Due to the complexity of the interactions within this measure, the Option A approach relies heavily on both the baseline and proposed energy models to document the measure savings. Building HVAC end-use energy consumption will be defined as functions of outside air temperature based on modeled hourly data for both baseline and proposed conditions. The largest portion of the energy savings for this measure are from setpoint and schedule adjustments. Therefore, the baseline bin-analysis hours will be based on the ECM 3 baseline, while the post-installation bin-analysis hours will be based on post-installation EMS trends.

The calculated energy savings will be normalized to account for weather variations between the weather file used for the stipulated baseline consumption and weather concurrent to the evaluation period.

ECM Assumptions for M&V

For ECM 3 the baseline energy model is based upon the previous parametric ECM model as indicated in the calibrated eQUEST model. The M&V approach also stipulates for performance purposes that the AHU and zone temperature setback control sequences perform as indicated in the ECM 3 parametric model, subject to operational verification in the course of the annual M&V inspections.

> Metering Plan

Pre-Installation

All pre-retrofit baseline performance parameters are defined by the preceding building energy simulation model. Output parameters from the model used to define the baseline performance for this measure include the following:

End-Use Electric Energy Demand (Hourly)

A. Space Cooling

B. Heat Rejection

C. Pumps & Auxiliary Systems

D. Ventilation Fans

End-Use Natural Gas Demand (Hourly)

E. Space Heating

Outdoor Air Temperature (Hourly)

F. Outdoor Air Temperature

The sum of Parameters A, B, C, and D will be further defined as Parameter F as follows:

G. Total HVAC Demand, G = A+B+C+D

Parameters G and E will further be defined as functions of parameter F (i.e. E(OAT) = Space Heating Natural Gas Demand) for use in bin analysis.

Baseline BIN-Analysis hours are defined as all hours where:

Parameter D > 0

Post-Installation

Post-retrofit performance parameters are defined by the building energy simulation model for ECM 3, and EMS trend data (15-minute interval) as follows:

From ECM 3 Energy Model:

End-Use Electric Energy Demand (Hourly)

A. Space Cooling

B. Heat Rejection

C. Pumps & Auxiliary Systems

D. Ventilation Fans

End-Use Natural Gas Demand (Hourly)

E. Space Heating

Outdoor Air Temperature (Hourly)

F. Outdoor Air Temperature

The sum of Parameters A, B, C, and D will be further defined as Parameter F as follows:

G. Total HVAC Demand, G = A+B+C+D

Parameters G and E will further be defined as functions of parameter F (i.e., E(OAT) = Space Heating Natural Gas Demand) for use in bin analysis.

From EMS Trends (15-Minute)

Proposed BIN-Analysis hours are defined as all hours where:

Fan Status Hours = “1” or “On”

> Performance Period Activities and Reporting

As part of the monitoring services under this agreement, Ameresco will require continuing access to Carson City’s energy management system for the purpose of initiating and intermittent download of data trends for the post-installation parameters defined above. Carson City will be required to maintain the trends established by Ameresco for the purposes of measurement and verification. Additional associated parameters, not used in the measured savings calculation, may also be trended for diagnostic

purposes. Ameresco will periodically download and archive the data off-site throughout the evaluation period.

Carson City will be required to maintain the trends established by Ameresco for the purposes of measurement and verification. In addition, the city will be required to notify Ameresco of any prolonged EMS outages that may result in trend data loss.

Annual Inspection

Ameresco will conduct an annual inspection of this measure at a statistically significant sample of the sites based on the IPMVP 80/20 table. In this inspection, Ameresco will verify the continued operation of this ECM. For ECM 3 this will include operational trend analysis of the following sample EMS points to confirm control sequence function. The EMS points may vary as appropriate for each location.

1. Outside Air Temperature
2. HVAC Schedule
3. Zone Cooling Temperature Setpoint – Occupied
4. Zone Cooling Temperature Setpoint – Unoccupied
5. Zone Heating Temperature Setpoint – Occupied
6. Zone Heating Temperature Setpoint – Unoccupied
7. Pump VFD Speed
8. Fan VFD Speed
9. Static Pressure Setpoint
10. Boiler Pump Status
11. Boiler Status
12. Heating Supply Temperature
13. Heating Return Temperature
14. Cooling Pump Status
15. Cooling Status
16. Cooling Supply Temperature
17. Cooling Return Temperature
18. Discharge Air Temperature
19. Mixed Air Temperature
20. Return Air Temperature
21. Supply Air Temperature
22. Supply Fan Status
23. Building Static Pressure
24. Building Humidity

The inspection results will be a part of the Annual M&V Reconciliation Report. In addition, Ameresco will calculate measured energy savings based on the Pre- and Post-Installation metered data as follows:

Savings Analysis

The energy savings will be calculated using a modified bin analysis method. Weather bins based on the base model weather file, with a maximum of three-degree weather bins will be compiled. For both the pre-retrofit and post-retrofit conditions, the base model weather bins will be used in order to normalize the energy savings calculations relative to weather.

For each weather bin, total energy consumption will be calculated on a pre- and post-retrofit basis using the following equations

Pre-Retrofit Electric Energy Consumption, H = F(OAT) x bin hours

Post-Retrofit Electric Energy Consumption, H = G (OAT) x bin hours

Pre-Retrofit Natural Gas Energy Consumption, I = Dpre(OAT) x bin hours

Post-Retrofit Natural Gas Energy Consumption, I = Dpost(OAT) x Proposed BIN-Analysis Hours

The energy savings will be the difference between parameters H and I for the pre- and post-retrofit cases.

ECM 4. Building Envelope

> ECM Summary

Ameresco proposes the installation of building envelope improvements. These improvements include the repair of air leakage at building envelope penetrations and windows and doors. It also includes the installation of a destratification fan at the Aquatic Facility.

> M&V Summary

Due to the highly interactive effects of this measure with respect to the other proposed measures, the M&V protocol for this measure is stipulated. The building envelope measures are relatively simple, low risk measures and therefore, do not support higher cost M&V methodologies. The stipulated savings are based upon the calibrated energy simulation models. The calibrated eQUEST energy modeling results will be used for the basis of savings relative to the previously occurring parametric run.

> Metering Plan

Pre-Retrofit Parameters

Ameresco proposed to verify the effectiveness of this measure through a process of visual verification as follows:

1. Document the specific location of each the infiltration/sealing locations.
2. Estimate and record the area (sq. ft.) of each seal location.
3. Document and record the length or volume and type of sealing material at each location.

Post-Retrofit Parameters

Ameresco will provide commissioning of the building envelope measure to ensure the quality of the installations.

1. Visually verify and photograph the seal/infiltration locations in each building.

> Performance Period Activities and Reporting

There are no recurring activities proposed for this measure.

> Energy Savings Calculation Methodology

Savings Analysis

Energy savings for this measure are derived from the calibrated eQUEST building energy simulation models and. Please refer to the savings analysis and executable program files provided in the technical appendix for all assumptions associated with the parametric evaluation.

ECM 5. City Hall HVAC Retrofit

> ECM Summary

The intent of this measure is to replace the existing constant volume multi-zone unit located in the rooftop mechanical well at City Hall with a variable volume air conditioning unit. Approximately 20 variable air volume zone boxes will be added for space temperature control. Replacing this equipment as a part of this project will result in avoided future capital costs, energy cost savings and improved comfort.

> M&V Summary

The M&V protocol for this measure is based on IPMVP Option A. Option A includes engineering calculations of energy consumption of modified systems based on both measurement and stipulation of system input variables. Stipulated input variables are chosen to account and correct for interaction with concurrent implemented measures.

Under this measurement plan, Ameresco assumes performance risk for modified system components and their associated sequences of operation. Ameresco will perform equipment measurements and implement energy management system trends to verify that the performance of the installed equipment operates according to the measure descriptions. If the installed systems do not perform as proposed, a reconciliation will be provided per the terms of the Energy Services Agreement.

For cooling and hot water energy savings, heat transfer savings at the heating and cooling coils will be calculated based on the measured and stipulated values. DX cooling and hot water heating inputs will be converted into building electric and natural gas energy consumption using stipulated conversion indices. The calculated energy savings will be normalized to account for weather variations between the weather file used for the stipulated baseline consumption, and weather experienced during the evaluation period.

For fan related energy savings, electric energy consumption and demand savings will be based on pre- and post-measured or trended power consumption, and measured or stipulated operating hours used in the Financial Grade Operational Audit.

ECM Assumptions for M&V

The M&V Plan for this ECM assumes that both the baseline and post-retrofit operating hours and heating/cooling loads are equal.

> Energy Savings Calculation Methodology

Pre-Installation Parameters

All pre-retrofit baseline performance parameters are defined by a calibrated building energy simulation model composed during the course of the FGOA. Output parameters from the model used to define the baseline (pre-retrofit) performance for this measure include the following:

A. Hourly cold deck airflow fraction of total airflow ($CFM_{C)}$

B. Hourly hot deck airflow fraction of total airflow (CFM_H)

C. Hourly mixed air temperature (MAT)

D. Hourly outdoor air temperature (OAT)

E. Hourly hot deck discharge air temperature (HDT)

F. Hourly cold deck discharge air temperature (CDT)

G. Hourly total system airflow (F_{Pre})

The following parameter will be spot measured pre-installation:

H. Motor fan power

Parameter H will be further defined as the sum of air handling unit supply, and return/relief fans.

Parameters A, B, G, and H will be further defined as functions of parameter D (i.e., f(OAT) = hot deck airflow fraction) for use in bin analysis.

Post-Installation Parameters

Post-retrofit performance parameters are defined by EMS trend data (15-minute interval):

D. Outdoor air temperature (OAT)

E. Supply air discharge temperature (SAT)

G. Hourly total system airflow (F_{Post})

H. Hourly motor fan power

I. Heating water flow (GPM)

J. Heating hot water temperature across building (ΔT)

Parameter C will be further defined as the average of a sample of terminal units

Parameters C, D, E and F will also be defined as a function of parameter A for use in bin analysis.

Parameter H will be further defined as the sum of air handling unit supply, and return/relief fans.

Parameter H will also be defined as a function of parameter G for use in bin analysis

Utility Consumption Indices

Utility consumption indices will be used to convert heating and cooling energy consumption at the coil to electric and natural gas energy consumption at the building. The utility savings indices are based on the results of the calibrated building energy simulation model. For this measure, these values are stipulated in Table 8.5.

Table 8.5. Utility Consumption Indices

		Electric Demand $/kW	Electric Energy $/kWh	Natural Gas $/therm
	Parameter Mark	K	L	M
Q_C	Cooling Energy (Ton-hours)	4.04	0.04864	
Q_H	Heating Energy (Btu/Hr)			0.69451

> Savings Analysis

The energy savings will be calculated using a modified bin analysis method. Weather bins based on the base model weather file will be compiled using 3-degree ranges (maximum). The weather bins will be segregated into on-and off-peak hours. For both the pre- and post-retrofit conditions, the base model weather bins will be used in order to normalize the energy savings calculations relative to weather.

For each weather bin, sensible energy consumption and fan energy consumption will be calculated on a pre- and post-retrofit basis using the following equations:

Heating Air Side (btu/hr) Q_H: = (0.0663 x (CFM_H) x (60) x (0.241) x ((HDT) – (MAT)) / (12,000)
Cooling Air Side (tons) Q_C: (0.0663 x (CFM_C) x (60) x (0.241) x ((HDT) – (MAT)) / (12,000)
Heating Water Side (btu/hr) Q_H: ((GPM) x (8.34 x 60)) x (ΔT) / (100,000) / .90
Fan power (kW) = H

Note that for the equations shown above:

Air density equals 0.0663 lb/cu.ft. at 4800 ft. elevation
Specific heat of air is 0.241 Btu/lb-°F
12,000 Btu/hr = 1 ton of cooling.
1 gallon of water = 8.34 lbs
100,000 Btu = 1 therm
Average boiler efficiency = 90%

The inputs for parameter C will be the result of the f(D) function for mixed air temperature for the pre-retrofit case.

The inputs for parameters A, B, E, and F will be the result of f(D) functions unique to the pre and post-retrofit cases.

The inputs for parameter H will be the result of the f(G) function for mixed air temperature for the pre-retrofit case.

The total energy consumption for the pre and post cases will be the following:

O. Electric energy demand (kW): (Q_C x K) + (H)
P. Electric energy (kWh): (Q_C x L) + ((H) x bin hours)
Q. Natural gas (therms): (Q_H x M)

The energy savings will be the difference between parameters O thru Q for the pre- and post-retrofit cases.

> Performance Period Activities and Reporting

As part of the monitoring services under this agreement, Ameresco will require continuing access to Carson City's energy management system for the purpose of initiating and intermittent download of data trends for the post-installation parameters defined above. Carson City will be required to maintain the trends established by Ameresco for the purposes of measurement and verification. Additional associated parameters, not used in the measured savings calculation, may also be trended for diagnostic purposes. Ameresco will periodically download and archive the data off-site throughout the evaluation period of each evaluation year. Carson City will also be required to notify Ameresco of any prolonged EMS outages that may result in trend data loss.

Annual Inspection

As part of the services provided under the measurement and verification agreement, Ameresco will conduct an annual inspection of the VAV system to ensure the equipment is correctly installed, properly maintained and operating per the intent of the measure. The observations made during the inspection will be documented in the Annual Reconciliation Report.

8.1 Project Risks and Responsibilities

As recommended by the IPMVP and FEMP Guidelines, Ameresco evaluates the contract responsibilities associated with a project when developing the M&V plan. To accomplish this, Ameresco has prepared a list of potential project risks and the party responsible for managing those risks. Tables 8.6 through 8.8 that follow list the financial, equipment performance and operational responsibilities.

Table 8.6. Financial Responsibility Matrix

Financial Factors	Responsible Party	Notes
Interest Rates	Neither	Set by market structure.
Energy Prices	Neither	Set by market structure.
Savings Methodology	Ameresco	
Construction Costs	Ameresco	Contract determines overall requirements for construction costs and changes.
M&V Costs	Ameresco	Depending on methods or alternatives suggested/selected.
Delays	Ameresco or Carson City	Depending on cause.

Table 8.7. Equipment Performance Responsibility Matrix

Performance Factors	Responsible Party	Notes
Investment Grade Assessment and Savings Calculations	Ameresco	All calculations are provided to Carson City.
Investment Grade Assessment, Savings Review, M & V Plan Review	Ameresco and Carson City	Schedule coordination and submittals to Ameresco and Carson City required from all parties.
Field Adjustments to Investment Grade Assessment and Savings Calculations as necessary to enhance project	Ameresco and Carson City	Where necessary, parties shall review and modify ECM to ensure appropriate savings and appropriate payback. M&V requirements shall be incorporated into changes as outlined.
Initial Equipment Performance	Ameresco	Upon completion of commissioning and necessary measurements as detailed herein.
Pre- and Post-Retrofit Measurements	Ameresco	Required as indicated for ECM analysis and as outlined in the M&V plan.
Long-Term Equipment Performance	Carson City	Tied to Operation and Maintenance. For service contract items, Ameresco.
Engineering Calculations and Adjustments as necessary	Ameresco	As outlined in M&V engineering calculations, modeling, and adjustments may be necessary for each ECM.
Maintenance	Carson City	Tied to long-term performance.
Operation	Carson City	Tied to long-term performance.

Table 8.8. Operational Responsibility Matrix

Operational Factors	Responsible Party	Notes
Major Facility Changes	Carson City	Facility changes affect many of the ECMs considered for this plan. The M&V plan as presented herein assumes existing usage patterns except where explicitly stated. Carson City shall inform designated Ameresco Representative of any changes to the facility.
Operating Hours	Carson City	This is stipulated and/or developed for the ECMs considered herein based on information provided by Carson City.
Load	Carson City	See analysis methodology descriptions.
User Participation	Carson City	Baseline conditions assumed.

> Operations and Maintenance Procedures

The operations and maintenance (O&M) requirements are identified in the O&M section of this FGOA report. The O&M section will include a description of the Owner's O&M requirements and procedures for all measures.

9.0 Commissioning Plan

9.1 Systems Start-Up and Commissioning

The performance testing and commissioning matrix for the project is provided in Table 9.0. Pre-functional and functional inspection and testing forms and procedures will be developed during the design and construction phases, based on actual system design and installation. Results of pre-functional and functional testing will be included in the operations and maintenance (O&M) manuals upon competition of the commissioning process.

The commissioning process consists of two main steps: pre-functional check and functional testing. Pre-functional check is the verification process before, during, and after construction to ensure the system is installed according to design. This process includes verification of installed equipment according to engineering specifications and submittals, verification of installation work according to manufacturer's specifications, inspections for equipment or installation flaws or inconsistency, and other related inspection works. Pre-functional checks must be performed before a full functional testing can be performed. Each subcontractor will be responsible for their own individual checks prior to start-up and functional testing of the equipment. Ameresco will be responsible for the project-wide pre-functional checks during and after constructions to ensure the system installed is as designed.

The second step in the commissioning process, the functional test, is the process of testing the installed systems to ensure they operate as designed, and that they can achieve the performance as intended. In the functional test, operation of each piece of equipment and its operation as part of a system are verified, including motor speed, water flow and pressure, as well as other necessary parameters. The functional test also includes testing the system performance under various simulated conditions (e.g., to simulate peak heating load if the test is conducted in the summer). Results of the tests will be recorded and any discrepancies with design values will be noted. Necessary modifications will be performed to rectify a performance level that does not conform to design. Generally, Ameresco will be responsible for conducting and supervising the functional test along with approved representatives from vendors and subcontractors. Carson City's facility personnel are also encouraged to be involved in the process as it will help in transitioning the operation and maintenance responsibilities.

The commissioning team members will include Ameresco's commissioning agent and representatives from the lighting, control, HVAC and boiler subcontractors. Ameresco requests that Carson City's commissioning team includes Facilities Management personnel responsible for the operation and maintenance of the lighting, EMS and boiler systems at each location where the measures will be installed.

This page is intentionally left blank.

Table 9.0. Performance Testing and Commissioning Matrix

Energy Conservation Measure	Equipment/Systems to be Performance Tested	Observations, Tests and Inspections During Construction (Pre-Functional)	Pre-Functional Responsibility	Observations, Tests and Inspections Prior to Acceptance (Functional)	Functional Responsibility	Testing Documentation
ECM 1.1. Interior Lighting Retrofits	Lighting fixtures.	Visually verify proper installation of all fixtures as completed.	Lighting contractor	Measure power input at the switch or fixture for a statistically significant number of fixtures in locations mutually agreed by Carson City and Ameresco.	Subcontractor, Ameresco, and Carson City	Lighting commissioning data sheets will be completed for all new fixtures.
ECM 1.2. Exterior Lighting Retrofits	Lighting fixtures.	Visually verify proper installation of all fixtures as completed.	Lighting contractor	Measure power input at the circuit or fixture for a statistically significant number of fixtures in locations mutually agreed by Carson City and Ameresco.	Subcontractor, Ameresco, and Carson City	Lighting commissioning data sheets will be completed for all new fixtures.
ECM 2. Boiler Replacement	New heating hot water boilers.	Combustion efficiency testing	Controls subcontractor Mechanical subcontractor	Verify proper operation of new heating hot water boilers. Verify water temperature setpoints.	Manufacturer's representative, Mechanical and Controls subcontractor, Ameresco and Carson City	Functional performance test reports will be provided.
ECM 3. Energy Management System Upgrades & Retro-Commissioning	HVAC units, VAV terminal units, schedules, setpoints, sequences, lockouts, alarms, interlocks, controls strategies and trending.	Verify operation, rotation and alignment of motors as installation completed, perform air-side and water-side flow balancing where applicable. Perform system check and verify all sequences of operation are in accordance with design.	Mechanical and controls subcontractor	Perform functional performance test (FPT) in accordance with FTP Plans. A matrix will also be provided at the conclusion of the design period to be used in the FPT period. The matrix will identify each piece of equipment to be controlled and "expected results" and "actual results" for schedules, setpoints, sequences and control strategies. For a typical AHU, FPT will include verification of temperature sensor calibration using a calibrated handheld device. On/Off sequencing, damper, and valve operation will be visually verified my manipulating temperature setpoints.	Mechanical and Controls subcontractor, Ameresco, and Carson City	Functional performance test reports will be completed for systems.

Table 9.0. Performance Testing and Commissioning Matrix

Energy Conservation Measure	Equipment/Systems to be Performance Tested	Observations, Tests and Inspections During Construction (Pre-Functional)	Pre-Functional Responsibility	Observations, Tests and Inspections Prior to Acceptance (Functional)	Functional Responsibility	Testing Documentation
ECM 4. Building Envelope	Building construction, window seals, door seals, gasketing, etc.	Visual inspections, photographs and infrared temperature testing, etc.	Building envelope subcontractor	Observe proper installation of gaskets, caulking, insulation, applied foam, etc.	Building Envelope subcontractor, Ameresco, and Carson City	Inspection reports will be provided for systems.
ECM 5. City Hall HVAC Retrofit	HVAC System including air handler, terminal devices, fans and controls.	Pre-construction supply and return air readings. Visual inspection and verification with pre-functional inspections and point-to-point verifications.	Controls subcontractor Mechanical subcontractor	Verify proper operation of new HVAC unit. Test VAV functionality in AHU through the EMS using functional performance test procedures. Perform post-construction air balancing on new system.	Manufacturer's representative, Mechanical and Controls subcontractor, Ameresco and Carson City	Documented results will be provided that include start-up and functional performance test reports.

9.2 Preliminary Commissioning Plan

> Purpose of the Commissioning Plan

The purpose of the commissioning plan is to provide direction for the commissioning process during construction, providing resolution for issues such as scheduling, roles and responsibilities, lines of communication and reporting, approvals and coordination.

> Commissioning Goals and Objectives

Commissioning is a systematic process of ensuring that the building systems perform according to the design intent and the owner's operational requirements. All equipment and systems should be installed according to manufacturer's recommendations and the best practices and standards of the industry.

Commissioning will include documenting the design intent, followed by activities in the construction, acceptance and warranty phases of the project. The participation of the contractors in commissioning activities will follow the requirements defined in the specifications. The three main goals of the commissioning process are:

1. Facilitate the final acceptance of the project at the earliest possible date.
2. Facilitate the transfer of the project to the owner's maintenance staff.
3. Ensure that the comfort systems meet the requirements of the occupants. Commissioning is also intended to achieve the following specific objectives:
   - Document that equipment is installed and started per manufacturer's recommendations.
   - Document that equipment and systems receive complete operational check-out by installing contractors.
   - Document system performance with thorough functional performance testing and monitoring.
   - Verify the completeness of operations and maintenance materials.
   - Ensure that the owner's operating personnel are adequately trained on the operation and maintenance of building equipment.

> Commissioning Team Information

The Commissioning Team will consist of representatives from Ameresco, the mechanical and control subcontractors, and Carson City facilities staff. Individual team members will be identified together with their qualifications at a future date.

> Abbreviations and Definitions

The following are common abbreviations used in this document.

A/E	Architect and Design Engineers	FPT	Functional Performance Test
CP	Commissioning Provider	GC	General Contractor
CC	Controls Contractor	MC	Mechanical Contractor
CX	Commissioning	PF	Pre-Functional Checklist
EM	Energy Manager	PM	Project Manager
CX Plan	Commissioning Plan Document	Subs	Subcontractors
EC	Electrical Contractor	TAB	Test and Balance Contractor
MM	Maintenance Manager	Staff	Maintenance Staff

> General Management Plan

In general, the CP coordinates the commissioning activities and reports to the Ameresco project manager. The CP's responsibilities, along with all other contractors' commissioning responsibilities are detailed in the specifications. The Specifications will take precedence over this Commissioning Plan. All members work together to fulfill contracted responsibilities and meet the objectives of the contract documents.

> General Descriptions of Roles

General descriptions of the commissioning roles are as follows:

CP: Coordinates the CX process, writes and/or reviews testing plans, directs and documents performance testing.

PM: Facilitates and supports the CX process and gives final approval of the CX work.

MM: Coordinates maintenance staff participation in commissioning activities.

GC: Facilitates the CX process, ensures that subcontractors perform their responsibilities and integrates CX into the construction process and schedule.

Subs: Demonstrate correct system performance.

Staff: Participate in commissioning tasks and performance testing, review O&M documentation and attend training.

A/E: Perform construction observation, approve O&M Manuals, and assist in resolving problems.

Mfr.: Equipment manufacturers and vendors provide documentation to facilitate the commissioning work and perform contracted start-up.

> Specifications and Commissioning

Commissioning language in the specifications details the scope of commissioning for this project. The following table lists the sections of the specifications that include commissioning related language with a brief description.

Commissioning specifications will be developed at a future date.

> General Management Plan and Protocols

The following protocols will be used on this project.

Issue	Protocol
For requests for information (RFI) or formal documentation requests:	The CP goes first through the PM.
For minor or verbal information and clarifications:	The CP goes directly to the informed party.
For notifying contractors of deficiencies:	The CP documents deficiencies through the PM, but may discuss deficiency issues with contractors prior to notifying the PM.
For scheduling functional tests or training:	The CP provides input and coordination of testing and training. Scheduling is done through the PM.
For scheduling commissioning meetings:	The CP selects the date and schedules through the PM.
For making a request for significant changes:	The CP has no authority to issue change orders.
For making minor changes in specified sequences of operations:	Any required changes in sequences of operations required to correct operational deficiencies must be approved and documented by the PM and A/E team. The CP may recommend to the PM changes in sequences of operation to improve efficiency or control.
Subcontractors disagreeing with requests or interpretations by the CP shall:	Resolve issues at the lowest level possible. First with the CP, then with the GC and PM. Some issues may require input from the A/E team.

> Commissioning Process

This section sequentially details the commissioning process by commissioning task or activity.

Commissioning Scoping Meeting

The scoping meeting brings together all members of the design, construction, and operations team that will be involved in the commissioning process. Each building system to be commissioned is addressed, including commissioning requirements and completion and start-up schedules. During the scoping meeting, all parties agree on the scope of work, tasks, schedules, deliverables and responsibilities for implementation of the Commissioning Plan.

Final Commissioning Plan

The commissioning agent finalizes the draft Commissioning Plan using the information gathered from the scoping meeting. The initial commissioning schedule is also developed along with a detailed timeline. The timeline is fine-tuned as construction progresses.

Design Intent Documentation

The design requirements, relative to the building systems selected for commissioning, must be explicitly documented in order to establish a baseline of performance expectations to which the actual installed performance is compared. The commissioning provider, with the assistance of the building owner and design team, prepares a Design Intent Summary that documents the design intent for those building systems selected for commissioning. The Design Intent Summary reflects the underlying assumptions and requirements that become represented in the construction documents.

Submittals

The general contractor will provide the commissioning agent with a set of equipment and system submittals. This equipment data includes installation and start-up procedures, O&M data, performance data and temperature control drawings. The subcontractors, general contractor or A/E notify the commissioning agent of any new design intent or operating parameter changes, added control strategies and sequences of operation, or other change orders that may affect commissioned systems.

Site Observation

The commissioning agent makes periodic site visits to witness equipment and system installations. Each site visit will have a specific agenda and will be coordinated with the general contractor site supervisor. The commissioning agent attends selected planning and job-site meetings in order to remain informed on construction progress and to update parties involved in commissioning. The general contractor provides the commissioning agent with information regarding substitutions or change orders that may affect commissioned equipment or the commissioning schedule.

Pre-functional Checklists and Startup Procedures

A Pre-Functional Inspection Checklist is developed and completed for all mechanical equipment being commissioned. The checklist captures equipment nameplate and characteristics data and confirms the

as-built status of the equipment or system. The checklists ensure that the systems are complete and operational and document the installation of components and completion of systems.

The checklists are prepared by the commissioning agent from manufacturer's data, drawings and specifications to include the required installation, checkout and start-up procedures. The installing subcontractors date and initial the checklists as the construction and start-up is completed. The commissioning agent reviews and verifies the completed checklists before scheduling the functional performance testing.

Development of Functional Test and Verification Procedures

Functional performance testing verifies the intended operation of individual components and system interactions under various conditions and modes of operation. The systems are run through all of the sequences of operation and the response of components is verified. Testing proceeds from components to subsystems to systems and, finally, to interlocks and connections between systems.

The commissioning agent prepares functional performance test plans so that the complete sequence of operations is included. The commissioning agent obtains all documentation, including an updated points list, control sequences and setpoints. If necessary, the commissioning agent may request clarifications from contractors and the design team regarding sequences and operation. Prior to execution, the commissioning agent provides a copy of the primary equipment tests to the installing subcontractor and general contractor who can review the tests for feasibility, safety, warranty and equipment protection.

Execution of Functional Testing Procedures

The commissioning agent schedules functional tests through the general contractor and subcontractors. Under the supervision of the commissioning agent, the installing subcontractor performs the hardware and/or software manipulations required for the testing. Owner maintenance staff may also be present in order to assist in system observations. The commissioning agent witnesses and records the results of functional performance testing. Any deficiencies found from functional performance testing will be documented in a Deficiency Report. The report will include all details of the components or systems found to be non-compliant with the parameters of the functional performance test plans and design documents. The Deficiency Report will become part of the punch list. The report will detail the adjustments or alterations required to correct the system operation and identify the responsible party. The Deficiency Report will be continuously updated. The commissioning agent schedules any required retesting through the general contractor. Decisions regarding deficiencies and corrections are made at as low a level as possible, preferably between commissioning agent, subcontractor and general contractor.

Short-Term Diagnostic Monitoring

Short-term diagnostic testing, using data acquisition equipment or Building Automation System (BAS) trends to record system operation over a suitable period, may be used to investigate the dynamic interactions between components in the building system. The monitoring occurs after occupancy to evaluate the building systems' performance under natural occupancy and ambient load conditions. The

objectives of the monitoring are to: evaluate scheduling, the interaction between heating and cooling and the effectiveness of the systems in meeting the comfort requirements of the occupants.

Operations and Maintenance Manuals

The Operation and Maintenance Manual is prepared by the contractors for the owner's maintenance personnel and is reviewed for completeness. The contractors are encouraged to submit O&M Manuals at the earliest possible date. Materials may be added, or requested from the contractors, to stress and enhance the importance of system interactions, troubleshooting and long-term preventative operations and maintenance. A database of preventative maintenance information may also be created from the materials in the O&M Manuals.

Training and Orientation of Owner Personnel and Occupants

Effective maintenance personnel training is critical to the long-term performance of the new building. The commissioning agent will assist the owner and general contractor in organizing the training sessions by identifying the appropriate staff for each session and creating an overall training plan.

For each training session, the contractors provide a detailed agenda for each piece of equipment or system for which training is required. The agenda describes the training scope, duration and methods, along with the name and qualifications of the trainers. The commissioning agent develops a plan for including in the training session contractors / trainers from different disciplines, when appropriate. The trainer documents each training session (duration, general subjects covered and attendees). The commissioning agent may witness any of the training sessions.

Warranty Period

Seasonal variation in operations or control strategies may require additional testing during peak cooling and heating seasons to verify system performance. During the warranty period, seasonal testing and other deferred testing is completed as required to fully test all sequences of operation. The commissioning agent coordinates this activity. Tests are executed and deficiencies corrected by the appropriate subcontractors, witnessed by facilities staff and the commissioning agent. Any final adjustments to the O&M Manuals and as-builts, due to the testing, are made. The commissioning agent will request input from the owner's operations staff and occupants about the performance of the building systems. The commissioning agent also supports the general contractor's troubleshooting process during the warranty period. The general contractor's warranty team will first try and resolve the issues before requesting assistance from the commissioning agent.

Commissioning Report

A final Commissioning Report will be compiled which summarizes all of the tasks, findings, and documentation of the commissioning process. The report will address the actual performance of the building systems in reference to the design documents. All test reports by various subcontractors, manufacturers and controlling authorities will be incorporated into the final report.

The Commissioning Report includes:

- An evaluation of the operating condition of the systems at the time of functional test completion;
- Deficiencies discovered and the measures taken to correct them,
- Functional test procedures and results;
- Reports that document all commissioning field activities as they progressed, and;
- A description and estimated schedule of required deferred testing.

> General Issues

The following sequential priorities are followed:

- Equipment is not "temporarily" started (for heating or cooling), until pre-start checklist items and all manufacturers' pre-start procedures are completed and moisture, dust and other environmental and building integrity issues have been addressed.
- Functional performance testing does not begin until pre-functional, start-up and testing and balance (TAB) is completed for a given system.
- The controls system and equipment it controls are not functionally tested until all points have been calibrated and pre-functional checklists are completed.

> Preliminary Commissioning Schedule - Sample

Commissioning Activity	Duration	Estimated Start Date	Estimated Completion Date
Document Design Intent and Basis of Design			
Commissioning Plan			
Preliminary Commissioning Plan			
Scoping Meeting			
Final Commissioning Plan			
Submittals and test writing			
Review mechanical submittals			
Write start-up and PF checklists			
DDC program review meeting			
Write FPT Tests			
Construction observation			
Site observations			
HVAC PF checklist completion			
Equipment start-up			
Start-up documentation			
Controls system checkout			
Test and balance (TAB)			
TAB air side			
TAB water side			
HVAC functional performance testing			
Substantial completion			
Post acceptance phase			
Owner move-in			
Short-term diagnostic monitoring			
O&M, training, reporting, and warranty			
O&M manuals submitted			
Review O&M manuals			
Review as-built documentation			
Seasonal testing			
Final Commissioning Report			

9.3 Sample Pre-Functional Checklist

Pre-functional Checklist

Project _____

PC-_____ VARIABLE FREQUENCY DRIVE on _____

1. Submittal / Approvals

Submittal. The above equipment and systems integral to them are complete and ready for functional testing. The checklist items are complete and have been checked off only by parties having direct knowledge of the event, as marked below, respective to each responsible contractor. This pre-functional checklist is submitted for approval, subject to an attached list of outstanding items yet to be completed. A Statement of Correction will be submitted upon completion of any outstanding areas. None of the outstanding items preclude safe and reliable functional tests being performed. ___List attached.

_____	_____	_____	
Mechanical Contractor	Date	Controls Contractor	Date
_____	_____	_____	
Electrical Contractor	Date	Sheet Metal Contractor	Date
_____	_____	_____	
TAB Contractor	Date	General Contractor	Date

Pre-functional checklist items are to be completed as part of start-up and initial checkout, preparatory to functional testing.

- This checklist does not take the place of the manufacturer's recommended check-out and start-up procedures or report.
- Items that do not apply shall be noted with the reasons on this form (N/A = not applicable, BO = by others).
- If this form is not used for documenting, one of similar rigor shall be used.
- Contractor's assigned responsibility for sections of the checklist shall be responsible to see that checklist items by their subcontractors are completed and checked off.
- "Contr." column or abbreviations in brackets to the right of an item refer to the contractor responsible to verify completion of this item. A/E = architect/engineer, All = all contractors, CA = commissioning agent, CC = controls contractor, EC = electrical contractor, GC = general contractor, MC = mechanical contractor, SC = sheet metal contractor, and TAB = test and balance contractor, _____ = _____.

Approvals. This filled-out checklist has been reviewed. Its completion is approved with the exceptions noted below.

Commissioning Agent	Date	Owner's Representative	Date

2. Requested documentation submitted

Check if Okay. Enter comment or note number if deficient.

Check Equip Tag->						Contr.
Manufacturer's cut sheets						
Performance data (fan curves, coil data, etc.)						
Installation and start-up manual and plan						
Sequences and control strategies						
O&M manuals						

- ***Documentation complete as per contract documents for given trade.....___ YES ___ NO***

3. Model verification [Contr = _____]

1 = as specified, 2 = as submitted, 3 = as installed. Check if Okay. Enter note number if deficient.

Equip Tag--->						
Manuf.	1					
	2					
	3					
Model	1					
	2					
	3					
Serial #	3					
Capacity	1					
	2					
	3					

- ***The equipment installed matches the specifications for given trade.....___ YES ___ NO***

4. Installation Checks

Check if Okay. Enter comment or note number if deficient.

Check Equip Tag->						Contr.
General Installation						
Permanent label affixed						

Check if Okay. Enter comment or note number if deficient.

Check Equip Tag->						Contr.
Securely mounted						
Drive location not subject to excessive temperatures						
Drive location not subject to excessive moisture or dirt						
Drive size matches motor size						
Pilot lights functioning						
VFD wired to controlled equipment						
Programming and Controls						
Internal setting designating the model is correct						
Input of motor FLA represents 100% to 105% of motor FLA rating						
Appropriate Volts vs Hz curve is being used						
Accel and decel times are around 10-50 seconds, except for special applications. Record actual for each unit.						
Lower frequency limit at 0 for VAV fans and around 10-30% for chilled water pumps. Record actual for each unit.						
Upper frequency limit set at 100%, unless explained otherwise						
VFD interlocked to control system						
Static or differential pressure sensor or other controlling sensor properly located and per drawings						
Controlling sensor calibrated						
Unit is programmed with full written programming record submitted						
RPM readout in BAS verified with VFD readout						
All control devices, pneumatic tubing, and wiring complete						
Specified sequences of operation and operating schedules have been implemented with all variations documented						
Specified point-to-point checks have been completed and documentation record submitted for this system						
Final						
Start-up report completed with this checklist attached						

Check if Okay. Enter comment or note number if deficient.

Check Equip Tag->						Contr.
Safeties installed and safe operating ranges for this equipment provided to the commissioning agent						

- ***The checklist items of Part 4 are all successfully completed for given trade. ..... ___ YES ___ NO***

9.4 Sample Functional Performance Test Procedure

Functional Performance Test

Variable Frequency Drive (VFD)
Pump Application

Secondary Hydronic Pump Application

Project: _____ Date: _____
Address: _____

Commissioning Participants:
Commissioning agent (CA): _____ of _____ EMS operator: _____ of _____
VFD technician: _____ of _____
HVAC technician: _____ of _____
Owner's rep.: _____ of _____

Pumps ID:_____ _____ _____ ____ **Chilled water** (CHW) **secondary,** ___**Hot water** (HW)
Design max.: Hp: ____ GPM: _____ Head _____ Ft

VFD brand and model: _____

The following functional performance test is for a VFD controlling a variable flow hydronic system to a **constant** differential pressure (DP). ***A check-mark denotes acceptance or compliance.***

I. Design Intent and Documentation Verification

___ Review the design documents and the specifications.
___ Verify that the VFD ___description, ___specifications, ___technical and troubleshooting guide and the installation, ___programming record and ___balance report are on-site.
From the design documents determine: Location for the DP measurement:
_____
Control strategy for the pump:_____
_____

II. VFD Installation

Differential Pressure Sensor

Actual location of DP measurement_____
The measurement should ideally be taken across the coil of the last branch.

____Complies?

Pressure Offset (Po) Conversion: psi x 2.31 = ft H_2O

DP pump is being controlled to: _____feet [A].
Pressure rise across pump at design conditions (from balance report): _____feet [B].
Pressure offset, Po, [A] ÷ [B]= _____.
Optimally, Po should be 0.3 or less in order for the VFD and pump to be able to respond to small pressure changes and realize adequate energy savings. If Po is greater than 0.4, the DP sensor is probably located too close to the pump.

___Complies?

Balancing to Lowest Pressure

Review the HVAC balance report and verify, according to the report, that the system was balanced so the VFD controls to the lowest possible DP (that is a capacity test was performed). The controlling DP from balance reports is _____feet. At design, the corresponding VFD frequency or pump RPM from the balance report is: Pump-1 _____, Pump-2 _____; Pump-3 _____. The corresponding flow from the balance report is_____GPM. Refer to the capacity test at the end of this form for details.

___Balanced to lowest DP?

General Issues

___ Verify that any power quality mitigation measures required from the specifications have been completed.
___ Verify that there are no 3-way coil valves that may negate the value of the VFD by allowing flow to bypass the coil, except for a very small min. flow bypass.
___ Verify verbally that the acceleration and deceleration ramp time of the VFD is between one and four minutes. Actual ramp time: up _____min. down _____min. (too short of ramp times will result in "hunting" and excess modulation by the VFD; typical ramp times are 1 to 4 minutes)
___ Verify that each VFD has been integrated into the EMS as per specification.
___ Verify that the lower frequency limit is programmed to 10-30% (the lower the better).
___ Verify that the EMS monitors the DP.
___ Min.flow bypass with 2-way or constant flow valve, if present, has flow less than 2% of design flow?
___ Shut off power feeding VFD. Restore power and verify that VFD resets automatically.

III. Functional Performance Test

This test is not intended to verify that the coil valve is functioning properly, but rather that the VFD is functioning properly.

1. **Design Flow by Test and Balance (TAB).** Record in Condition 1 in Table 1 the speed, DP and total supply flow at design conditions from the TAB report.

2. **Intermediate Flow** (coil valves partially open)**.** If current conditions are such, that the system is not expected to be in full cooling or full heating, nor be at minimum flow.
   a. Read the speed, DP and the total supply flow in the secondary loop and record in Condition 3 in Table 1.

If the conditions are not in an "intermediate" position, change all space temperature set points to 4 degrees below the actual temperature in the space, for *CHW pumps* OR 4 degrees above for *HW pumps* (circle one) to simulate an approaching of thermostat satisfaction and take readings.

3. **Design Flow** (coil valves full open)**.** Using the (EMS) or other means, change all the space temperature set points to at least 10 degrees *below* the current space temperature for *CHW pumps*, OR 10 degrees *above* for *HW pumps*, so that the entire HVAC system supplied from these pumps is in full cooling (or heating, as appropriate, circle) in all zones. Observe that all coil valves are to their *design* maximum position (from the TAB report). Wait at least 20 minutes for lag time while observing:

___Does the first lag pump turn on (after a delay) when the lead pump exceeds its _____ gpm design flow?

___Does the 2nd lag pump turn on (after a delay) when the sum Lead + Lag 1 exceeds the sum of their design, *AND* the DP drops to ____% or _____ feet? (typically 80%)

a. Read the speeds, DP and the total supply flow and record in Condition 2.

4. **Minimum Flow** (Coil valves shut)**.** Change all space temperature set points to be equal to the actual space temperatures to simulate a satisfied condition, driving the boxes to their minimum and the coil valves closed. Wait at least 25 minutes.

___Do the lag pumps sequentially turn off (with a delay) when the flow is less than the design of all *running* pumps?

___Does the last pump shut off appropriately?

a. Take the frequency, pressure and flow readings and record in Condition 4.

IV. Analysis

Table 1.

Condition	Secondary Pump No.	Speed (Hz or RPM)		DP at Sensor (psi)		Total Flow (gpm)
		Reading	Average	Reading	Average	
1. At design flow by TAB	**Lead**					
	Lag-1					
	Lag-2					
2. At design flow (during commissioning)	**Lead**					
	Lag-1					
	Lag-2					
3. At intermediate flow (during commissioning)	**Lead**					
	Lag-1					
	Lag-2					
4. At no flow (during commissioning)	**Lead**					
	Lag-1					
	Lag-2					

Conversion: 0.434 x ft H_2O = psi, 2.31 x psi = ft H_2O

1. In Table 1, average the speed and the DP for all pumps at each of the four conditions.
2. If the speed at Condition 1 (TAB test) is not within 10% of the current test at Condition 2, all the boxes may not have been driven wide open during the Cx'g test, or the readings were taken before the lag time was complete. Investigate and repeat tests as appropriate.
   ___Less than 10% variance?
3. During operation of lead-lag pump combinations, the average DP readings at all four conditions should remain within 10% of each other. If the there is more than a 10% variance, the sensor may be faulty. (During lead-lag pump transition, the DP may appropriately vary by as much as 20%)
   ___Less than 10% variance?

4.**___At no flow, Condition 4, is the flow and DP zero or equal to the min. flow bypass?**

5.**___For the total flow readings in Table 1, are the values in Condition 2 > 3 > 4?**

6.**___Collaborative Trending**
The system operation will, will not (circle) be trended to further verify the proper operation of the VFD. Points to be trended are listed in the Trending Request Form.
___From studying the trends, is the VFD is functioning properly?

7. Additional tests. Refer to the chilled water systems sequence of operations tests for further collaboration on the VFD performance.

V. Training

___The training specified in the design incentive agreement has been completed.

VI. O&M Plan

___An acceptable O&M Plan has been put into place. Describe:

VII. Capacity Test

To insure that energy use is minimized, the hydronic system must be balanced at design conditions at the lowest possible differential pressure (DP) possible. This requires that the lowest possible DP at the sensor be found that will allow the delivery of design flow through the valve most difficult to satisfy. This system minimum DP found is what the VFD should control to. This is accomplished by changing the temperature setpoint for all zones to 55F for cooling coils or 85F for heating coils, causing all AHU coil valves to be calling for full cooling or heating, as applicable. Each coil's flow is then measured against the design flow. The coil that is receiving the lowest fraction of design is identified. The current DP at the controlling sensor is noted. A calculation is made, giving the DP required at the sensor to allow the identified most critical coil to meet its design flow. The equation is $DP_2 = DP_1 \times Q_2^2 / Q_1^2$. Where Q_1 = actual or fraction of design flow during capacity test. Q_2 = design flow or 1.0 if using fractions. DP_1 = DP at sensor. DP_2 = DP to control to. It is noted that if all coils were calling for full cooling simultaneously, the pump could not maintain the new DP_2 value, due to diversity pump size reduction having been made by the design engineer.

Parties required for VFD site commissioning work

Commissioning agent To witness and record the tests.

EMS operator To drive boxes open and shut by changing the set points, etc.

VFD technician To use the keypad to verify the ramp time. (unless verified at start-up, which is recommended). Sequencing the keypad to display ramp time could be done by the commissioning agent, alone after reviewing the VFD technical manual.

This page is intentionally left blank.

9.5 Sample Manufacturer's Installation Checklist and Start-Up

Each piece of equipment will be started and tested following the manufacturer's written start-up procedures. These procedures will be included as part of the O&M manuals provided at the conclusion of the project.

This page is intentionally left blank.

10.0 Operations and Maintenance Plan

A well-designed and properly executed maintenance program is a crucial element to long-term energy conservation measure (ECM) performance and savings. In order to maximize the energy savings and equipment performance, the ECMs should be maintained under an ongoing, structured service program for the life of the contract, and ideally beyond. Ameresco has a vested interest in the equipment performance and maintenance required to realize all possible energy savings, which form the basis of our guarantee. Typically, the equipment and systems Ameresco proposes can generally be maintained and serviced by a variety of service entities including maintenance personnel currently employed by Carson City and/or a combination of service providers.

10.1 Scheduled Preventative Maintenance

Table 10.0 shows a summary of the operations and maintenance (O&M) plans for this project. Detailed descriptions of the included scope for each ECM are presented following Table 10.0.

This page is intentionally left blank.

Table 10.0. Operations and Maintenance Matrix

Energy Conservation Measure	Operations Responsibilities		Maintenance Responsibilities		
	Ameresco	Carson City	Ameresco	Carson City	Warranty
ECM 1.1. Interior Lighting Retrofits	None	None	None	Fixture cleaning. Corrective maintenance of lamps and ballasts after warranty period.	The lamps and ballasts are covered by manufacturer's warranties. All warranties will be administered by each individual manufacturer. Ameresco will furnish, upon completion of work, contact information for all manufacturers. For warranty purposes, manufacturers may request the defective product be returned for analysis. Carson City must retain all lamps and ballasts which fail prematurely and provide to the manufacturer upon request.
ECM 1.2. Exterior Lighting Retrofits	None	None	None	Fixture cleaning. Corrective maintenance of lamps and ballasts after warranty period.	The lamps and ballasts are covered by manufacturer's warranties. All warranties will be administered by each individual manufacturer. Ameresco will furnish, upon completion of work, contact information for all manufacturers. For warranty purposes, manufacturers may request the defective product be returned for analysis. Carson City must retain all lamps and ballasts which fail prematurely and provide to the manufacturer upon request.
ECM 2: Boiler Replacement	None	Periodic inspections to verify proper operation.	None	Preventive maintenance per manufacturer's recommendations including sensor calibration at recommended intervals. Corrective maintenance at boilers and sensors, equipment and sequences, as necessary.	Ameresco provides a 1-year warranty and transfers manufacturer's warranty on equipment and material.

Table 10.0. Operations and Maintenance Matrix

Energy Conservation Measure	Operations Responsibilities		Maintenance Responsibilities		
	Ameresco	Carson City	Ameresco	Carson City	Warranty
ECM 3: Energy Management System Upgrades & Retro-Commissioning	None	Periodic inspections to verify proper operation. Periodic inspections to verify proper operation. Programming and adjustment of equipment operating schedules and thermostat set points as agreed in M&V plan.	None	Preventive maintenance per manufacturer's recommendations including sensor calibration at recommended intervals. Corrective maintenance of sensors, equipment and sequences, as necessary.	Ameresco provides a 1-year warranty and transfers manufacturer's warranty on equipment and material.
ECM 4: Building Envelope	None	Periodic inspections to verify proper condition.	None	Corrective maintenance at installation points as necessary.	Ameresco provides a 1-year warranty and transfers manufacturer's warranty on equipment and material.
ECM 5: City Hall HVAC Retrofit	None	Periodic inspections to verify proper operation. Maintain schedules and temperature setpoints in the control system.	None	Preventative maintenance per manufacturer's recommendations including sensor calibration and filter changes at recommended intervals. Corrective maintenance at sensors, equipment and sequences, as necessary.	Ameresco provides a 1-year material and labor warranty. Any extended warranties will be transferred to the City.

10.2 Service Descriptions

System Operation: Ongoing, normal equipment adjustments necessary to satisfy the building occupants and assure the continued effective and efficient operation of equipment or systems.

Preventative Maintenance: Periodic inspections, tests, calibrations, and adjustments needed for sustaining or restoring energy systems to required performance.

Corrective Maintenance: Services needed to replace, rebuild, or restore to specified performance, the systems and equipment that are in danger of failing or are inadequate.

Local Maintenance and Support: The primary point of contact for service support.

10.3 Service Coordination

Ameresco's service contact will be determined at a future date prior to turn-over to Carson City.

The scope of services for any and all of the ECMs included with this performance contract, or the programs as a whole, can be modified or fine-tuned at any time during the contract term. For example, where full coverage is not included, additional services can be provided on a time and materials basis, based on pre-negotiated rates. Services can also be provided for equipment not replaced or modified as part of this performance contract.

10.4 Operation and Maintenance Scope

The following work is a description of Ameresco's maintenance and operation obligations under this contract. Any additional work requested beyond the scope identified below can be performed on a time and materials basis as directed by Carson City, subject to mark-ups identified in the contract.

> ECM 1.1 : Interior Lighting Retrofits

System Operation

Carson City is responsible for the operations of the system.

Preventative Maintenance

Not applicable for this measure.

Corrective Maintenance

Ameresco will provide Carson City with additional bench stock at the end of construction to allow Carson City staff to replace any lamp or ballast that fails prematurely. Carson City will be responsible for providing replacement lamps and ballasts after the warranty period expires.

Local Maintenance and Repair Support

To be determined.

> ECM 1.2: Exterior Lighting Retrofits

System Operation

Carson City is responsible for the operations of the system.

Preventative Maintenance

Not applicable for this measure.

Corrective Maintenance

Ameresco will provide Carson City with additional bench stock at the end of construction to allow Carson City staff to replace any lamp or ballast that fails prematurely. Carson City will be responsible for providing replacement lamps and ballasts after the warranty period expires.

Local Maintenance and Repair Support

To be determined.

> ECM 2: Boiler Replacement

System Operation

Carson City is responsible for the operations of the system and shall utilize approved control sequences of operation on an ongoing basis.

Preventative Maintenance

Carson City will periodically inspect field devices, verify system of operations, inspect and check boiler components including sensors, thermometers, controls, valves, pumps, safety and other active devices, as needed.

Corrective Maintenance

Carson City will perform corrective maintenance, as needed.

Local Maintenance and Repair Support

To be determined.

> ECM 3: Energy Management System Upgrades & Retro-Commissioning

System Operation

Carson City is responsible for the operations of the system, and shall maintain all control elements of the system. This includes the approved sequences of operation, setpoints and schedules and any other programming of the system components on an on-going basis. Carson City shall maintain all M&V required trend logs and provide for the secure archive of trend data.

Preventative Maintenance

Carson City will periodically inspect field devices, verify proper operation, and maintain setpoints, sequences and programming, and site network access communications.

Corrective Maintenance

Carson City will perform corrective maintenance as needed.

Local Maintenance and Repair Support

To be determined.

> ECM 4: Building Envelope

System Operation

Carson City is responsible for the operations of the system and shall utilize manufacturer's recommended maintenance on an on-going basis.

Preventative Maintenance

Carson City will periodically inspect installed building envelope components, including but not limited to: insulation, gasketing, caulking, foam barriers, door and windows seals and other components, as needed.

Corrective Maintenance

Carson City will perform corrective maintenance as needed.

Local Maintenance and Repair Support

To be determined.

> ECM 5: City Hall HVAC Retrofit

System Operation

Carson City is responsible for the operations of the system and shall utilize approved control sequences of operation on an ongoing basis.

Preventative Maintenance

Carson City will periodically inspect field devices, verify system of operations, inspect and check AHU components including filters, dampers, coils, valves, motors, belts and sheaves, and other active devices, as needed.

Corrective Maintenance

Carson City will perform corrective maintenance, as needed.

Local Maintenance and Repair Support

To be determined.

This page is intentionally left blank.

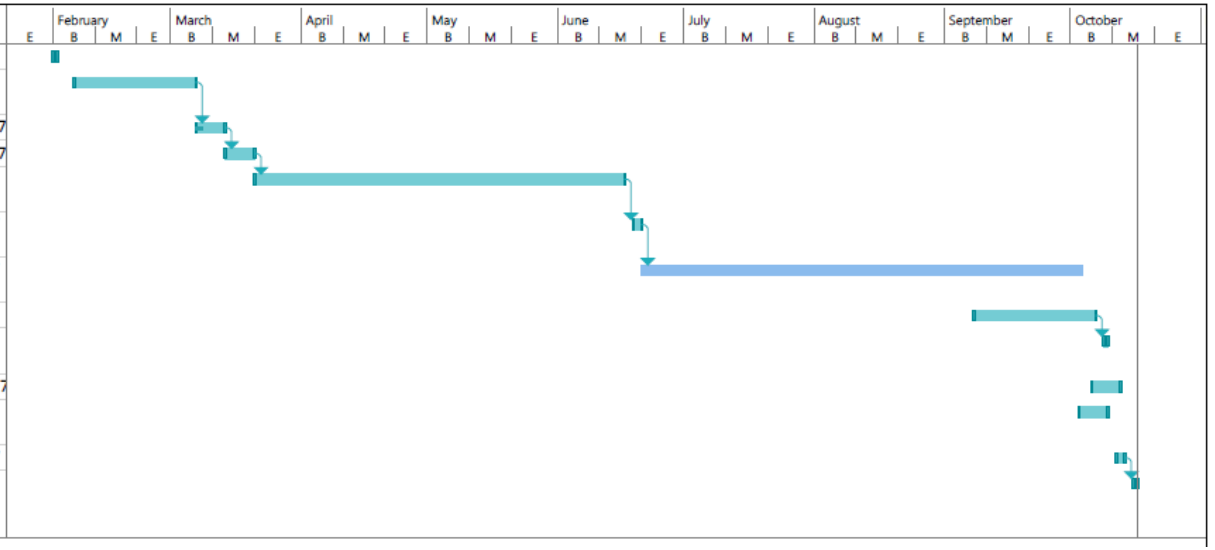
11.0 Construction Schedule

Construction and installation of the proposed energy conservation measures (ECMs) would likely take place over the course of nine months, beginning upon execution of the Energy Performance Contract. A summary of the draft construction schedule is shown herein. All dates shown assume a notice to proceed date of February 1, 2017.

This page is intentionally left blank.

> Draft EPC Site Specific Construction Schedule

ID	Task Name	Duration	Start	Finish
1	Notice to Proceed	1 day	Wed 2/1/17	Wed 2/1/17
2	Engineering and Design	21 days	Mon 2/6/17	Mon 3/6/17
3	Design Reviews	5 days	Tue 3/7/17	Mon 3/13/17
4	Permitting	5 days	Tue 3/14/17	Mon 3/20/17
5	Material Procurement	64 days	Tue 3/21/17	Fri 6/16/17
6	Construction Mobilization	2 days	Mon 6/19/17	Tue 6/20/17
7	Physical Construction	75 days	Wed 6/21/17	Tue 10/3/17
8	Commissioning	21 days	Fri 9/8/17	Fri 10/6/17
9	Substantial Completion	1 day	Mon 10/9/17	Mon 10/9/17
10	Punch List	5 days	Fri 10/6/17	Thu 10/12/17
11	Documentation and Drawings	5 days	Tue 10/3/17	Mon 10/9/17
12	Final Commissioning	2 days	Thu 10/12/17	Fri 10/13/17
13	Final Delivery, Acceptance Close Out	1 day	Mon 10/16/17	Mon 10/16/17



This page is intentionally left blank.

Appendix

The following Appendices have been included herein:

- Appendix A. Historical Utility Data
- Appendix B. Data Logger and EMS Trend Point Tables
- Appendix C. Facility EUI vs. Benchmark EUI Analysis
- Appendix D. Lighting Usage Assumptions
- Appendix E. Lighting Maintenance Calculations
- Appendix F. Model vs. Baseline: Monthly Comparisons
- Appendix G. Sample Lighting Calculations
- Appendix H. Lighting Logger Data
- Appendix I. Equipment Inventory
- Appendix J. ECM Implementation Costs
- Appendix K. Carson City Standards of Comfort

Appendix A. Historical Utility Data

Table A.0. Ameresco Sites: Electrical Historical Consumption: Carson City Facilities

	Aquatic Facility			Building Department			Cemetery			City Hall		
Month	$	kWh	kW	$	kWh	kW	$	kWh	kW	$	kWh	kW
Jul-12	7,091	75,200	166	658	6,065	-	163	1,380	-	3,937	40,500	99
Aug-12	7,625	81,840	170	634	5,808	-	194	1,680	-	3,488	34,500	96
Sep-12	7,721	80,240	188	627	5,742	-	246	2,200	-	3,701	36,600	102
Oct-12	7,604	79,920	179	472	4,207	-	160	1,340	-	3,105	29,700	93
Nov-12	8,189	85,840	197	477	4,274	-	127	1,020	-	3,274	33,600	84
Dec-12	9,599	104,320	210	379	3,299	-	171	1,460	-	2,935	29,700	78
Jan-13	8,986	98,320	192	399	3,529	-	179	1,540	-	2,986	30,300	81
Feb-13	9,300	103,440	195	393	3,504	-	190	1,680	-	2,810	29,100	75
Mar-13	8,929	98,800	200	370	3,263	-	174	1,520	-	2,863	28,500	84
Apr-13	8,363	90,000	204	376	3,316	-	135	1,120	-	2,835	28,800	78
May-13	8,273	91,360	182	442	3,950	-	104	800	-	3,077	35,100	81
Jun-13	9,230	102,240	194	498	4,520	-	126	1,020	-	3,393	35,100	87
	100,908	**1,091,520**	**2,277**	**5,724**	**51,477**	**-**	**1,968**	**16,760**	**-**	**38,403**	**391,500**	**1,038**
Jul-13	8,427	89,920	200	616	5,613	-	136	1,120	-	4,354	45,900	99
Aug-13	9,066	97,520	195	702	6,350	-	209	1,800	-	4,245	44,100	93
Sep-13	8,394	87,120	186	566	5,025	-	198	1,680	-	3,828	39,300	87
Oct-13	7,485	77,360	168	473	4,016	-	145	1,160	-	3,286	30,900	87
Nov-13	9,451	99,920	173	381	3,076	-	130	980	-	2,965	26,700	81
Dec-13	8,472	85,360	190	393	3,426	-	109	900	-	3,159	32,700	78
Jan-14	9,407	95,600	179	438	3,758	-	279	2,360	-	3,748	36,600	78
Feb-14	10,300	103,281	196	411	3,672	-	231	2,080	-	2,953	31,800	72
Mar-14	8,464	91,200	208	408	3,637	-	165	1,400	-	2,974	32,100	72
Apr-14	8,502	91,760	208	417	3,734	-	120	920	-	3,152	33,300	81
May-14	9,440	105,120	210	434	3,914	-	125	980	-	3,361	35,700	85
Jun-14	9,218	101,200	214	527	4,905	-	127	1,000	-	3,351	35,100	88
	106,626	**1,125,361**	**2,327**	**5,767**	**51,126**	**-**	**1,974**	**16,380**	**-**	**41,377**	**424,200**	**1,001**
Jul-14	8,790	94,480	217	630	6,024	-	144	1,180	-	3,550	35,700	104
Aug-14	8,785	97,840	198	640	6,158	-	181	1,580	-	3,738	39,000	102
Sep-14	8,562	92,640	214	579	5,504	-	160	1,360	-	3,635	37,800	100
Oct-14	8,089	88,480	196	468	4,356	-	132	1,060	-	3,326	33,600	101
Nov-14	8,476	94,800	201	380	3,464	-	117	920	-	3,143	32,700	95
Dec-14	8,808	101,040	211	380	3,468	-	131	1,080	-	3,374	38,400	82
Jan-15	10,244	120,560	227	402	3,634	-	183	1,660	-	3,353	37,500	82
Feb-15	9,283	110,800	186	341	2,869	-	253	2,340	-	3,164	33,600	83
Mar-15	7,803	84,960	193	364	3,115	-	190	1,640	-	3,233	35,100	80
Apr-15	7,944	88,160	186	372	3,213	-	165	1,380	-	3,316	35,700	85
May-15	8,326	93,920	188	366	3,164	-	125	960	-	3,111	32,400	88
Jun-15	7,833	83,360	212	413	3,660	-	132	1,040	-	3,510	36,300	101
	102,943	**1,151,040**	**2,429**	**5,335**	**48,629**	**-**	**1,913**	**16,200**	**-**	**40,452**	**427,800**	**1,103**

Table A.0. Ameresco Sites: Electrical Historical Consumption: Carson City Facilities

	Community Center			Corporate Yard #2 (Fleet)			Corporate Yard #9			Corporate Yard #11		
Month	**$**	**kWh**	**kW**	**$**	**kWh**	**kW**	**$**	**kWh**	**kW**	**$**	**kWh**	**kW**
Jul-12	2,638	19,680	117	225	2,000	-	65	400	-	46	212	-
Aug-12	3,078	23,840	130	202	1,760	-	228	2,020	-	44	189	-
Sep-12	2,812	21,360	121	250	2,240	-	302	2,760	-	35	96	-
Oct-12	2,289	18,000	94	177	1,520	-	232	2,060	-	37	119	-
Nov-12	2,046	14,400	96	217	1,920	-	251	2,260	-	36	106	-
Dec-12	2,515	21,840	91	257	2,320	-	622	5,980	-	25	-	-
Jan-13	2,783	24,000	102	311	2,880	-	971	9,540	-	25	-	-
Feb-13	2,932	26,400	102	331	3,120	-	777	7,680	-	25	-	-
Mar-13	2,948	25,040	115	307	2,880	-	430	4,140	-	25	-	-
Apr-13	2,515	22,560	90	253	2,320	-	261	2,400	-	25	-	-
May-13	2,316	19,520	90	200	1,760	-	124	1,000	-	25	-	-
Jun-13	2,338	19,040	94	192	1,680	-	85	600	-	25	-	-
	31,209	**255,680**	**1,242**	**2,920**	**26,400**	**-**	**4,347**	**40,840**	**-**	**373**	**722**	**-**
Jul-13	2,745	18,880	134	202	1,760	-	113	880	-	25	-	-
Aug-13	2,701	22,480	102	370	3,360	-	541	5,020	-	35	-	-
Sep-13	2,948	24,240	109	222	1,920	-	428	3,920	-	15	-	-
Oct-13	2,491	17,360	114	243	2,080	-	279	2,420	-	31	-	-
Nov-13	2,486	17,920	105	292	2,480	-	303	2,580	-	19	-	-
Dec-13	2,178	19,280	85	322	2,880	-	763	6,980	-	12	-	-
Jan-14	3,190	25,680	110	323	2,880	-	761	7,160	-	25	-	-
Feb-14	3,398	27,840	108	288	2,720	-	691	7,020	-	28	-	-
Mar-14	2,875	25,040	108	281	2,640	-	442	4,360	-	34	-	-
Apr-14	2,751	23,200	108	273	2,560	-	219	1,980	-	34	-	-
May-14	1,982	14,640	91	221	2,000	-	130	760	-	52	192	-
Jun-14	2,553	20,480	107	274	2,560	-	112	620	-	58	259	-
	32,299	**257,040**	**1,281**	**3,311**	**29,840**	**-**	**4,782**	**43,700**	**-**	**367**	**451**	**-**
Jul-14	2,977	22,320	135	273	2,560	-	194	1,600	-	54	221	-
Aug-14	3,032	24,480	127	331	3,200	-	454	4,500	-	51	184	-
Sep-14	3,162	26,720	126	272	2,560	-	310	2,940	-	53	207	-
Oct-14	2,001	16,640	81	255	2,400	-	302	2,900	-	62	301	-
Nov-14	1,787	15,600	69	236	2,240	-	267	2,620	-	56	243	-
Dec-14	2,121	17,920	89	402	4,080	-	502	5,220	-	62	312	-
Jan-15	2,709	25,520	98	436	4,400	-	537	5,520	-	75	454	-
Feb-15	2,819	26,320	101	377	3,600	-	546	5,380	-	67	365	-
Mar-15	2,171	20,160	75	407	3,920	-	392	3,780	-	68	357	-
Apr-15	2,497	21,360	98	368	3,520	-	208	1,860	-	62	303	-
May-15	2,743	24,480	102	291	2,720	-	53	240	-	61	288	-
Jun-15	2,395	19,280	103	344	3,280	-	65	360	-	59	266	-
	30,414	**260,800**	**1,204**	**3,991**	**38,480**	**-**	**3,832**	**36,920**	**-**	**729**	**3,501**	**-**

Table A.0. Ameresco Sites: Electrical Historical Consumption: Carson City Facilities

	Corporate Yard #7			Corporate Yard #13			Corporate Yard #3 (Sand Barn)			Public Works		
Month	$	kWh	kW	$	kWh	kW	$	kWh	kW	$	kWh	kW
Jul-12	397	3,720	-	(4)	(294)	-	67	418	-	1,169	8,112	55
Aug-12	518	4,920	-	58	326	-	70	449	-	1,353	8,736	68
Sep-12	556	5,280	-	59	335	-	71	458	-	1,490	10,368	70
Oct-12	471	4,440	-	34	87	-	65	395	-	1,237	9,792	50
Nov-12	342	3,160	-	37	119	-	57	317	-	1,970	16,800	73
Dec-12	225	2,000	-	60	353	-	85	600	-	3,320	35,136	78
Jan-13	380	3,560	-	115	898	-	112	873	-	3,556	37,152	89
Feb-13	469	4,480	-	139	1,150	-	133	1,089	-	3,638	38,064	95
Mar-13	569	5,560	-	103	797	-	199	1,780	-	2,662	25,440	85
Apr-13	503	4,880	-	66	419	-	189	1,671	-	1,631	13,152	67
May-13	348	3,280	-	146	1,234	-	154	1,311	-	1,047	6,480	55
Jun-13	295	2,720	-	58	337	-	119	949	-	935	3,984	61
	5,071	**48,000**	**-**	**871**	**5,761**	**-**	**1,321**	**10,310**	**-**	**24,009**	**213,216**	**846**
Jul-13	311	2,880	-	46	212	-	122	977	-	936	3,936	61
Aug-13	314	2,880	-	44	187	-	92	663	-	1,329	7,008	76
Sep-13	666	6,240	-	39	135	-	156	1,275	-	1,411	8,832	71
Oct-13	403	3,680	-	41	157	-	83	565	-	1,414	8,592	71
Nov-13	281	2,440	-	78	500	-	195	1,620	-	2,045	16,320	71
Dec-13	275	2,440	-	86	687	-	102	836	-	2,836	28,992	75
Jan-14	490	4,320	-	173	1,370	-	149	1,148	-	3,631	33,888	84
Feb-14	483	4,440	-	166	1,349	-	120	899	-	3,188	33,360	84
Mar-14	446	4,400	-	126	987	-	141	1,143	-	2,398	23,376	74
Apr-14	416	4,080	-	129	1,023	-	106	770	-	1,691	13,344	72
May-14	333	3,200	-	176	1,520	-	101	718	-	1,303	7,776	63
Jun-14	296	2,800	-	118	904	-	96	663	-	1,116	5,712	60
	4,713	**43,800**	**-**	**1,222**	**9,031**	**-**	**1,461**	**11,277**	**-**	**23,300**	**191,136**	**862**
Jul-14	412	4,040	-	86	562	-	95	656	-	1,355	6,192	82
Aug-14	407	4,000	-	71	405	-	86	559	-	3,040	28,656	102
Sep-14	473	4,720	-	89	597	-	95	663	-	1,678	13,248	71
Oct-14	406	4,000	-	68	373	-	95	659	-	1,384	9,936	66
Nov-14	289	2,760	-	81	516	-	97	685	-	1,419	12,000	60
Dec-14	218	2,040	-	78	489	-	101	751	-	2,435	25,296	74
Jan-15	348	3,480	-	105	793	-	128	1,047	-	2,908	30,576	84
Feb-15	360	3,560	-	139	1,147	-	134	1,100	-	2,554	25,872	75
Mar-15	369	3,520	-	134	1,054	-	121	912	-	2,015	19,056	68
Apr-15	423	4,080	-	135	1,060	-	126	974	-	1,834	15,984	71
May-15	346	3,280	-	105	753	-	116	862	-	1,247	7,728	69
Jun-15	355	3,400	-	107	774	-	105	757	-	1,057	7,440	53
	4,403	**42,880**	**-**	**1,199**	**8,523**	**-**	**1,299**	**9,625**	**-**	**22,926**	**201,984**	**875**

Table A.0. Ameresco Sites: Electrical Historical Consumption: Carson City Facilities

	Court House			Fire Station 51			Fire Station 52			Fire Station 53		
Month	**$**	**kWh**	**kW**	**$**	**kWh**	**kW**	**$**	**kWh**	**kW**	**$**	**kWh**	**kW**
Jul-12	19,389	208,800	430	2,754	29,274	66	1,579	13,981	47	516	4,502	-
Aug-12	18,075	190,080	427	3,353	30,126	72	1,653	12,914	45	1,144	7,013	-
Sep-12	17,975	195,120	383	3,470	32,234	70	1,644	12,781	46	1,041	6,390	-
Oct-12	14,919	156,120	362	2,578	25,540	56	1,169	9,587	40	817	5,805	-
Nov-12	14,797	153,960	371	2,162	26,000	51	1,063	9,709	47	299	3,513	-
Dec-12	13,201	146,040	272	2,435	29,900	55	1,067	10,659	37	287	3,362	-
Jan-13	13,913	156,480	281	2,306	27,985	57	1,086	10,890	39	474	6,235	-
Feb-13	13,312	150,480	278	2,355	29,644	56	1,068	11,009	38	455	6,048	-
Mar-13	13,957	144,360	380	2,044	25,484	50	1,090	10,097	51	509	6,813	-
Apr-13	14,454	150,600	379	1,935	23,672	48	987	8,843	45	467	6,202	-
May-13	16,424	177,240	378	1,937	23,203	50	991	8,794	45	471	6,170	-
Jun-13	16,630	179,880	380	2,183	26,303	56	987	9,144	41	475	6,184	-
	187,044	**2,009,160**	**4,321**	**29,511**	**329,365**	**687**	**14,384**	**128,408**	**521**	**6,956**	**68,237**	**-**
Jul-13	21,324	225,840	485	2,517	26,382	69	1,287	10,857	43	796	7,514	-
Aug-13	20,766	217,440	449	3,056	28,632	57	1,485	11,150	43	1,152	7,049	-
Sep-13	18,355	194,280	382	2,863	26,616	53	1,402	9,716	45	1,055	6,718	-
Oct-13	17,024	172,800	365	2,517	25,035	49	1,073	7,983	46	849	6,240	-
Nov-13	14,614	138,480	354	2,179	23,808	52	952	8,097	36	507	5,988	-
Dec-13	14,878	146,040	346	2,576	31,011	58	957	10,545	39	511	6,442	-
Jan-14	15,371	156,840	274	2,673	30,115	57	1,074	9,419	45	581	7,224	-
Feb-14	13,041	147,840	274	2,134	28,396	57	840	8,280	36	465	6,443	-
Mar-14	12,852	145,080	274	1,718	22,276	49	935	9,655	39	453	6,258	-
Apr-14	13,118	148,920	274	1,747	22,644	51	863	8,343	45	481	6,689	-
May-14	14,485	156,360	354	1,801	23,678	48	910	8,513	40	442	6,078	-
Jun-14	17,154	189,120	394	2,019	26,544	56	1,042	11,148	40	533	7,431	-
	192,981	**2,039,040**	**4,225**	**27,800**	**315,137**	**656**	**12,820**	**113,706**	**497**	**7,825**	**80,074**	**-**
Jul-14	19,229	214,560	432	2,362	26,909	57	1,278	10,557	45	759	7,128	-
Aug-14	18,828	204,960	464	3,053	28,762	60	1,555	11,357	47	1,085	6,537	-
Sep-14	17,280	189,960	414	2,956	26,822	61	1,464	10,712	43	1,111	6,858	-
Oct-14	15,927	178,080	379	2,446	23,779	59	1,150	8,614	51	879	5,833	-
Nov-14	13,978	153,360	378	1,651	22,113	51	854	8,891	38	430	6,128	-
Dec-14	14,732	166,800	367	1,904	26,639	52	966	10,612	40	452	6,480	-
Jan-15	13,529	160,920	275	1,852	25,372	51	1,111	12,288	46	556	8,005	-
Feb-15	13,042	138,120	348	1,767	22,707	53	969	9,975	40	520	7,158	-
Mar-15	14,238	155,520	350	1,880	24,602	52	1,073	11,636	41	488	6,695	-
Apr-15	15,968	181,320	354	1,780	23,163	50	892	9,176	36	506	6,966	-
May-15	15,398	165,120	410	1,582	20,448	46	956	9,505	44	433	5,948	-
Jun-15	16,416	180,360	410	1,871	24,088	58	1,033	10,992	41	408	5,568	-
	188,565	**2,089,080**	**4,581**	**25,104**	**295,404**	**650**	**13,301**	**124,315**	**512**	**7,627**	**79,304**	**-**

Table A.0. Ameresco Sites: Electrical Historical Consumption: Carson City Facilities

	Health & Human Resources			Juvenile Administration			Juvenile Annex			Juvenile Detention		
Month	$	kWh	kW	$	kWh	kW	$	kWh	kW	$	kWh	kW
Jul-12	6,666	73,640	136	447	4,211	-	212	1,561	-	2,419	26,400	50
Aug-12	7,124	78,720	142	441	4,143	-	303	2,461	-	2,282	24,360	50
Sep-12	7,564	84,920	141	478	4,509	-	274	2,172	-	2,496	27,360	50
Oct-12	6,634	72,360	138	348	3,218	-	243	1,856	-	1,922	20,280	44
Nov-12	6,140	65,720	140	316	2,913	-	194	1,381	-	1,705	18,240	38
Dec-12	6,132	67,320	129	319	2,949	-	237	1,813	-	1,684	17,640	40
Jan-13	4,832	52,360	106	291	2,678	-	255	1,991	-	1,417	14,880	34
Feb-13	5,029	57,120	101	315	2,962	-	272	2,185	-	1,519	16,920	32
Mar-13	5,008	57,000	101	294	2,744	-	294	2,434	-	1,443	15,960	31
Apr-13	4,907	52,960	118	296	2,750	-	236	1,839	-	1,569	16,320	40
May-13	5,090	54,440	120	298	2,758	-	219	1,656	-	1,658	18,000	36
Jun-13	6,655	74,240	136	346	3,237	-	201	1,465	-	2,073	23,160	41
	71,782	**790,800**	**1,508**	**4,188**	**39,072**	**-**	**2,942**	**22,814**	**-**	**22,188**	**239,520**	**486**
Jul-13	5,965	64,560	135	385	3,581	-	217	1,613	-	2,102	23,160	41
Aug-13	6,801	72,960	137	413	3,773	-	223	1,643	-	2,184	21,000	59
Sep-13	7,156	77,720	134	379	3,442	-	284	2,213	-	2,069	2,100	48
Oct-13	6,056	63,280	128	302	2,641	-	230	1,677	-	1,363	13,320	32
Nov-13	5,145	49,880	118	271	2,285	-	204	1,395	-	1,387	13,560	29
Dec-13	4,464	45,040	110	308	2,753	-	215	1,709	-	1,377	16,440	30
Jan-14	5,052	50,320	103	288	2,536	-	282	2,099	-	1,464	14,640	26
Feb-14	4,360	45,480	87	284	2,669	-	262	1,940	-	1,322	14,640	29
Mar-14	4,851	53,320	112	266	2,476	-	245	1,812	-	1,303	14,520	28
Apr-14	4,980	54,280	118	250	2,314	-	222	1,565	-	1,360	14,160	33
May-14	5,185	56,920	120	266	2,477	-	208	1,419	-	1,517	16,080	38
Jun-14	6,041	68,160	128	299	2,829	-	212	1,467	-	2,224	23,760	55
	66,056	**701,920**	**1,430**	**3,709**	**33,776**	**-**	**2,802**	**20,552**	**-**	**19,672**	**187,380**	**448**
Jul-14	5,927	65,720	196	307	2,922	-	233	1,691	-	2,224	22,920	61
Aug-14	6,322	71,680	136	348	3,379	-	262	2,004	-	2,568	28,320	60
Sep-14	6,386	73,080	134	326	3,144	-	229	1,656	-	2,228	24,240	54
Oct-14	5,785	64,520	132	264	2,493	-	206	1,408	-	1,800	18,600	51
Nov-14	5,030	55,880	128	223	2,102	-	187	1,226	-	1,520	15,720	46
Dec-14	4,231	46,200	115	272	2,646	-	212	1,518	-	1,429	16,440	33
Jan-15	4,327	49,320	105	294	2,847	-	246	1,885	-	1,288	14,280	32
Feb-15	4,254	48,520	94	289	2,679	-	254	1,924	-	1,147	12,720	26
Mar-15	4,715	52,160	111	298	2,777	-	246	1,796	-	1,218	13,920	25
Apr-15	4,731	52,080	113	289	2,691	-	287	2,226	-	1,166	12,720	28
May-15	4,716	51,840	116	282	2,622	-	218	1,506	-	1,153	12,480	29
Jun-15	5,844	67,760	123	323	3,061	-	213	1,459	-	1,743	18,120	49
	62,267	**698,760**	**1,503**	**3,515**	**33,363**	**-**	**2,792**	**20,299**	**-**	**19,482**	**210,480**	**494**

Table A.0. Ameresco Sites: Electrical Historical Consumption: Carson City Facilities

	Library			Senior Center			Sheriff's Administration			Sheriff's Dispatch		
Month	$	kWh	kW	$	kWh	kW	$	kWh	kW	$	kWh	kW
Jul-12	4,322	45,600	101	3,427	32,720	104	6,534	69,760	148	1,133	12,020	25
Aug-12	4,135	42,960	100	3,756	35,360	116	6,163	63,280	155	1,145	12,120	25
Sep-12	4,092	42,360	100	4,073	39,760	116	5,932	62,240	140	1,090	11,500	24
Oct-12	3,695	36,960	100	3,403	32,000	105	4,905	50,880	121	1,095	11,440	25
Nov-12	3,080	30,120	89	2,923	27,280	93	4,443	47,600	101	1,093	11,800	23
Dec-12	2,492	25,800	62	2,968	29,280	84	4,179	46,080	86	1,023	10,960	22
Jan-13	2,138	22,080	55	2,720	26,960	76	3,982	45,280	76	973	10,760	19
Feb-13	2,162	21,840	61	2,719	27,840	74	3,375	37,440	74	929	10,180	20
Mar-13	2,505	25,440	70	2,701	27,520	75	4,006	44,000	91	1,041	11,360	23
Apr-13	2,773	28,200	76	2,602	26,240	74	4,209	46,000	95	990	9,820	-
May-13	3,264	32,520	92	2,566	24,720	78	4,931	54,160	106	1,154	12,760	23
Jun-13	3,390	33,120	100	3,164	30,800	94	5,280	57,200	119	1,119	12,260	23
	38,046	**387,000**	**1,006**	**37,023**	**360,480**	**1,089**	**57,939**	**623,920**	**1,312**	**12,783**	**136,980**	**252**
Jul-13	3,443	33,120	100	3,348	31,040	110	6,469	69,680	138	1,385	15,080	28
Aug-13	4,834	50,520	104	4,121	38,560	122	6,628	70,000	138	1,306	13,640	27
Sep-13	3,846	37,560	101	3,902	37,040	110	5,917	60,800	135	1,366	14,020	30
Oct-13	3,580	33,240	98	3,207	28,560	102	5,720	58,000	122	1,171	11,400	28
Nov-13	3,007	24,960	98	2,786	24,880	79	4,931	46,240	122	1,126	11,040	23
Dec-13	2,571	26,280	70	2,429	23,280	79	4,583	48,160	98	1,170	11,740	22
Jan-14	2,652	24,960	61	3,157	29,680	77	4,951	51,120	83	1,442	14,859	21
Feb-14	2,441	25,560	64	2,375	26,000	71	4,502	50,240	99	930	10,320	20
Mar-14	2,359	24,360	64	2,355	23,360	70	4,091	44,240	99	898	10,000	19
Apr-14	2,508	23,880	81	2,406	22,560	80	5,066	58,000	102	1,010	10,420	19
May-14	3,092	32,400	81	2,568	25,680	75	5,066	57,040	108	1,015	11,080	23
Jun-14	3,730	38,760	100	3,061	29,920	94	5,419	60,480	119	1,175	13,100	25
	38,063	**375,600**	**1,022**	**35,716**	**340,560**	**1,069**	**63,343**	**674,000**	**1,363**	**13,992**	**146,699**	**285**
Jul-14	4,117	42,000	117	3,309	31,520	107	6,067	67,200	139	1,256	13,720	29
Aug-14	4,069	42,000	114	3,780	37,360	116	5,815	65,280	130	1,282	14,360	28
Sep-14	4,012	41,160	114	3,599	35,840	109	5,783	64,640	131	1,382	16,000	27
Oct-14	3,635	36,600	111	3,220	30,560	107	5,078	54,720	133	1,177	13,080	27
Nov-14	3,044	30,360	100	2,528	24,320	83	4,225	48,240	102	1,076	12,480	24
Dec-14	2,818	30,480	78	2,408	26,480	77	4,650	55,120	100	1,053	12,280	23
Jan-15	2,767	28,920	80	2,569	26,240	79	4,628	55,440	91	987	11,680	20
Feb-15	2,808	28,800	80	2,530	26,960	72	4,231	47,040	98	1,021	11,320	23
Mar-15	2,803	29,040	78	2,630	26,320	75	4,408	49,040	102	1,065	11,820	24
Apr-15	3,504	36,600	97	2,576	26,320	74	5,097	57,440	115	1,218	14,120	24
May-15	3,095	30,720	97	2,582	26,000	78	5,032	55,600	123	1,111	12,480	25
Jun-15	3,220	30,840	108	2,935	29,760	88	5,395	60,880	124	1,113	12,360	26
	39,892	**407,520**	**1,174**	**34,666**	**347,680**	**1,065**	**60,410**	**680,640**	**1,388**	**13,741**	**155,700**	**300**

Table A.0. Ameresco Sites: Electrical Historical Consumption: Carson City Facilities

	Mills Park & Marv Pavilion			Centennial Park Complex			Pete Livermore Sports Complex			Fairview Street Lighting		
Month	$	kWh	kW	$	kWh	kW	$	kWh	kW	$	kWh	kW
Jul-12	1,217	11,396	-	4,800	25,878	273	1,895	9,440	111	438	3,628	-
Aug-12	1,224	11,443	-	4,741	25,000	273	917	8,660	-	451	3,740	-
Sep-12	1,090	10,101	-	4,785	20,087	303	1,777	8,700	104	494	4,167	-
Oct-12	932	8,545	-	5,185	26,339	303	912	8,580	-	506	4,300	-
Nov-12	1,472	12,195	48	4,580	18,651	301	969	9,160	-	549	4,748	-
Dec-12	1,425	13,536	-	4,096	12,183	298	1,502	10,000	70	661	5,870	-
Jan-13	1,571	13,478	48	574	5,247	-	1,504	9,840	72	626	5,551	-
Feb-13	1,527	13,256	48	522	4,764	-	1,009	9,660	-	622	5,583	-
Mar-13	1,490	12,960	46	568	5,294	-	857	8,240	-	576	5,111	-
Apr-13	1,123	10,653	-	563	5,234	-	1,663	9,980	88	465	3,969	-
May-13	1,117	10,520	-	545	5,029	-	1,815	9,660	104	443	3,711	-
Jun-13	1,035	9,682	-	3,870	9,509	296	1,790	9,180	104	455	3,828	-
	15,222	**137,765**	**190**	**34,827**	**163,215**	**2,047**	**16,610**	**111,100**	**653**	**6,286**	**54,206**	**-**
Jul-13	1,142	10,614	-	5,336	29,589	301	2,069	11,340	115	438	3,617	-
Aug-13	1,031	9,325	-	5,398	29,933	298	2,060	10,600	118	464	3,792	-
Sep-13	885	7,885	-	4,793	20,985	298	995	9,200	-	485	3,994	-
Oct-13	1,024	9,034	-	5,375	29,174	296	1,036	9,600	-	516	4,221	-
Nov-13	1,111	9,649	-	4,858	20,957	298	1,047	9,540	-	570	4,607	-
Dec-13	1,245	11,230	-	3,554	8,806	292	1,939	11,400	118	649	5,688	-
Jan-14	1,733	14,160	45	905	7,946	-	1,285	11,380	32	649	5,510	-
Feb-14	1,578	13,863	45	1,018	9,540	-	1,239	10,500	31	602	5,357	-
Mar-14	1,556	13,348	48	843	8,278	-	921	9,120	-	538	4,670	-
Apr-14	1,145	11,144	-	879	8,669	-	1,780	8,720	106	493	4,191	-
May-14	1,061	10,244	-	790	7,715	-	2,478	10,200	113	481	4,060	-
Jun-14	1,488	13,031	43	4,352	16,649	293	2,341	14,140	123	465	3,882	-
	14,998	**133,527**	**181**	**38,101**	**198,241**	**2,076**	**19,190**	**125,740**	**756**	**6,350**	**53,589**	**-**
Jul-14	1,213	11,001	-	5,222	30,083	287	2,103	12,160	113	429	3,508	-
Aug-14	1,021	9,878	-	4,880	25,704	284	2,060	11,440	114	481	4,082	-
Sep-14	1,043	10,134	-	4,174	15,432	284	3,530	22,980	121	476	4,035	-
Oct-14	1,118	10,938	-	4,953	26,326	288	1,479	9,900	70	477	4,077	-
Nov-14	1,048	10,398	-	5,111	25,463	310	1,931	9,880	115	501	4,431	-
Dec-14	1,513	13,611	45	3,581	9,853	266	1,024	10,600	-	613	5,680	-
Jan-15	1,759	16,614	46	726	7,298	-	945	9,640	-	610	5,576	-
Feb-15	1,953	18,502	49	594	5,724	-	870	8,460	-	581	5,060	-
Mar-15	1,857	16,842	50	593	5,511	-	1,712	8,460	101	584	5,066	-
Apr-15	1,877	17,478	48	585	5,429	-	1,931	10,780	107	519	4,397	-
May-15	1,646	14,629	45	745	7,140	-	658	6,420	-	470	3,898	-
Jun-15	1,250	12,149	-	4,311	18,269	282	2,008	11,080	112	473	3,937	-
	17,297	**162,174**	**283**	**35,472**	**182,232**	**2,001**	**20,252**	**131,800**	**853**	**6,214**	**53,747**	**-**

Table A.1. Ameresco Sites: Natural Gas Historical Consumption: Carson City Facilities

	Aquatic Facility		Building Department		Cemetery		City Hall	
Month	$	Therm	$	Therm	$	Therm	$	Therm
Aug-13	2,648	3,827	30	-	30	-	171	5
Sep-13	2,750	4,003	30	-	40	12	173	8
Oct-13	5,759	8,255	41	12	95	69	526	501
Nov-13	6,230	8,299	84	56	182	159	1,067	1,172
Dec-13	8,204	11,123	263	243	278	260	2,772	3,393
Jan-14	8,751	11,897	255	235	224	203	2,786	3,410
Feb-14	7,072	9,494	174	150	195	173	2,065	2,469
Mar-14	6,398	8,531	92	64	147	122	1,473	1,699
Apr-14	6,101	7,903	75	46	100	71	1,443	1,622
May-14	6,912	8,896	45	15	41	11	1,082	1,147
Jun-14	4,518	5,612	33	3	30	-	375	260
Jul-14	3,522	3,912	30	-	30	-	200	37
	68,865	**91,752**	**1,152**	**824**	**1,393**	**1,080**	**14,134**	**15,723**
Aug-14	3,785	4,070	30	-	30	-	197	32
Sep-14	4,523	4,957	30	-	31	1	216	53
Oct-14	5,852	6,521	37	6	43	11	725	615
Nov-14	9,196	10,475	116	76	215	165	2,005	2,022
Dec-14	8,899	10,121	201	152	269	213	2,584	2,659
Jan-15	9,752	10,857	319	252	265	203	3,224	3,286
Feb-15	6,938	7,459	201	147	212	157	2,411	2,373
Mar-15	6,314	6,747	186	134	143	95	2,114	2,059
Apr-15	5,910	6,154	118	74	85	46	1,812	1,705
May-15	7,455	7,787	66	30	30	-	1,053	908
Jun-15	6,855	7,126	35	4	32	-	819	668
Jul-15	3,792	4,175	30	-	-	-	327	180
	79,271	**86,449**	**1,368**	**875**	**1,355**	**891**	**17,487**	**16,560**

Table A.1. Ameresco Sites: Natural Gas Historical Consumption: Carson City Facilities

	Community Center		Corporate Yard #2 (Fleet)		Corporate Yard #9		Public Works	
Month	$	Therm	$	Therm	$	Therm	$	Therm
Aug-13	392	86	177	14	42	14	169	1
Sep-13	374	59	177	14	42	14	171	4
Oct-13	1,155	1,147	334	231	140	121	339	237
Nov-13	2,153	2,320	632	604	454	444	1,176	1,152
Dec-13	4,716	5,708	1,607	1,875	1,241	1,270	2,635	2,933
Jan-14	4,902	5,947	1,647	1,926	1,242	1,270	2,671	3,013
Feb-14	3,109	3,610	1,185	1,324	836	844	1,837	1,993
Mar-14	2,202	2,429	844	880	500	492	1,182	1,184
Apr-14	1,762	1,814	827	836	327	305	832	752
May-14	1,203	1,087	614	560	153	125	492	347
Jun-14	605	337	269	127	71	41	252	64
Jul-14	432	112	191	27	48	17	220	25
	23,005	**24,656**	**8,504**	**8,418**	**5,095**	**4,957**	**11,974**	**11,705**
Aug-14	435	110	191	25	50	18	221	25
Sep-14	408	80	191	26	58	25	211	14
Oct-14	853	571	439	299	120	80	280	84
Nov-14	2,449	2,326	992	907	556	469	1,033	880
Dec-14	3,407	3,381	1,199	1,135	900	776	1,696	1,566
Jan-15	4,437	4,409	1,524	1,456	1,391	1,190	2,446	2,285
Feb-15	3,068	2,890	1,043	926	902	753	1,419	1,235
Mar-15	2,592	2,386	1,136	1,024	718	594	1,208	1,025
Apr-15	1,979	1,704	1,057	920	475	377	736	542
May-15	1,047	809	781	629	253	188	226	139
Jun-15	454	241	330	166	118	74	93	27
Jul-15	302	104	206	43	50	18	62	1
	21,432	**19,011**	**9,089**	**7,556**	**5,590**	**4,562**	**9,631**	**7,823**

Table A.1. Ameresco Sites: Natural Gas Historical Consumption: Carson City Facilities

	Court House		Fire Station 51		Fire Station 53		Health & Human Resources	
Month	$	Therm	$	Therm	$	Therm	$	Therm
Aug-13	2,627	3,895	73	51	49	22	1,757	2,438
Sep-13	3,089	4,692	86	67	50	24	1,796	2,498
Oct-13	4,248	6,009	764	815	61	36	2,290	2,795
Nov-13	6,148	8,132	3,142	3,263	127	101	3,323	4,094
Dec-13	10,729	14,821	4,105	4,273	288	270	3,965	4,926
Jan-14	9,862	13,572	3,165	3,903	665	666	3,039	3,722
Feb-14	8,600	11,764	1,028	1,119	404	392	2,941	3,594
Mar-14	6,185	8,313	722	721	286	268	2,868	3,496
Apr-14	4,893	6,304	556	494	241	220	2,328	2,698
May-14	4,264	5,346	414	309	124	95	2,086	2,396
Jun-14	3,190	3,872	307	174	89	60	2,332	2,703
Jul-14	2,806	3,083	272	121	55	25	1,972	1,996
	66,641	**89,803**	**14,633**	**15,310**	**2,439**	**2,179**	**30,696**	**37,356**
Aug-14	3,307	3,532	289	134	59	26	1,945	1,966
Sep-14	3,470	3,728	281	125	58	25	2,125	2,165
Oct-14	4,123	4,490	328	177	64	30	2,186	2,214
Nov-14	6,659	7,491	710	597	91	54	2,394	2,441
Dec-14	9,352	10,697	1,111	1,038	305	245	2,817	2,905
Jan-15	12,370	13,930	1,554	1,490	497	414	3,164	3,158
Feb-15	7,670	8,329	966	844	346	273	3,649	3,670
Mar-15	7,347	7,960	778	646	320	250	2,567	2,526
Apr-15	6,933	7,329	424	335	190	137	2,706	2,595
May-15	4,945	5,051	234	172	116	72	3,826	3,740
Jun-15	4,228	4,260	175	122	75	38	2,845	2,733
Jul-15	3,252	3,548	128	89	70	34	2,280	2,551
	73,656	**80,345**	**6,978**	**5,769**	**2,189**	**1,598**	**32,503**	**32,664**

Table A.1. Ameresco Sites: Natural Gas Historical Consumption: Carson City Facilities

	Juvenile Detention		Library		Senior Center		Sheriff's Administration	
Month	$	Therm	$	Therm	$	Therm	$	Therm
Aug-13	300	204	248	124	422	283	891	1,110
Sep-13	299	202	285	180	426	398	1,014	1,298
Oct-13	702	748	656	684	953	1,039	1,348	1,645
Nov-13	1,187	1,301	946	987	1,529	1,774	1,642	1,868
Dec-13	2,002	2,390	1,775	2,094	2,689	3,285	2,449	2,959
Jan-14	1,993	2,377	1,818	2,149	1,746	2,054	2,798	3,411
Feb-14	1,531	1,775	1,317	1,496	1,548	1,796	2,472	2,986
Mar-14	1,242	1,398	927	988	1,145	1,270	2,110	2,518
Apr-14	1,025	1,090	405	302	911	932	1,696	1,936
May-14	765	749	528	452	630	579	1,653	1,855
Jun-14	394	283	307	174	414	309	1,026	1,072
Jul-14	309	164	218	58	379	234	740	663
	11,750	**12,681**	**9,430**	**9,688**	**12,792**	**13,953**	**19,840**	**23,321**
Aug-14	314	162	289	134	386	242	961	877
Sep-14	314	162	282	127	466	331	1,124	1,057
Oct-14	611	489	464	327	724	612	1,258	1,200
Nov-14	1,148	1,079	980	894	1,626	1,605	1,728	1,711
Dec-14	1,536	1,506	1,229	1,168	2,029	2,049	2,492	2,549
Jan-15	2,021	1,992	1,733	1,683	2,025	1,964	2,994	3,028
Feb-15	1,408	1,312	1,200	1,092	1,696	1,616	2,060	1,994
Mar-15	1,163	1,053	1,097	983	1,104	989	1,998	1,929
Apr-15	907	766	979	841	1,152	1,010	1,836	1,724
May-15	604	447	694	540	819	668	1,819	1,688
Jun-15	496	337	411	249	410	248	1,837	1,706
Jul-15	330	183	244	86	355	227	1,962	2,028
	10,852	**9,488**	**9,603**	**8,124**	**12,793**	**11,561**	**22,068**	**21,491**

Table A.1. Ameresco Sites: Natural Gas Historical Consumption: Carson City Facilities

	Corporate Yard #11		Corporate Yard #7		Corporate Yard #13		Fire Station 52	
Month	$	Therm	$	Therm	$	Therm	$	Therm
Nov-13	230	210	626	597	398	386	147	91
Dec-13	504	497	1,565	1,821	834	843	239	187
Jan-14	507	500	1,646	1,925	726	729	187	133
Feb-14	366	352	1,074	1,179	738	742	164	108
Mar-14	235	215	675	660	371	357	131	74
Apr-14	196	170	544	477	316	293	158	99
May-14	128	99	323	194	161	133	119	60
Jun-14	60	30	212	55	54	24	86	26
Jul-14	46	15	177	10	30	-	84	21
Aug-14	46	14	173	6	30	-	83	20
Sep-14	46	14	178	11	30	-	86	23
Oct-14	76	41	236	75	77	42	128	60
	2,441	**2,157**	**7,428**	**7,010**	**3,766**	**3,549**	**1,611**	**902**
Nov-14	236	184	788	682	387	318	239	159
Dec-14	354	289	1,460	1,422	530	446	322	233
Jan-15	520	428	1,955	1,919	737	618	319	224
Feb-15	423	339	1,673	1,419	551	450	250	164
Mar-15	234	176	1,491	1,262	578	473	194	115
Apr-15	265	199	571	459	406	319	147	73
May-15	189	134	148	99	245	181	108	40
Jun-15	79	41	62	27	77	39	87	22
Jul-15	53	21	41	10	30	-	81	20
Aug-15	49	18	42	11	30	-	49	18
Sep-15	54	23	50	19	45	14	52	21
Oct-15	58	28	118	87	74	44	67	37
	2,514	**1,880**	**8,398**	**7,416**	**3,690**	**2,902**	**1,914**	**1,126**

Table A.1. Ameresco Sites: Natural Gas Historical Consumption: Carson City Facilities

	Juvenile Administration		Juvenile Annex		Mills Park & Marv Pavilion	
Month	$	Therm	$	Therm	$	Therm
Nov-13	114	88	126	100	169	145
Dec-13	257	238	351	336	327	311
Jan-14	252	232	334	318	409	397
Feb-14	200	178	209	187	341	326
Mar-14	135	110	143	118	228	207
Apr-14	109	81	100	72	161	134
May-14	79	50	50	20	82	53
Jun-14	40	10	34	4	58	28
Jul-14	31	1	34	4	95	61
Aug-14	30	-	36	5	222	172
Sep-14	31	1	35	4	255	202
Oct-14	62	28	35	4	293	235
	1,341	**1,017**	**1,485**	**1,172**	**2,638**	**2,271**
Nov-14	132	91	123	83	119	79
Dec-14	203	154	220	169	210	160
Jan-15	293	230	329	262	286	224
Feb-15	204	150	218	162	433	348
Mar-15	168	119	175	125	217	161
Apr-15	135	89	157	108	77	40
May-15	88	49	68	32	30	-
Jun-15	46	13	36	5	37	6
Jul-15	31	1	36	5	47	15
Aug-15	30	-	35	5	31	1
Sep-15	33	3	35	5	30	-
Oct-15	38	8	34	4	33	3
	1,402	**907**	**1,468**	**965**	**1,550**	**1,037**

Appendix B. Data Logger and EMS Trend Point Tables

Glossary of Terms:

CHWS - Chilled water supply

CHWR - Chilled water return

CHWP - Chilled water pump

HHWS - Heating hot water supply

HHWR - Heating hot water return

HWP - Heating hot water pump

CWS - Condenser water supply

CWR - Condenser water return

OA - Outside air

OAT - Outside air temperature

HX - Heat exchanger

CD - Cold deck

HD - Hot deck

RAT - Return air temperature

MAT - Mixed air temperature

SAT – Supply air temperature

RA - Return air

DP - Differential pressure

SP – Static Pressure

RH - Relative humidity

Building	Type of EMS Data	Description	Points
Library	Screenshots	Schedule	Occupied and Unoccupied Schedule
		MZ-1	OAT
			Unoccupied Mode Setpoint
			CD Temperature
			HD Temperature
			RAT
			MAT
			Supply Fan Status
			Heat OA Lockout Temperature
			Compressors OA Lockout Temperature
			Economizer OA Lockout Temperature
			MAT Low Limit
			OA Damper Position
			Zone Damper Position
			Zone Room Temperature
			Zone Room Setpoint
			Zone Supply Temperature
		AC 1-9	Fan Status
			Space Temperature
			Occupied Mode Setpoint
			Unoccupied Mode Setpoint
			OAT
			Supply Air Temperature
			Equipment Runtimes
			Heating/Cooling Lockout Temperature
			Heating/Cooling Signal

Building	Type of EMS Data	Description	Points
Public Safety	Screenshots	Schedule	Occupied and Unoccupied Schedule
		AHU 1-3	OAT
			Unoccupied Mode Setpoint
			Occupied Mode Setpoint
			Space Temperature
			SAT
			RAT
			MAT
			RA CO2 PPM
			Supply Fan Status
			Supply/Return Fan Speed
			Economizer OA Lockout Temperature
			HW/CHW valve position
			CHWS Temperature
			HWS Temperature
			OA Damper Position
			OA Min. Damper Position
		AHU 4,6,7,9,10,11	OAT
			Unoccupied Mode Setpoint
			Occupied Mode Setpoint
			Space Temperature
			SAT
			RAT
			MAT
			RA CO2 PPM
			Supply Fan Status
			Supply/Return Fan Speed
			Supply Duct Pressure

			Building Pressure
			Highest VAV Cooling Signal
			Economizer OA Lockout Temperature
			HW/CHW valve position
			CHWS Temperature
			HWS Temperature
			OA Damper Position
			OA Min. Damper Position
		AHU 5	**OAT**
			Unoccupied Mode Setpoint
			Occupied Mode Setpoint
			Space Temperature
			SAT
			MAT
			Supply Fan Status
			Economizer OA Lockout Temperature
			HW/CHW valve position
			OA Damper Position
			OA Min. Damper Position
		AHU 8	**Unoccupied Mode Setpoint**
			Occupied Mode Setpoint
			Space Temperature
			SAT
			CHW valve position
		AHU 12	**OAT**
			Unoccupied Mode Setpoint
			Occupied Mode Setpoint
			Space Temperature
			SAT

			HW/CHW valve position
			Heat OA Lockout Temperature
		Boilers	**Boilers Status**
			Boiler HW Setpoint
			HWS Temperature
			HWR Temperature
			HWP 1 Status
			HWP 2 Status
			HWP 1 Speed
			HWP 2 Speed
			OAT
			OAT Lockout Temperature
			DP Setpoint
		Chillers	**Chiller Status**
			CHWS Temperature
			CHWR Temperature
			CHWP 1-5 Status
			CHWP 1-2 Speed
			CWP 1-3 Status
			DP Setpoint
			OAT
			OAT Lockout Temperature
		Cooling Towers	**Cooling tower Status**
			Cooling Tower Speed
			CWS Setpoint
			CWS Temperature
			CWR Temperature

			Sump Heater Setpoint
Building	**Type of EMS Data**	**Description**	**Points**
Senior Center	Screenshots	Schedule	Occupied and Unoccupied Schedule
		AC 1-9	Fan Status
			Space Temperature
			Occupied Mode Setpoint
			Unoccupied Mode Setpoint
			OAT
			Supply Air Temperature
			Equipment Runtimes
			Heating/Cooling Lockout Temperature
			Heating/Cooling Signal
Aquatic Center	Screenshots	Schedule	Occupied and Unoccupied Schedule
		MUA 1-2	OAT
			Heating Setpoint
			Night Low Setpoint
			Space Temperature
			Supply Air Temperature
			Heating Signal
			OA Heat Lockout Temperature
			Space Humidity
			Humidity Setpoint
			Exhaust Air Temperature
			OA Damper Control
			Exhaust Damper Position
			Building Static Setpoint
			Building Static Pressure

			Supply/Return Fan VFD Speed
		MUA-3	**OAT**
			Heating Setpoint
			Night Low Setpoint
			Space Temperature
			Supply Air Temperature
			Heating Signal
			OA Heat Lockout Temperature
			Space Humidity
			Humidity Setpoint
			Exhaust Air Temperature
			OA Damper Position
			OA Damper Minimum Position
			Building Static Pressure
			Supply/Return Fan VFD Speed
		MUA-4	**OAT**
			Heating Setpoint
			Max Heating Setpoint
			OA Heating Sepoint
			Night Low Setpoint
			Space Temperature
			Supply Air Temperature
			Gas Valve Signal
			Supply Fan VFD Speed
		AC-1	**Unoccupied Mode Setpoint**
			Occupied Mode Setpoint
			Fan Mode
			Cooling/Heating Status
			Space Temperature
			Zone Discharge Temperature

			SAT
			OAT
		Boilers	**Boilers Status**
			Boiler HW Setpoint
			HWS Temperature
			HWR Temperature
			HWP 1 Status
			Cogen Status
		Indoor Pool	**Pool Temperature**
			Pool Occupied Setpoint
			Pool Max Setpoint
			Pump Status
			Pump VFD Speed
			HWS Temperature
			HW Valve Position
		Outdoor Pool	**Pool Temperature**
			Pool Occupied Setpoint
			Pool Max Setpoint
			Pump Status
			Pump VFD Speed
			HWS Temperature
			HW Valve Position
		Therapy Pool	**Pool Temperature**
			Pool Occupied Setpoint
			Pool Max Setpoint
			Pump Status
			Pump VFD Speed
			HWS Temperature
			HW Valve Position

		Tot Pool	Pool Temperature
			Pool Occupied Setpoint
			Pool Max Setpoint
			Pump Status
			Pump VFD Speed
			HWS Temperature
			HW Valve Position
City Hall	Screenshots	Schedule	Occupied and Unoccupied Schedule
		MZ-1	OAT
			CD/HD Setpoint
			CD/HD Temperature
			MAT
			MAT Setpoint
			HW Valve Position
			HW Supply Temperature
			Compressor Lockouts
			Return Air Damper Position
			Min. OA Damper Position
			OA Damper Position
			Zone Damper Position
			Zone Room Temperature
			Zone Room Setpoint
			Zone Supply Temperature
		Boilers	Boilers Status
			OA Lockout Temperature
			HWS Temperature
			HWR Temperature
			HWP 1 Status
			OAT
		Garage Exhaust Fan	OAT

			North/South C02 Sensor
			PPM Setpoint
			PPM Throttling Range Setpoint
			Garage Exhaust Fan Status

Building	Type of EMS Data	Description	Points
Aquatic Center	**Trends**	**MUA 1-2**	**Supply Fan Status**
			Return Fan Status
Community Center	**Trends**	**AC-11, AC-12**	**Occupied Command Status**
			Supply Fan Status
Public Safety	**Trends**	**AHU-6**	**Duct Static Pressure**
		AHU-10	**Duct Static Pressure**
		AHU-11	**Duct Static Pressure**
Library	**Trends**	**AC-6, AC-9**	**Supply Fan Status**
			Occupied Command Status
Senior Center	**Trends**	**AC 1-2,4-9**	**Supply Fan Status**
			Occupied Command Status

Due to the large file size, all digital EMS screenshots and CSV trend data can be made available on request.

Appendix C. Facility EUI vs. Benchmark EUI Analysis

Table C.0. Carson City Facility Electrical and Natural Gas Energy Use Intensities

	Aquatic Facility						Building Department					
Month	kWh	Therms	Electric EUI	Natural Gas EUI	Benchmark Electric EUI	Benchmark Natural Gas EUI	kWh	Therms	Electric EUI	Natural Gas EUI	Benchmark Electric EUI	Benchmark Natural Gas EUI
Jul-14	94,480	3,912	2.91	12.04	1.63	4.72	6,024	-	0.60	-	0.38	1.07
Aug-14	97,840	4,070	3.01	12.52	1.63	4.72	6,158	-	0.62	-	0.38	1.07
Sep-14	92,640	4,957	2.85	15.25	1.63	4.72	5,504	-	0.55	-	0.38	1.07
Oct-14	88,480	6,521	2.72	20.07	1.63	4.72	4,356	6	0.44	0.06	0.38	1.07
Nov-14	94,800	10,475	2.92	32.23	1.63	4.72	3,464	76	0.35	0.76	0.38	1.07
Dec-14	101,040	10,121	3.11	31.14	1.63	4.72	3,468	152	0.35	1.52	0.38	1.07
Jan-15	120,560	10,857	3.71	33.41	1.63	4.72	3,634	252	0.36	2.52	0.38	1.07
Feb-15	110,800	7,459	3.41	22.95	1.63	4.72	2,869	147	0.29	1.47	0.38	1.07
Mar-15	84,960	6,747	2.61	20.76	1.63	4.72	3,115	134	0.31	1.34	0.38	1.07
Apr-15	88,160	6,154	2.71	18.94	1.63	4.72	3,213	74	0.32	0.74	0.38	1.07
May-15	93,920	7,787	2.89	23.96	1.63	4.72	3,164	30	0.32	0.30	0.38	1.07
Jun-15	83,360	7,126	2.57	21.93	1.63	4.72	3,660	4	0.37	0.04	0.38	1.07
	1,151,040	**86,186**	**35.42**	**265.20**	**19.50**	**56.60**	**48,629**	**875**	**4.86**	**8.75**	**4.50**	**12.80**

	Cemetery						City Hall					
Month	kWh	Therms	Electric EUI	Natural Gas EUI	Benchmark Electric EUI	Benchmark Natural Gas EUI	kWh	Therms	Electric EUI	Natural Gas EUI	Benchmark Electric EUI	Benchmark Natural Gas EUI
Jul-14	1,180	-	0.39	-	0.38	1.07	35,700	37	1.05	0.11	1.04	3.89
Aug-14	1,580	-	0.53	-	0.38	1.07	39,000	32	1.14	0.09	1.04	3.89
Sep-14	1,360	1	0.45	0.03	0.38	1.07	37,800	53	1.11	0.16	1.04	3.89
Oct-14	1,060	11	0.35	0.37	0.38	1.07	33,600	615	0.99	1.80	1.04	3.89
Nov-14	920	165	0.31	5.50	0.38	1.07	32,700	2,022	0.96	5.93	1.04	3.89
Dec-14	1,080	213	0.36	7.10	0.38	1.07	38,400	2,659	1.13	7.80	1.04	3.89
Jan-15	1,660	203	0.55	6.77	0.38	1.07	37,500	3,286	1.10	9.64	1.04	3.89
Feb-15	2,340	157	0.78	5.23	0.38	1.07	33,600	2,373	0.99	6.96	1.04	3.89
Mar-15	1,640	95	0.55	3.17	0.38	1.07	35,100	2,059	1.03	6.04	1.04	3.89
Apr-15	1,380	46	0.46	1.53	0.38	1.07	35,700	1,705	1.05	5.00	1.04	3.89
May-15	960	-	0.32	-	0.38	1.07	32,400	908	0.95	2.66	1.04	3.89
Jun-15	1,040	-	0.35	-	0.38	1.07	36,300	668	1.06	1.96	1.04	3.89
	16,200	**891**	**5.40**	**29.70**	**4.50**	**12.80**	**427,800**	**16,417**	**12.55**	**48.15**	**12.50**	**46.70**

	Community Center						Corporate Yard #2 (Fleet)					
Month	kWh	Therms	Electric EUI	Natural Gas EUI	Benchmark Electric EUI	Benchmark Natural Gas EUI	kWh	Therms	Electric EUI	Natural Gas EUI	Benchmark Electric EUI	Benchmark Natural Gas EUI
Jul-14	22,320	112	0.53	0.26	1.04	3.89	2,560	27	0.39	0.42	0.38	3.93
Aug-14	24,480	110	0.58	0.25	1.04	3.89	3,200	25	0.49	0.38	0.38	3.93
Sep-14	26,720	80	0.63	0.19	1.04	3.89	2,560	26	0.39	0.40	0.38	3.93
Oct-14	16,640	571	0.39	1.32	1.04	3.89	2,400	299	0.37	4.60	0.38	3.93
Nov-14	15,600	2,326	0.37	5.38	1.04	3.89	2,240	907	0.34	13.95	0.38	3.93
Dec-14	17,920	3,381	0.42	7.82	1.04	3.89	4,080	1,135	0.63	17.46	0.38	3.93
Jan-15	25,520	4,409	0.60	10.20	1.04	3.89	4,400	1,456	0.68	22.40	0.38	3.93
Feb-15	26,320	2,890	0.62	6.69	1.04	3.89	3,600	926	0.55	14.25	0.38	3.93
Mar-15	20,160	2,386	0.48	5.52	1.04	3.89	3,920	1,024	0.60	15.75	0.38	3.93
Apr-15	21,360	1,704	0.51	3.94	1.04	3.89	3,520	920	0.54	14.15	0.38	3.93
May-15	24,480	809	0.58	1.87	1.04	3.89	2,720	629	0.42	9.68	0.38	3.93
Jun-15	19,280	241	0.46	0.56	1.04	3.89	3,280	166	0.50	2.55	0.38	3.93
	260,800	**19,019**	**6.18**	**43.99**	**12.50**	**46.70**	**38,480**	**7,540**	**5.92**	**116.00**	**4.50**	**47.10**

	Corporate Yard #9						Corporate Yard #11					
Month	kWh	Therms	Electric EUI	Natural Gas EUI	Benchmark Electric EUI	Benchmark Natural Gas EUI	kWh	Therms	Electric EUI	Natural Gas EUI	Benchmark Electric EUI	Benchmark Natural Gas EUI
Jul-14	1,600	17	0.08	0.09	0.38	2.62	221	15	0.22	1.50	0.09	2.62
Aug-14	4,500	18	0.23	0.09	0.38	2.62	184	14	0.18	1.40	0.09	2.62
Sep-14	2,940	25	0.15	0.13	0.38	2.62	207	14	0.21	1.40	0.09	2.62
Oct-14	2,900	80	0.15	0.42	0.38	2.62	301	41	0.30	4.10	0.09	2.62
Nov-14	2,620	469	0.14	2.45	0.38	2.62	243	184	0.24	18.40	0.09	2.62
Dec-14	5,220	776	0.27	4.05	0.38	2.62	312	289	0.31	28.90	0.09	2.62
Jan-15	5,520	1,190	0.29	6.20	0.38	2.62	454	428	0.45	42.80	0.09	2.62
Feb-15	5,380	753	0.28	3.93	0.38	2.62	365	339	0.37	33.90	0.09	2.62
Mar-15	3,780	594	0.20	3.10	0.38	2.62	357	176	0.36	17.60	0.09	2.62
Apr-15	1,860	377	0.10	1.97	0.38	2.62	303	199	0.30	19.90	0.09	2.62
May-15	240	188	0.01	0.98	0.38	2.62	288	134	0.29	13.40	0.09	2.62
Jun-15	360	74	0.02	0.39	0.38	2.62	266	41	0.27	4.10	0.09	2.62
	36,920	**4,561**	**1.92**	**23.78**	**4.50**	**31.40**	**3,501**	**1,874**	**3.50**	**187.40**	**1.10**	**31.40**

	Corporate Yard #7						Corporate Yard #13					
Month	kWh	Therms	Electric EUI	Natural Gas EUI	Benchmark Electric EUI	Benchmark Natural Gas EUI	kWh	Therms	Electric EUI	Natural Gas EUI	Benchmark Electric EUI	Benchmark Natural Gas EUI
Jul-14	4,040	10	0.32	0.08	0.38	3.93	562	-	0.09	-	0.09	2.62
Aug-14	4,000	6	0.31	0.05	0.38	3.93	405	-	0.07	-	0.09	2.62
Sep-14	4,720	11	0.37	0.09	0.38	3.93	597	-	0.10	-	0.09	2.62
Oct-14	4,000	75	0.31	0.59	0.38	3.93	373	42	0.06	0.70	0.09	2.62
Nov-14	2,760	682	0.22	5.37	0.38	3.93	516	318	0.09	5.30	0.09	2.62
Dec-14	2,040	1,422	0.16	11.20	0.38	3.93	489	446	0.08	7.43	0.09	2.62
Jan-15	3,480	1,919	0.27	15.11	0.38	3.93	793	618	0.13	10.30	0.09	2.62
Feb-15	3,560	1,419	0.28	11.17	0.38	3.93	1,147	450	0.19	7.50	0.09	2.62
Mar-15	3,520	1,262	0.28	9.94	0.38	3.93	1,054	473	0.18	7.88	0.09	2.62
Apr-15	4,080	459	0.32	3.61	0.38	3.93	1,060	319	0.18	5.32	0.09	2.62
May-15	3,280	99	0.26	0.78	0.38	3.93	753	181	0.13	3.02	0.09	2.62
Jun-15	3,400	27	0.27	0.21	0.38	3.93	774	39	0.13	0.65	0.09	2.62
	42,880	**7,391**	**3.38**	**58.20**	**4.50**	**47.10**	**8,523**	**2,886**	**1.42**	**48.10**	**1.10**	**31.40**

	Corporate Yard #3 (Sand Barn)						Public Works					
Month	kWh	Therms	Electric EUI	Natural Gas EUI	Benchmark Electric EUI	Benchmark Natural Gas EUI	kWh	Therms	Electric EUI	Natural Gas EUI	Benchmark Electric EUI	Benchmark Natural Gas EUI
Jul-14	656	-	N/A	N/A			6,192	25	0.18	0.07	1.04	3.93
Aug-14	559	-	N/A	N/A			28,656	25	0.83	0.07	1.04	3.93
Sep-14	663	-	N/A	N/A			13,248	14	0.38	0.04	1.04	3.93
Oct-14	659	-	N/A	N/A			9,936	84	0.29	0.24	1.04	3.93
Nov-14	685	-	N/A	N/A			12,000	880	0.35	2.55	1.04	3.93
Dec-14	751	-	N/A	N/A			25,296	1,566	0.73	4.54	1.04	3.93
Jan-15	1,047	-	N/A	N/A			30,576	2,285	0.89	6.62	1.04	3.93
Feb-15	1,100	-	N/A	N/A			25,872	1,235	0.75	3.58	1.04	3.93
Mar-15	912	-	N/A	N/A			19,056	1,025	0.55	2.97	1.04	3.93
Apr-15	974	-	N/A	N/A			15,984	542	0.46	1.57	1.04	3.93
May-15	862	-	N/A	N/A			7,728	139	0.22	0.40	1.04	3.93
Jun-15	757	-	N/A	N/A			7,440	27	0.22	0.08	1.04	3.93
	9,625						**201,984**	**7,847**	**5.85**	**22.74**	**12.50**	**47.10**

	Court House						Fire Station 51					
Month	kWh	Therms	Electric EUI	Natural Gas EUI	Benchmark Electric EUI	Benchmark Natural Gas EUI	kWh	Therms	Electric EUI	Natural Gas EUI	Benchmark Electric EUI	Benchmark Natural Gas EUI
Jul-14	214,560	3,083	1.63	2.34	1.63	4.72	26,909	121	1.49	0.67	1.04	3.93
Aug-14	204,960	3,532	1.56	2.68	1.63	4.72	28,762	134	1.59	0.74	1.04	3.93
Sep-14	189,960	3,728	1.44	2.83	1.63	4.72	26,822	125	1.48	0.69	1.04	3.93
Oct-14	178,080	4,490	1.35	3.41	1.63	4.72	23,779	177	1.32	0.98	1.04	3.93
Nov-14	153,360	7,491	1.16	5.68	1.63	4.72	22,113	597	1.22	3.30	1.04	3.93
Dec-14	166,800	10,697	1.27	8.12	1.63	4.72	26,639	1,038	1.47	5.74	1.04	3.93
Jan-15	160,920	13,930	1.22	10.57	1.63	4.72	25,372	1,490	1.40	8.24	1.04	3.93
Feb-15	138,120	8,329	1.05	6.32	1.63	4.72	22,707	844	1.26	4.67	1.04	3.93
Mar-15	155,520	7,960	1.18	6.04	1.63	4.72	24,602	646	1.36	3.57	1.04	3.93
Apr-15	181,320	7,329	1.38	5.56	1.63	4.72	23,163	335	1.28	1.85	1.04	3.93
May-15	165,120	5,051	1.25	3.83	1.63	4.72	20,448	172	1.13	0.95	1.04	3.93
Jun-15	180,360	4,260	1.37	3.23	1.63	4.72	24,088	122	1.33	0.68	1.04	3.93
	2,089,080	**79,880**	**15.85**	**60.62**	**19.50**	**56.60**	**295,404**	**5,801**	**16.34**	**32.10**	**12.50**	**47.10**

	Fire Station 52						Fire Station 53					
Month	kWh	Therms	Electric EUI	Natural Gas EUI	Benchmark Electric EUI	Benchmark Natural Gas EUI	kWh	Therms	Electric EUI	Natural Gas EUI	Benchmark Electric EUI	Benchmark Natural Gas EUI
Jul-14	10,557	21	0.38	0.12	1.04	2.62	7,128	25	1.63	0.57	0.61	2.62
Aug-14	11,357	20	0.41	0.07	1.04	2.62	6,537	26	1.50	0.60	0.61	2.62
Sep-14	10,712	23	0.39	0.08	1.04	2.62	6,858	25	1.57	0.57	0.61	2.62
Oct-14	8,614	60	0.31	0.22	1.04	2.62	5,833	30	1.34	0.69	0.61	2.62
Nov-14	8,891	159	0.32	0.57	1.04	2.62	6,128	54	1.40	1.24	0.61	2.62
Dec-14	10,612	233	0.38	0.84	1.04	2.62	6,480	245	1.48	5.61	0.61	2.62
Jan-15	12,288	224	0.44	0.81	1.04	2.62	8,005	414	1.83	9.48	0.61	2.62
Feb-15	9,975	164	0.36	0.59	1.04	2.62	7,158	273	1.64	6.25	0.61	2.62
Mar-15	11,636	115	0.42	0.41	1.04	2.62	6,695	250	1.53	5.72	0.61	2.62
Apr-15	9,176	73	0.33	0.26	1.04	2.62	6,966	137	1.60	3.14	0.61	2.62
May-15	9,505	40	0.34	0.14	1.04	2.62	5,948	72	1.36	1.65	0.61	2.62
Jun-15	10,992	22	0.40	0.08	1.04	2.62	5,568	38	1.28	0.87	0.61	2.62
	124,315	**1,154**	**4.48**	**4.20**	**12.50**	**31.40**	**79,304**	**1,589**	**18.16**	**36.39**	**7.30**	**31.40**

	Health & Human Resources						Juvenile Administration					
Month	kWh	Therms	Electric EUI	Natural Gas EUI	Benchmark Electric EUI	Benchmark Natural Gas EUI	kWh	Therms	Electric EUI	Natural Gas EUI	Benchmark Electric EUI	Benchmark Natural Gas EUI
Jul-14	65,720	1,996	2.57	7.81	1.00	4.03	2,922	1	0.70	0.02	0.38	1.07
Aug-14	71,680	1,966	2.81	7.70	1.00	4.03	3,379	-	0.81	-	0.38	1.07
Sep-14	73,080	2,165	2.86	8.47	1.00	4.03	3,144	1	0.75	0.02	0.38	1.07
Oct-14	64,520	2,214	2.53	8.67	1.00	4.03	2,493	28	0.59	0.67	0.38	1.07
Nov-14	55,880	2,441	2.19	9.56	1.00	4.03	2,102	91	0.50	2.17	0.38	1.07
Dec-14	46,200	2,905	1.81	11.37	1.00	4.03	2,646	154	0.63	3.67	0.38	1.07
Jan-15	49,320	3,158	1.93	12.36	1.00	4.03	2,847	230	0.68	5.48	0.38	1.07
Feb-15	48,520	3,670	1.90	14.37	1.00	4.03	2,679	150	0.64	3.57	0.38	1.07
Mar-15	52,160	2,526	2.04	9.89	1.00	4.03	2,777	119	0.66	2.84	0.38	1.07
Apr-15	52,080	2,595	2.04	10.16	1.00	4.03	2,691	89	0.64	2.12	0.38	1.07
May-15	51,840	3,740	2.03	14.64	1.00	4.03	2,622	49	0.62	1.17	0.38	1.07
Jun-15	67,760	2,733	2.65	10.70	1.00	4.03	3,061	13	0.73	0.31	0.38	1.07
	698,760	**32,109**	**27.35**	**125.69**	**12.00**	**48.40**	**33,363**	**925**	**7.95**	**22.04**	**4.50**	**12.80**

	Juvenile Annex						Juvenile Detention					
Month	kWh	Therms	Electric EUI	Natural Gas EUI	Benchmark Electric EUI	Benchmark Natural Gas EUI	kWh	Therms	Electric EUI	Natural Gas EUI	Benchmark Electric EUI	Benchmark Natural Gas EUI
Jul-14	1,691	4	0.53	0.13	0.38	1.07	22,920	164	1.99	1.43	1.04	3.93
Aug-14	2,004	5	0.63	0.16	0.38	1.07	28,320	162	2.46	1.41	1.04	3.93
Sep-14	1,656	4	0.52	0.13	0.38	1.07	24,240	162	2.11	1.41	1.04	3.93
Oct-14	1,408	4	0.44	0.13	0.38	1.07	18,600	489	1.62	4.25	1.04	3.93
Nov-14	1,226	83	0.38	2.59	0.38	1.07	15,720	1,079	1.37	9.38	1.04	3.93
Dec-14	1,518	169	0.47	5.28	0.38	1.07	16,440	1,506	1.43	13.10	1.04	3.93
Jan-15	1,885	262	0.59	8.19	0.38	1.07	14,280	1,992	1.24	17.32	1.04	3.93
Feb-15	1,924	162	0.60	5.06	0.38	1.07	12,720	1,312	1.11	11.41	1.04	3.93
Mar-15	1,796	125	0.56	3.91	0.38	1.07	13,920	1,053	1.21	9.16	1.04	3.93
Apr-15	2,226	108	0.70	3.38	0.38	1.07	12,720	766	1.11	6.66	1.04	3.93
May-15	1,506	32	0.47	1.00	0.38	1.07	12,480	447	1.09	3.89	1.04	3.93
Jun-15	1,459	5	0.46	0.16	0.38	1.07	18,120	337	1.58	2.93	1.04	3.93
	20,299	**963**	**6.34**	**30.09**	**4.50**	**12.80**	**210,480**	**9,469**	**18.30**	**82.34**	**12.50**	**47.10**

	Library						Senior Center					
Month	kWh	Therms	Electric EUI	Natural Gas EUI	Benchmark Electric EUI	Benchmark Natural Gas EUI	kWh	Therms	Electric EUI	Natural Gas EUI	Benchmark Electric EUI	Benchmark Natural Gas EUI
Jul-14	42,000	58	2.00	0.28	1.04	3.93	31,520	234	0.53	0.39	1.04	3.89
Aug-14	42,000	134	2.00	0.64	1.04	3.93	37,360	242	0.63	0.41	1.04	3.89
Sep-14	41,160	127	1.96	0.60	1.04	3.93	35,840	331	0.60	0.56	1.04	3.89
Oct-14	36,600	327	1.74	1.56	1.04	3.93	30,560	612	0.51	1.03	1.04	3.89
Nov-14	30,360	894	1.44	4.25	1.04	3.93	24,320	1,605	0.41	2.70	1.04	3.89
Dec-14	30,480	1,168	1.45	5.56	1.04	3.93	26,480	2,049	0.45	3.45	1.04	3.89
Jan-15	28,920	1,683	1.38	8.01	1.04	3.93	26,240	1,964	0.44	3.31	1.04	3.89
Feb-15	28,800	1,092	1.37	5.19	1.04	3.93	26,960	1,616	0.45	2.72	1.04	3.89
Mar-15	29,040	983	1.38	4.68	1.04	3.93	26,320	989	0.44	1.67	1.04	3.89
Apr-15	36,600	841	1.74	4.00	1.04	3.93	26,320	1,010	0.44	1.70	1.04	3.89
May-15	30,720	540	1.46	2.57	1.04	3.93	26,000	668	0.44	1.13	1.04	3.89
Jun-15	30,840	249	1.47	1.18	1.04	3.93	29,760	248	0.50	0.42	1.04	3.89
	407,520	**8,096**	**19.38**	**38.51**	**12.50**	**47.10**	**347,680**	**11,568**	**5.86**	**19.49**	**12.50**	**46.70**

	Sheriff's Administration						Sheriff's Dispatch					
Month	kWh	Therms	Electric EUI	Natural Gas EUI	Benchmark Electric EUI	Benchmark Natural Gas EUI	kWh	Therms	Electric EUI	Natural Gas EUI	Benchmark Electric EUI	Benchmark Natural Gas EUI
Jul-14	67,200	663	1.64	1.62	1.00	3.89	13,720	-	4.65	-	1.04	
Aug-14	65,280	877	1.59	2.14	1.00	3.89	14,360	-	4.87	-	1.04	
Sep-14	64,640	1,057	1.58	2.58	1.00	3.89	16,000	-	5.43	-	1.04	
Oct-14	54,720	1,200	1.33	2.92	1.00	3.89	13,080	-	4.44	-	1.04	
Nov-14	48,240	1,711	1.18	4.17	1.00	3.89	12,480	-	4.23	-	1.04	
Dec-14	55,120	2,549	1.34	6.21	1.00	3.89	12,280	-	4.17	-	1.04	
Jan-15	55,440	3,028	1.35	7.38	1.00	3.89	11,680	-	3.96	-	1.04	
Feb-15	47,040	1,994	1.15	4.86	1.00	3.89	11,320	-	3.84	-	1.04	
Mar-15	49,040	1,929	1.20	4.70	1.00	3.89	11,820	-	4.01	-	1.04	
Apr-15	57,440	1,724	1.40	4.20	1.00	3.89	14,120	-	4.79	-	1.04	
May-15	55,600	1,688	1.36	4.11	1.00	3.89	12,480	-	4.23	-	1.04	
Jun-15	60,880	1,706	1.48	4.16	1.00	3.89	12,360	-	4.19	-	1.04	
	680,640	**20,126**	**16.59**	**49.06**	**12.00**	**46.70**	**155,700**	**-**	**52.82**	**-**	**12.50**	

	Mills Park & Marv Pavilion						Centennial Park Complex					
Month	kWh	Therms	Electric EUI	Natural Gas EUI	Benchmark Electric EUI	Benchmark Natural Gas EUI	kWh	Therms	Electric EUI	Natural Gas EUI	Benchmark Electric EUI	Benchmark Natural Gas EUI
Jul-14	11,001	61	N/A	N/A			30,083	-	N/A	N/A		
Aug-14	9,878	172	N/A	N/A			25,704	-	N/A	N/A		
Sep-14	10,134	202	N/A	N/A			15,432	-	N/A	N/A		
Oct-14	10,938	235	N/A	N/A			26,326	-	N/A	N/A		
Nov-14	10,398	79	N/A	N/A			25,463	-	N/A	N/A		
Dec-14	13,611	160	N/A	N/A			9,853	-	N/A	N/A		
Jan-15	16,614	224	N/A	N/A			7,298	-	N/A	N/A		
Feb-15	18,502	348	N/A	N/A			5,724	-	N/A	N/A		
Mar-15	16,842	161	N/A	N/A			5,511	-	N/A	N/A		
Apr-15	17,478	40	N/A	N/A			5,429	-	N/A	N/A		
May-15	14,629	-	N/A	N/A			7,140	-	N/A	N/A		
Jun-15	12,149	6	N/A	N/A			18,269	-	N/A	N/A		
	162,174	**1,688**	-	-			**182,232**	-				

	Pete Livermore Sports Complex						Fairview Street Lighting					
Month	kWh	Therms	Electric EUI	Natural Gas EUI	Benchmark Electric EUI	Benchmark Natural Gas EUI	kWh	Therms	Electric EUI	Natural Gas EUI	Benchmark Electric EUI	Benchmark Natural Gas EUI
Jul-14	12,160	-	N/A	N/A			3,508	-	N/A	N/A		
Aug-14	11,440	-	N/A	N/A			4,082	-	N/A	N/A		
Sep-14	22,980	-	N/A	N/A			4,035	-	N/A	N/A		
Oct-14	9,900	-	N/A	N/A			4,077	-	N/A	N/A		
Nov-14	9,880	-	N/A	N/A			4,431	-	N/A	N/A		
Dec-14	10,600	-	N/A	N/A			5,680	-	N/A	N/A		
Jan-15	9,640	-	N/A	N/A			5,576	-	N/A	N/A		
Feb-15	8,460	-	N/A	N/A			5,060	-	N/A	N/A		
Mar-15	8,460	-	N/A	N/A			5,066	-	N/A	N/A		
Apr-15	10,780	-	N/A	N/A			4,397	-	N/A	N/A		
May-15	6,420	-	N/A	N/A			3,898	-	N/A	N/A		
Jun-15	11,080	-	N/A	N/A			3,937	-	N/A	N/A		
	131,800	-					**53,747**	-				

Benchmark data is provided by the Commercial Buildings Energy Consumption Survey (CBECS) Tables C20 and C30; "Table C20. Electricity Consumption and Conditional Energy Intensity by Climate Zone for Non-Mall Buildings, 2003" and "Table C30. Natural Gas Consumption and Conditional Energy Intensity by Climate Zone for Non-Mall Buildings, 2003".

Annual consumption in kilowatt-hours of electricity and hundred cubic feet of natural gas for climate Zone 2 buildings was used as the benchmark criteria. Climate Zone 2 (30-year average) is defined as having under 2,000 Cooling Degree Days and 5,500-7,000 Heating Degree Days.

Appendix D. Lighting Usage Assumptions

Table D.0. Annual Operating Hours for Logged, Baseline and Proposed Lighting Areas

Area Description	Annual Operating Hours		
	Logged	Baseline	Proposed
Auditorium		2,088	2088
Baseball Field		305	305
Baseball Field - Centennial		731	731
Bedroom	2339	2,339	2339
Cafeteria	2320	2,320	2320
Jail Cell	5735	5,735	5735
Conference Room	1240	1,240	1240
Conference Room, existing occupancy sensor		1,670	1670
Classroom	2088	2,088	2088
Classroom, existing occupancy sensor		1,670	1670
Court Room	3075	3,075	3075
Court Room, Existing Occupancy Sensor		1,941	1941
Fire Station	6570	6,570	6570
Locker Room	3911	3,911	3911
Gymnasium, add new occupancy sensor		3,561	2386
Hallways & Common Areas	4645	4,645	4645
Hallways & Common Areas, existing occupancy sensor		2,588	2588
Janitor Closet		522	522
Janitors Closet, existing occupancy sensor		418	418
Kitchen		2,088	2088
Kitchen - Centennial		2,088	2088
Lobby		3,863	3863
Lounge		3,654	3654
Mechanical Room		3,863	3863
Mechanical Room - Centennial		3,863	3863
No Hours		0	0
Office	2912	2,912	2912
Office - Centennial		2,808	2808
Office, existing occupancy sensor	2246	2,246	2246
Open Office	3346	3,346	3346
Pool	3534	3,534	3534
Library	3603	3,603	3603
Restroom	3117	3,117	3117
Restroom - Centennial		3,117	3117
Restroom, existing occupancy sensor	2338	2,338	2338
Restroom, add new occupancy sensor		3,117	2338
Private Restroom	507	507	507
Private Restroom, existing occupancy sensor		418	418
Restroom-Private, existing timer		1,159	1159
Special Event		522	522
Shop		3,028	3028
Storage Room		522	522
Storage Room - Centennial		522	522
Storage Room, existing sensor		418	418
Storage Room, existing timer switch		418	418

Area Description	Annual Operating Hours		
	Logged	Baseline	Proposed
Storage Room, add new timer		522	350
Stairwell		5,011	5011
Tennis Courts		987	987
Tennis Courts - Centennial		2,393	2393
Outside Areas	4380	4,380	4380
Outside Areas, Low Hours		1,462	1462
Street Lights		4,380	4380
Outside Areas - Summer		914	914
24 Hour Areas	8760	8,760	8760

Appendix E. Lighting Maintenance Calculations

Lighting Maintenance Overview

The following describes both the material savings calculations associated with a lighting retro-fit. Please see the room-by-room worksheet for actual values specific to the project. There are no labor savings claimed for this measure. Therefore, the savings from labor costs are excluded from the calculations.

Material Maintenance Calculations: Lamps

The first step is to calculate the ***Existing Average Annual Lamp Burn Outs*** **(EAALB)**. This is the percentage of annual percentage of burned out lamps expected each year. It is calculated by dividing the annual hours of operation by the manufacturers stated lamp life, then multiplying by the number of lamps in each fixture. See Equation 1.

Equation 1

$$EAALB = \frac{Annual\ Hours\ of\ Operation}{Lamp\ Life} * Total\ Number\ of Lamps$$

Next, the Existing Average Annual Lamp Burn Outs percentage is multiplied by the ***Existing Estimated Lamp Purchase Cost*** **(EELPC)**, giving us the ***Existing Estimated Lamp Replacement Cost*** **(EELRC)**. This cost is assumed based on historical data. If actual costs are known, they can be substituted into the calculations. See Equation 2.

Equation 2

$$EELRC = EAALB * Existing\ Estimated\ Lamp\ Purchase\ Cost$$

Equation 2 gives the total annual cost of replacement lamps per fixture which is then multiplied by the ***Total Number of Existing Fixtures*** **(TNEF)** resulting in the ***Existing Total Lamp Replacement Material Cost*** **(ETLRMC)**. See Equation 3.

Equation 3

$$ETLRMC = EELRC * Total\ Number\ of\ Existing\ Fixtures$$

Equations 1-3 are then repeated for the proposed lighting system. The difference between the ***Existing Total Lamp Replacement Material Cost*** and the ***Proposed Total Lamp Replacement Material Cost*** will yield the ***Total Lamp Material Savings*** **(TLMS)**. See Equation 4.

Equation 4

$$Exising\ TLRMC - Proposed\ TLRMC = Lamp\ Material\ Savings$$

Material Maintenance Calculations: Ballasts

The first step is to calculate the ***Existing Average Annual Ballast Burn Outs*** **(EAABB)**. This is the percentage of annual percentage of burned out ballasts expected each year. It is calculated by dividing the annual hours of operation by the manufacturer's stated operating life, then multiplying by the number of ballasts in each fixture. See Equation 5.

Equation 5

$$EAABB = \frac{Annual\ Hours\ of\ Operation}{Operating\ Life} * Total\ Number\ of Ballasts$$

Next, the Existing Average Annual Ballast Burn Outs percentage is multiplied by the ***Existing Estimated Ballast Purchase Cost*** **(EEBPC)**. This cost is assumed based on historical data. If actual costs are known, they can be substituted into the calculations. See Equation 6.

Equation 6

$$EEBRC = EAABB * Existing\ Estimated\ Ballast\ Replacement\ Cost$$

Equation 2 gives the total annual cost of replacement ballasts per fixture which is multiplied by the *Total Number of Existing Fixtures* (TNEF) resulting in the ***Existing Total Ballast Replacement Material Cost*** **(ETBRMC)**. See Equation 7.

Equation 7

$$ETBRMC = EEBRC * Total\ Number\ of\ Existing\ Fixtures$$

Equations 1-3 are then repeated for the proposed lighting system. The difference between the *Existing Total Ballast Replacement Material Cost* and the *Proposed Total Ballast Replacement Material Cost* will yield the ***Total Ballast Material Savings*** **(TLMS).** See Equation 8.

Equation 8

$$Exising\ TBRMC - Proposed\ TBRMC = Ballast\ Material\ Savings$$

The total lamp material savings and total ballast material savings are then added together to yield the ***Total Material Savings*** **(TMS)**. See Equation 9.

Equation 9

$$Total\ Material\ Savings = Lamp\ Material\ Savings + Ballast\ Material\ Savings$$

Appendix F. Model vs. Baseline: Monthly Comparisons

Aquatic Center

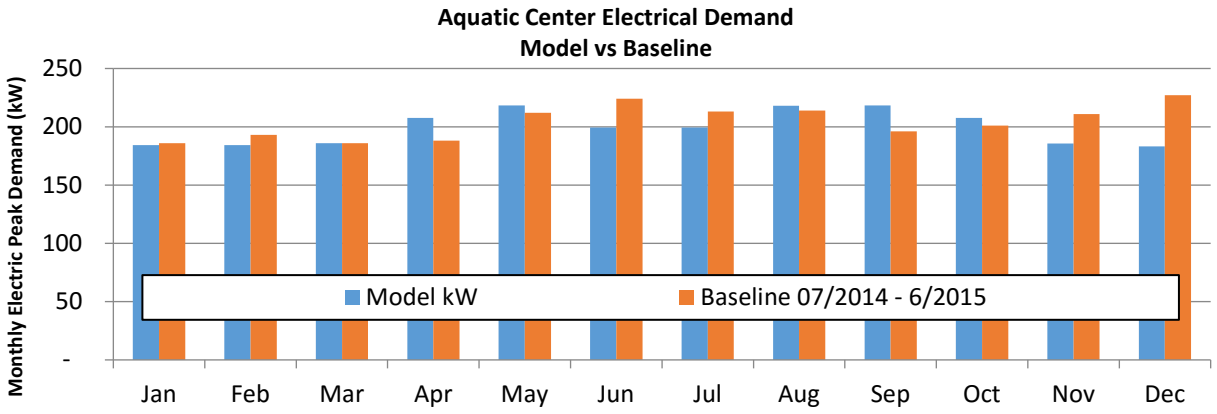


Figure F.0. Aquatic Center Electrical Demand

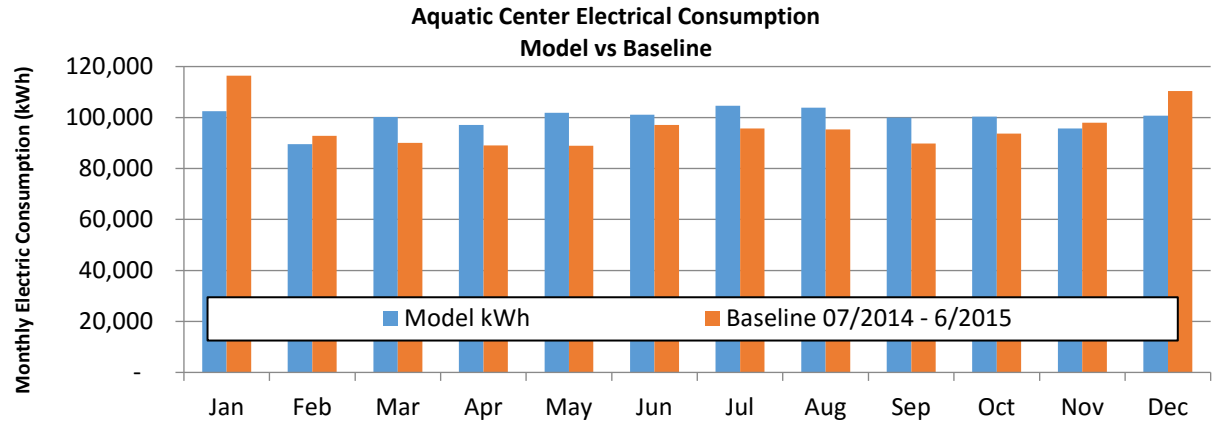


Figure F.1. Aquatic Center Electrical Consumption

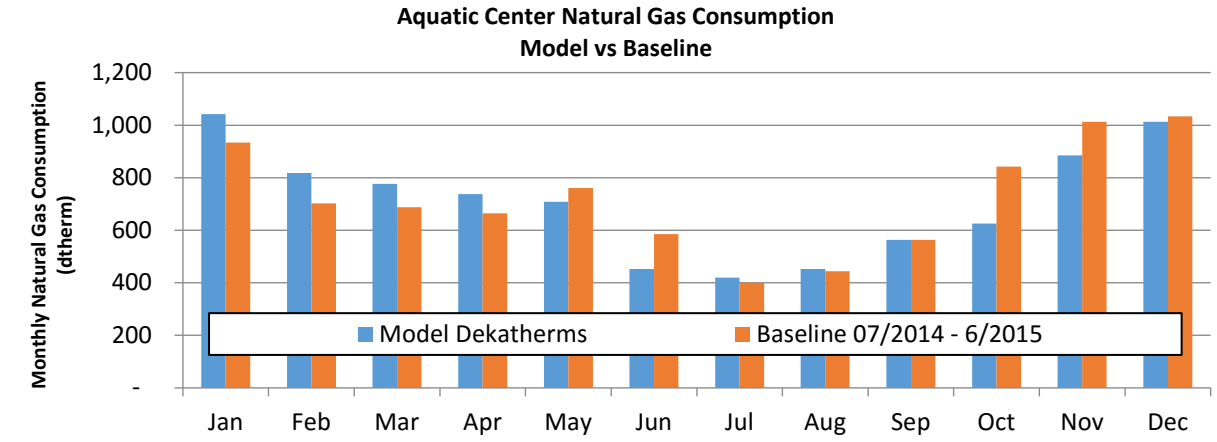


Figure F.2. Aquatic Center Natural Gas Consumption

City Hall

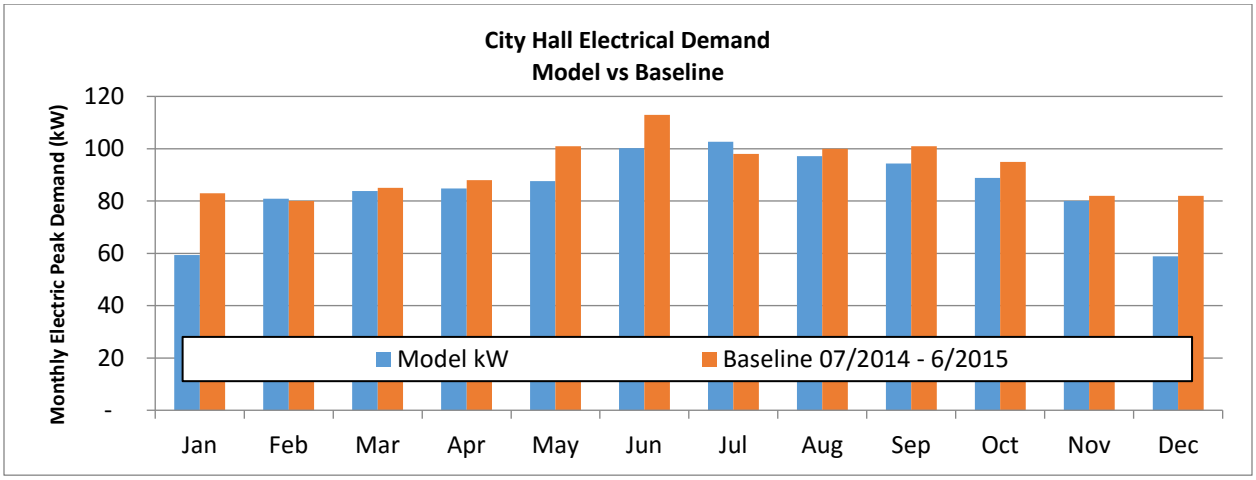


Figure F.3. City Hall Electrical Demand

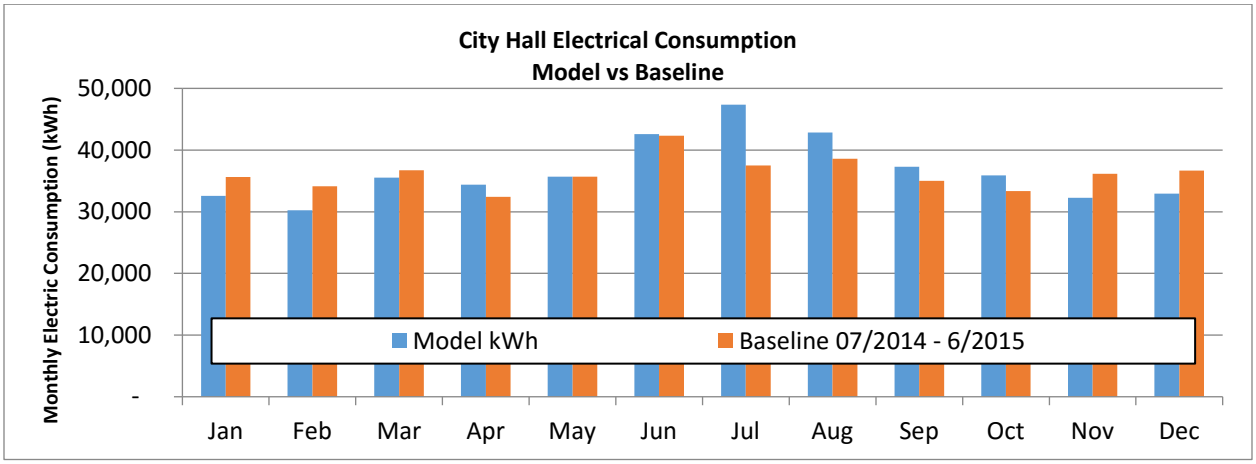


Figure F.4. City Hall Electrical Consumption

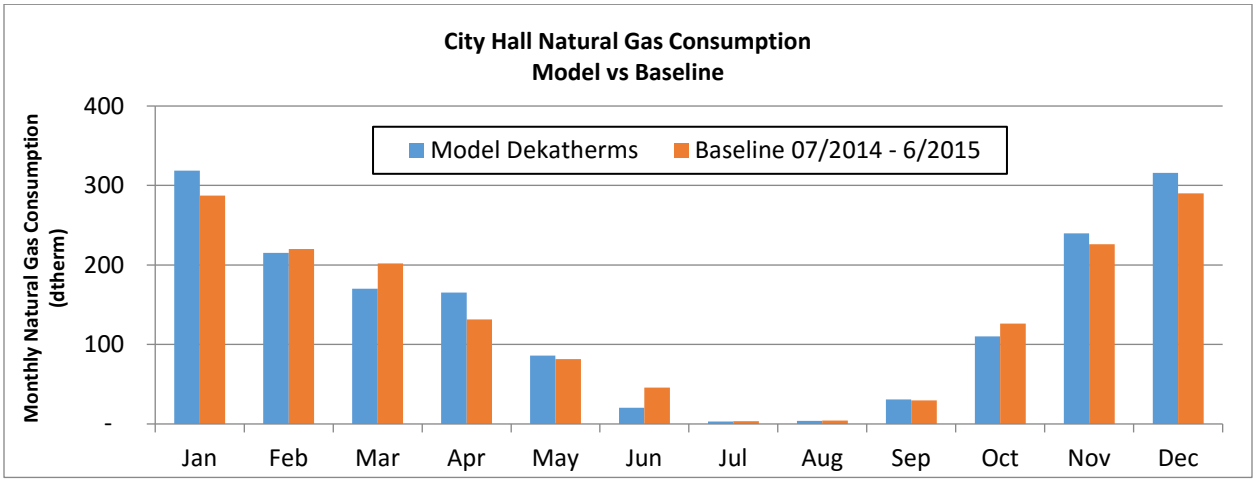


Figure F.5. City Hall Natural Gas Consumption

Public Safety Complex

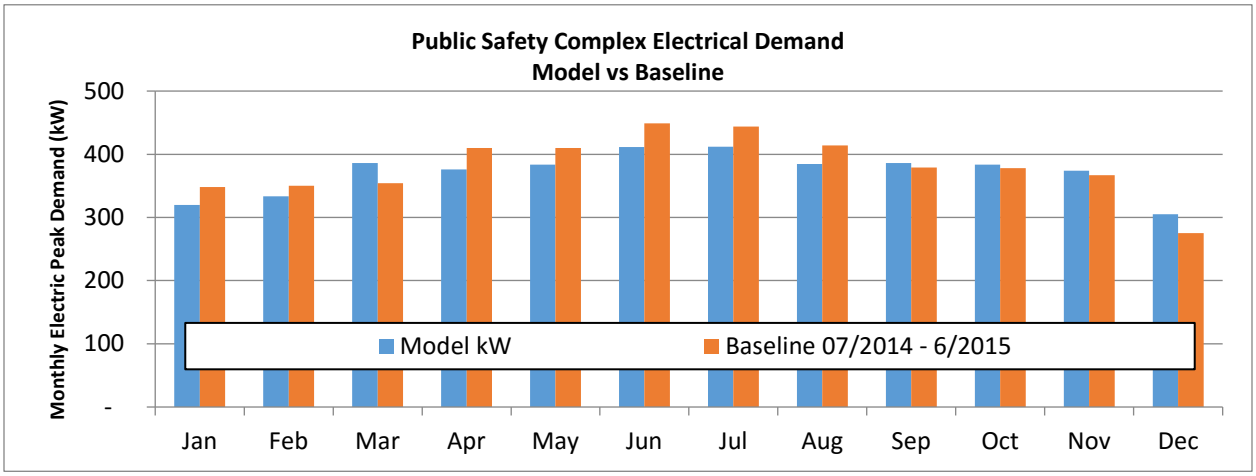


Figure F.6. Public Safety Complex Electrical Demand

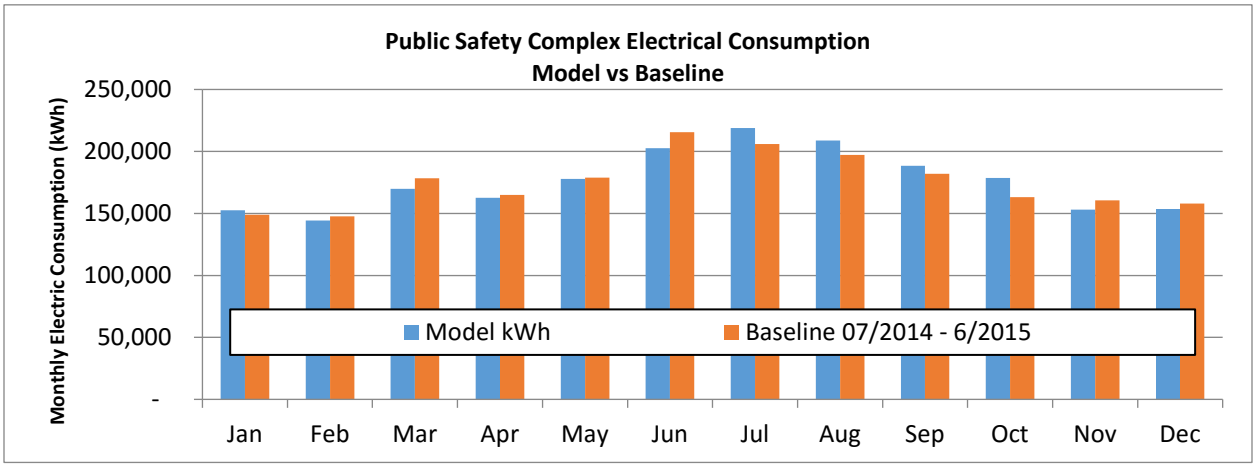


Figure F.7. Public Safety Complex Electrical Consumption

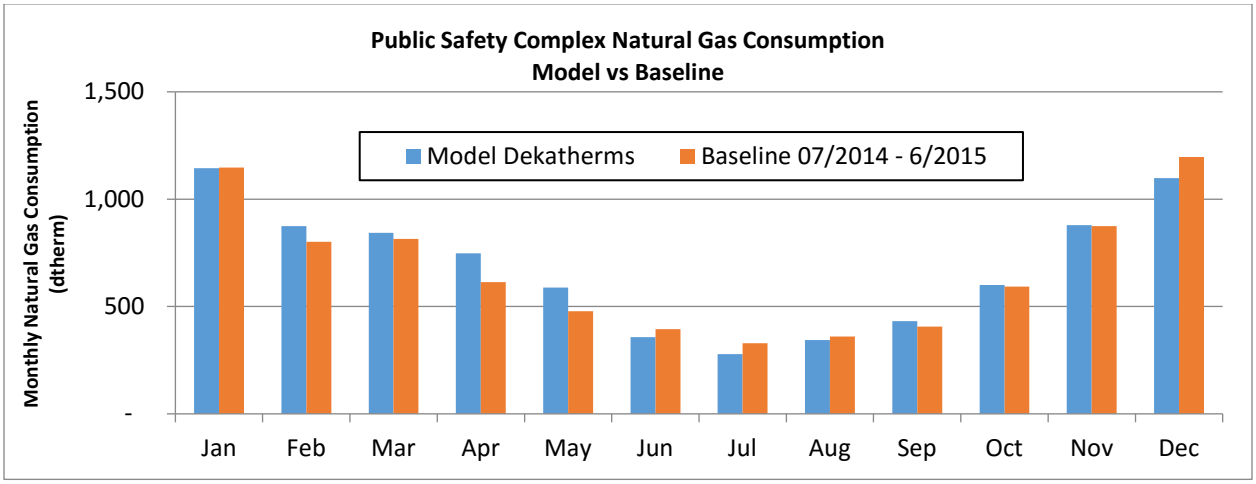


Figure F.8. Public Safety Complex Natural Gas Consumption

Fire Station 51

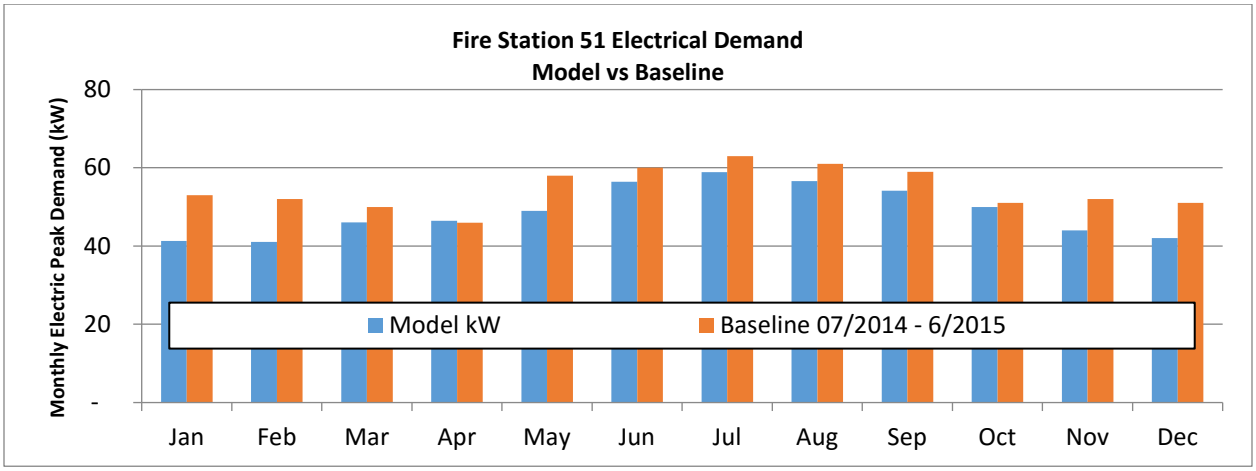


Figure F.9. Fire Station 51 Electrical Demand

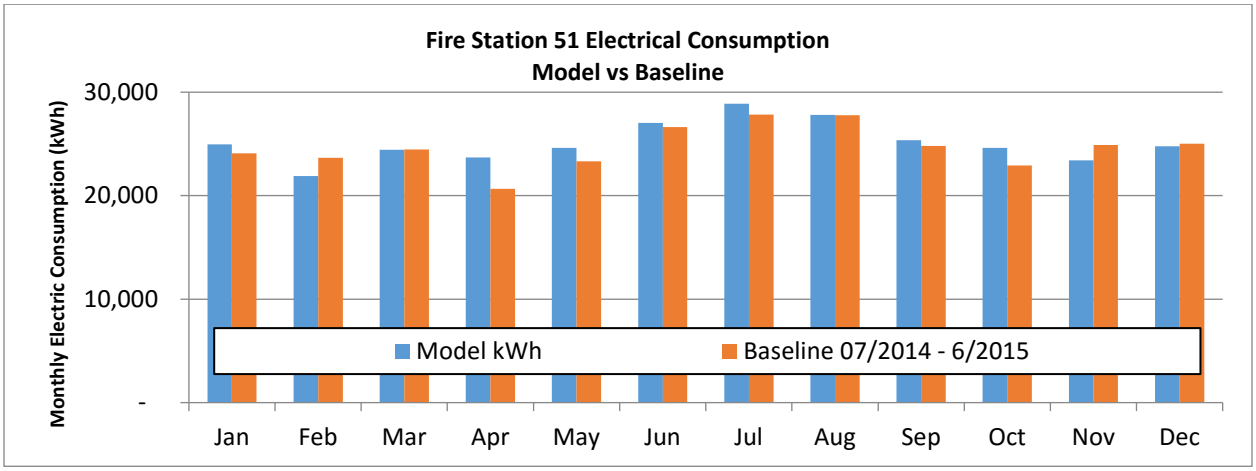


Figure F.10. Fire Station 51 Electrical Consumption

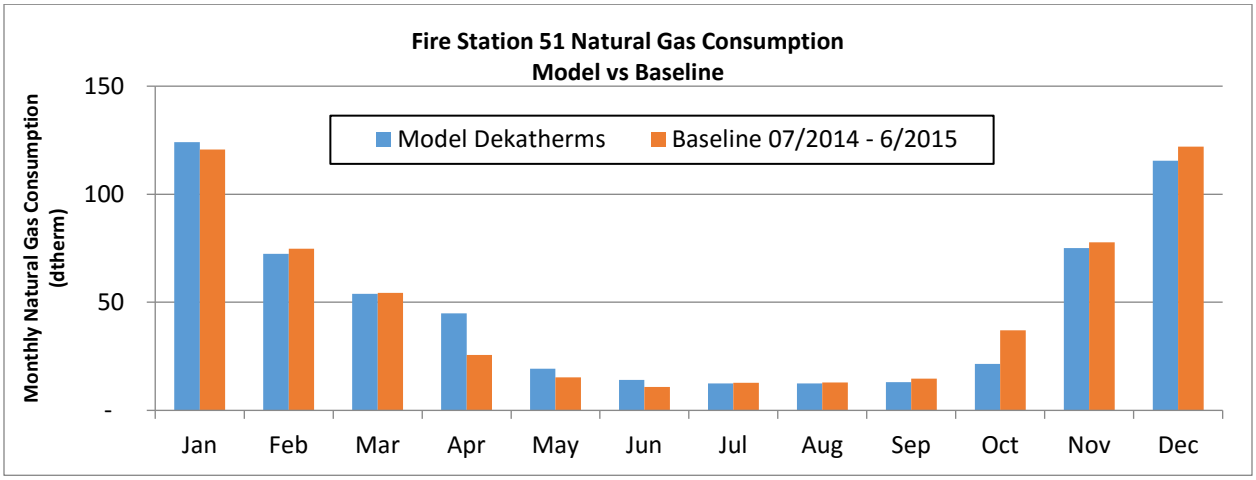


Figure F.11. Fire Station 51 Natural Gas Consumption

Library

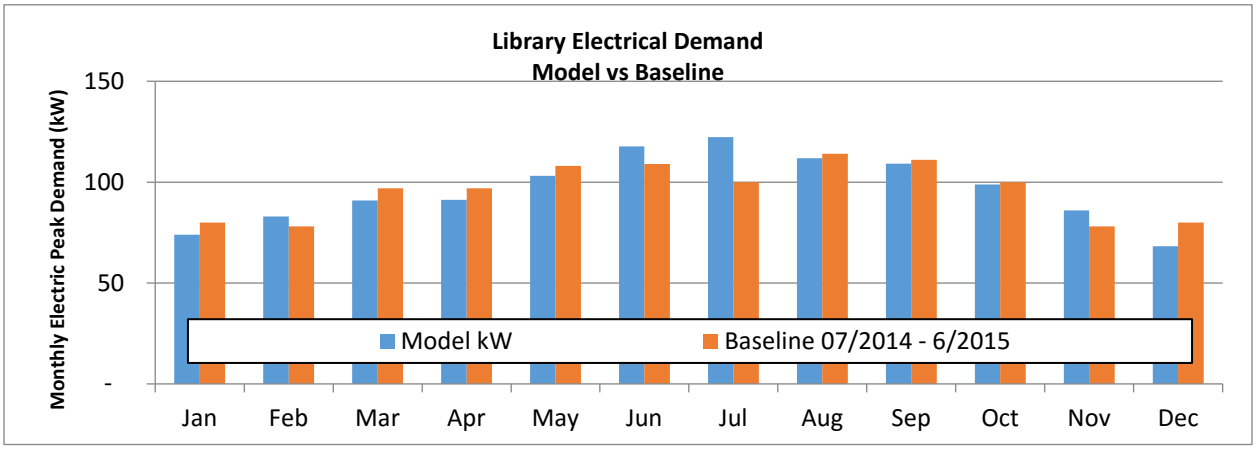


Figure F.12. Library Electrical Demand

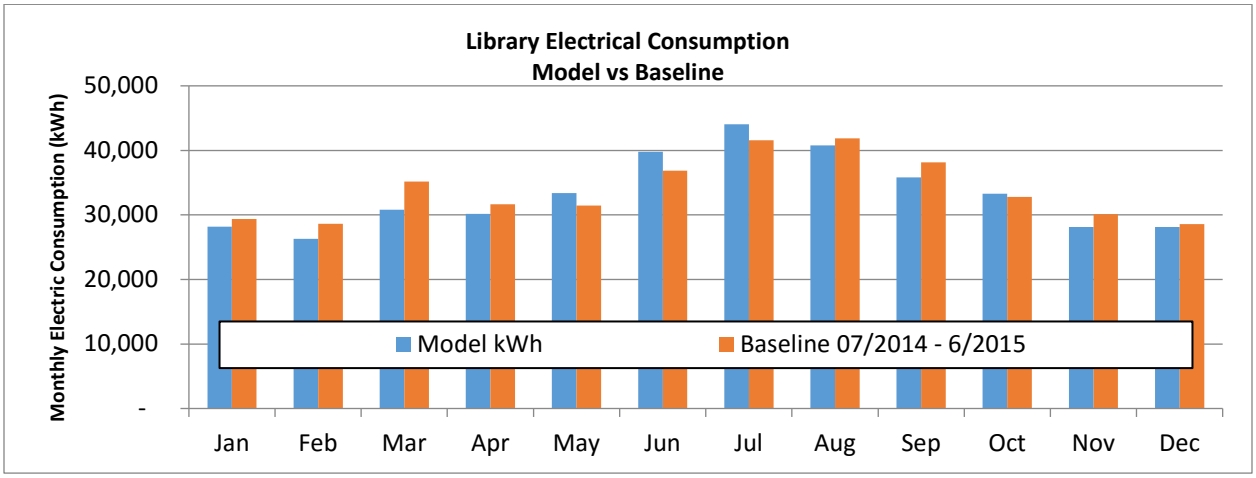


Figure F.13. Library Electrical Consumption

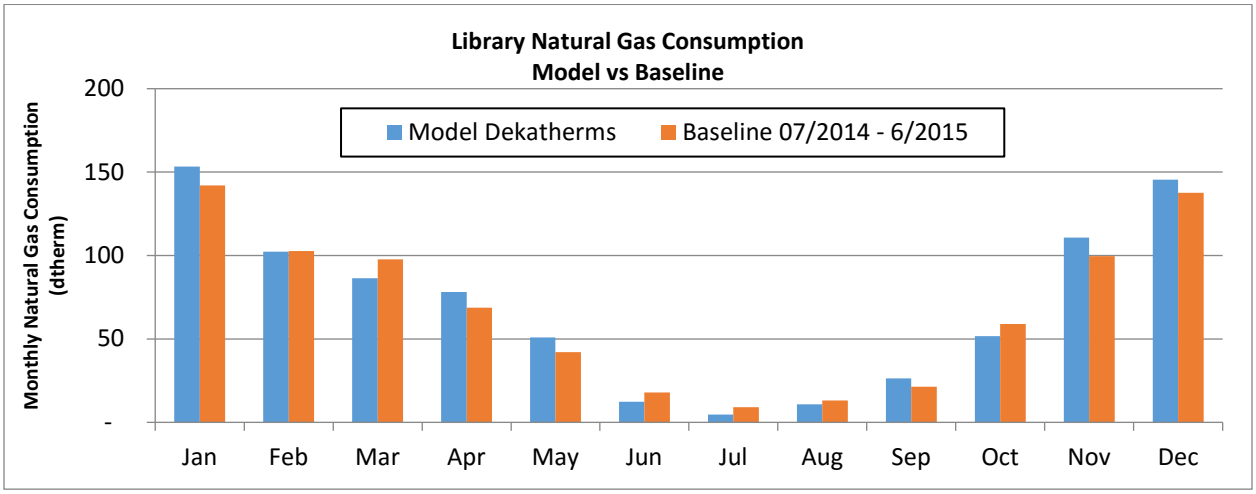


Figure F.14. Library Natural Gas Consumption

Senior Center

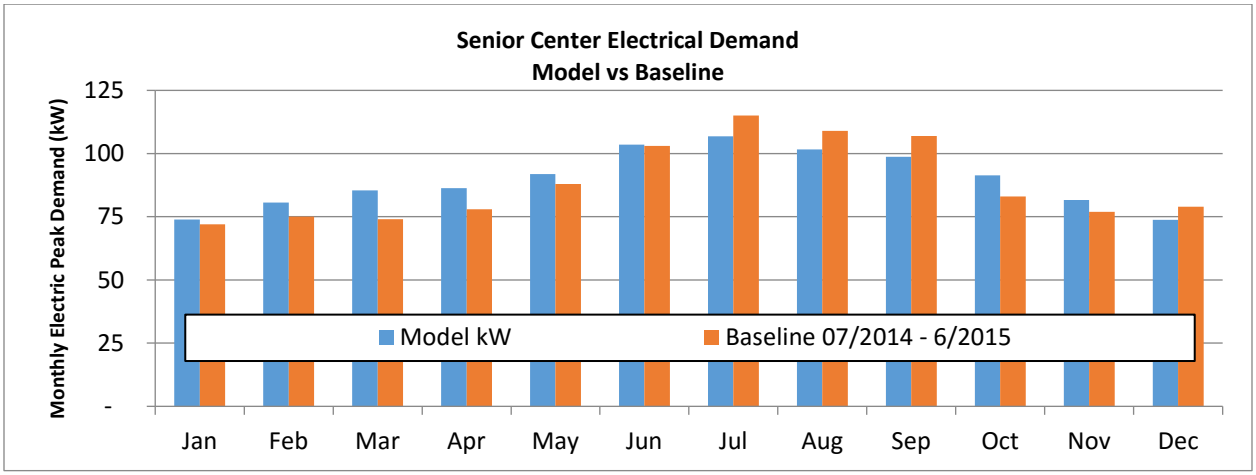


Figure F.15. Senior Center Electrical Demand

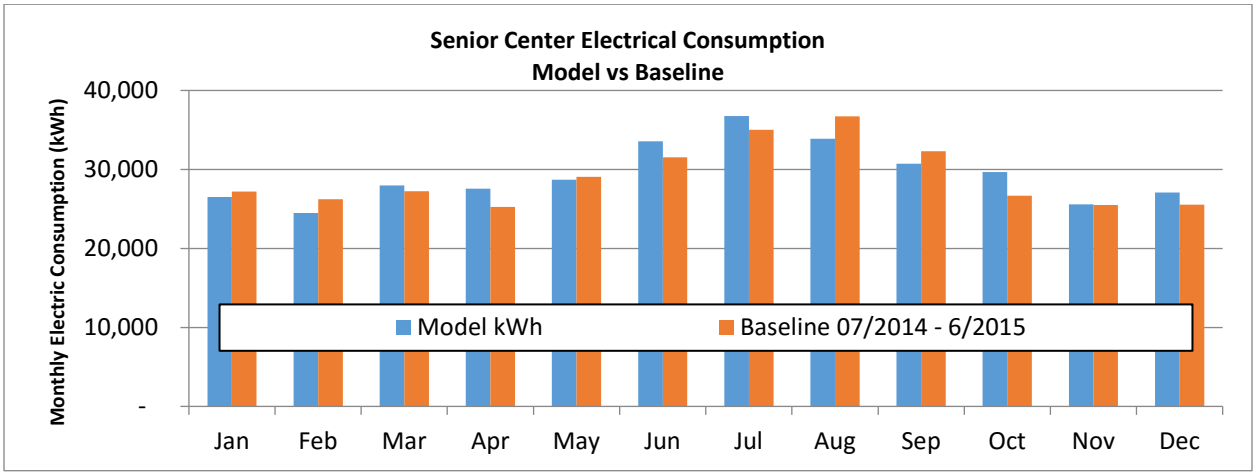


Figure F.16. Senior Center Electrical Consumption

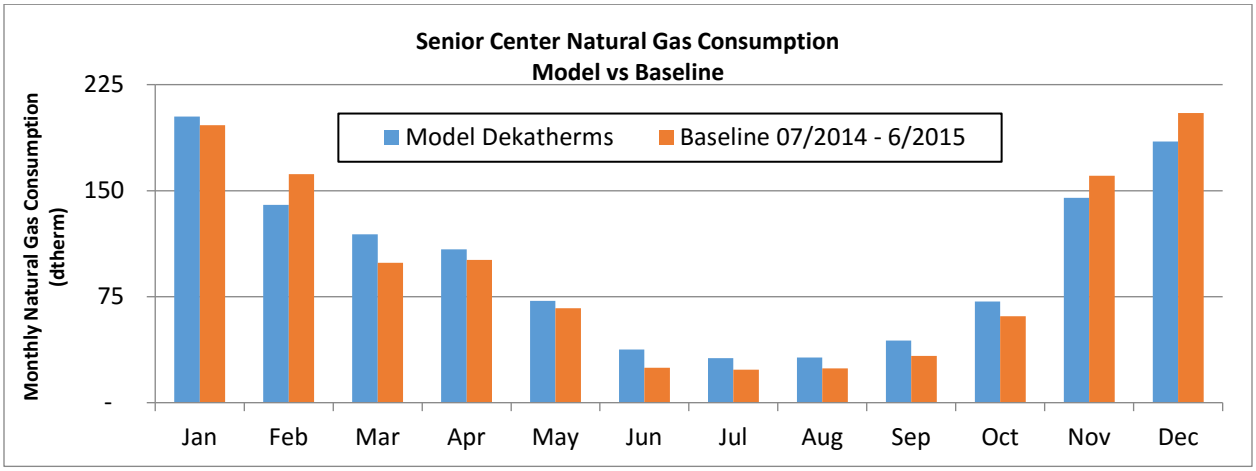


Figure F.17. Senior Center Natural Gas Consumption

Appendix G. Sample Lighting Calculations

> Tables

This appendix displays the lighting audit detail and associated calculations. Table G.0. Sample of Lighting Calculations Spreadsheet – columns, displays all the columns in the lighting calculation spreadsheet with the respective titles. They are shown here to demonstrate the level of detail in the lighting audit and the associated calculations.

Many of these columns are hidden in the printout shown in Table G.1. Sample of Lighting Calculations Spreadsheet – Part I through V, since there are too many to include the entire print-out of the spread sheet. This printout includes select fixtures for three facilities; Aquatic Center, City Hall and Courthouse. Shown are 103 rows of data out of over 2,000 rows in the full audit.

Table G.0. Sample of Lighting Calculations Spreadsheet – Columns Depict All Aspects Considered for Every Fixture

Retro-Tech Systems, Inc.

Lighting Inventory and Recommended Improvements for Carson City, NV

BUILDING AND ROOM INFORMATION FOR OPTION 2

ID No:	Project Phase	Rebate ($0.05 per kwh saved)	Facility Name or Code	Location in Facility	Room Type and Number	RTS Map ID# (RTS Operations)	Energy Rate Code	Lighting Burn Hour Code	Lighting Code (Existing System)	Lighting Code (Upgraded System)	Lighting Description (Existing System)	Lighting Description (Upgraded System)
88	INTERIOR	$ 534.60	COURTHOUSE	FLOOR 02	LOBBY		CRT	HALL	175MHCL-HARD	LED 17PAR38HO-BYPASS	EXISTING (1) LAMP 175 WATT METAL HALIDE LUMINAIRE	LED: SCREW IN LED LAMP
162	INTERIOR	$ 195.30	COURTHOUSE	FLOOR 02	OFFICE		CRT	O	2LPR-T8	LED R 2LT8[INT DRV]	EXISTING (2) LAMP F32T8 LUMINAIRE	RETROFIT WITH LED T8 LAMPS WITH INTERNAL DRIVER
246	INTERIOR	$ 432.00	COURTHOUSE	FLOOR 01	DAYROOM		CRT	Z	250HPSB-ROUND	LED N 55VAN-2X2	EXISTING (1) LAMP 250 WATT HIGH PRESSURE SODIUM LUMINAIRE	NEW: LED LUMINAIRE

MATERIAL MAINTENANCE CALCULATIONS

LABOR MAINTENANCE CALCULATIONS

Lamp Burn-Out Annual Avg. (Existing System)	Lamp Burn-Out Annual Avg. (Upgraded System)	Total Material Savings (Lamps)	Ballast Burn-Out Annual Avg. (Existing System)	Ballast Burn-Out Annual Avg. (Upgraded System)	Total Material Savings (Ballast)	Total Savings (Material)	Labor Cost for Lamps per Luminaire (Existing System)	Total Labor Cost for Lamps (Existing System)	Labor Cost for Lamps per Luminaire (Upgraded System)	Total Labor Cost for Lamps (Upgraded System)	Total Labor Hour Savings (Lamps)	Total Labor Dollar Saving (Lamps)	Labor Cost for Ballast per Luminaire (Existing System)
46%	9%	$90.02	8%	0%	$38.84	$128.86	$2.32	$0.00	$0.46	$0.00	0.67	$0.00	$2.30
24%	12%	($2.58)	5%	0%	$10.19	$7.61	$1.21	$0.00	$0.58	$0.00	0.53	$0.00	$1.44
36%	18%	($7.30)	15%	0%	$96.15	$88.85	$1.82	$0.00	$3.85	$0.00	(0.49)	$0.00	$4.34

					MAINTENANCE SAVING TOTALS				ROOM INFORMATION				
Total Labor Cost for Ballast (Existing System)	Labor Cost for Ballast per Luminaire (Upgraded System)	Total Labor Cost for Ballast (Upgraded System)	Total Labor Hour Savings (Ballast)	Total Labor Dollar Saving (Ballast)	Total Maint. Cost (Existing System)	Total Maint. Cost (Upgraded System)	Total Maint. Savings (Labor Hours)	Total Maint. Savings (Labor Dollars)	Total Maint. Savings	Foot-Candle Level (Measured)	Quantity of Luminaires (Existing System)	Input Watts (Existing System)	Total kW Used (Existing System)
$0.00	0.46	$0.00	$133.04	$4.18	1.13	$0.00	$128.86	25' MH	9	210.00	1.80	$0.00	0.46
$0.00	0.67	$0.00	$25.95	$18.34	1.20	$0.00	$7.61	35	21	58.00	1.16	$0.00	0.67
$0.00	0.58	$0.00	$141.40	$52.56	0.09	$0.00	$88.85	77	6	295.00	1.77	$0.00	0.58

EXISTING LIGHTING SYSTEM ENERGY CALCULATIONS (WINTER)						EXISTING LIGHTING SYSTEM ENERGY CALCULATIONS (SUMMER)					
Total kW Used (Existing System) (w/o D.F.) MAXIMUM POTENTIAL	Total Cost of kW in Winter (Existing System)	kWh Used On-Peak in Winter (Existing System)	kWh Used Off-Peak in Winter (Existing System)	Total Cost of kWh in Winter (Existing System)	Total Energy Cost in Winter (Existing System)	Total Cost of kW in Summer (Existing System)	kWh Used On-Peak in Summer	kWh Used Off-Peak in Summer	Total Cost of kWh in Summer (Existing System)	Total Energy Cost in Summer (Existing System)	Total kWh Used (Existing System)
1.89	$145.65	2,630.88	3,221.82	$284.68	$430.33	72.83	1,315.44	1,610.91	$142.34	$215.16	8,779.05
1.22	$93.86	1,695.46	668.86	$115.00	$208.86	46.93	847.73	334.22	$57.49	$104.42	3,546.26
1.77	$143.58	2,459.42	7,879.86	$502.90	$646.48	71.79	1,227.50	3,937.72	$251.24	$323.03	15,504.49

				UPGRADED LIGHTING SYSTEM ENERGY CALCULATIONS (WINTER)					UPGRADED LIGHTING SYSTEM ENERGY CALCULATIONS (SUMMER)			
Total Energy Cost (Existing System)	Quantity of Luminaires (Upgraded System)	Input Watts (Upgraded System)	Total kW Used (Upgraded System)	Total kW Used (Upgraded System) (w/o D.F.) MAXIMUM POTENTIAL	Total Cost of kW in Winter (Upgraded System)	kWh Used On-Peak in Winter (Upgraded System)	kWh Used Off-Peak in Winter (Upgraded System)	Total Cost of kWh in Winter (Upgraded System)	Total Energy Cost in Winter (Upgraded System)	Total Cost of kW in Summer (Upgraded System)	kWh Used On-Peak in Summer	kWh Used Off-Peak in Summer	Total Cost of kWh in Summer (Upgraded System)
$645.49	9	17.00	0.145	0.153	$11.79	212.98	260.81	$23.05	$34.84	$5.90	106.49	130.41	$11.52
$313.29	21	28.00	0.559	0.588	$45.31	818.50	322.90	$55.52	$100.83	$22.66	409.25	161.35	$27.75
$969.51	6	55.00	0.330	0.330	$26.77	458.54	1,469.13	$93.76	$120.53	$13.38	228.86	734.15	$46.84

SENSOR SAVINGS AND BREAKOUTS

Total Energy Cost in Summer (Upgraded System)	Total kWh Used (Upgraded System)	Total Energy Cost (Upgraded System)	kW Reduction from Occupancy Sensors	Occupancy Sensor Savings From kW Reduction	Occupancy Sensor Savings kWh On-Peak Winter	Occupancy Sensor Savings kWh On-Peak Summer	Occupancy Sensor Savings kWh Off-Peak Winter	Occupancy Sensor Savings kWh Off-Peak Summer	Occupancy Sensor Savings Cost On-Peak	Occupancy Sensor Savings Cost Off-Peak	Occupancy Sensor Savings Total kWh	Occupancy Sensor Savings
$17.42	710.69	$52.25	-	$ -	-	-	-	-	$0.00	$0.00	-	$0.00
$50.41	1,711.99	$151.24	-	$ -	-	-	-	-	$0.00	$0.00	-	$0.00
$60.23	2,890.67	$180.76	-	$ -	-	-	-	-	$0.00	$0.00	-	$0.00

HVAC Multiplier	HVAC Penalty or Savings	Total kW Saved (w/o Occupancy Sensors)	Total kW Saved MAXIMUM POTENTIAL	Total kW Saved	Total kWh Saved (w/o Occupancy Sensors)	Total kWh Saved	Total Savings (Energy) w/o Occupancy Sensors	Total Savings (Energy)	Total Savings (Maint, HVAC, Energy)
(0.02)	($11.86)	1.65	1.74	1.65	8,068.37	8,068.37	$593	$593	$710
(0.02)	($3.24)	0.60	0.63	0.60	1,834.27	1,834.27	$162	$162	$166
(0.02)	($15.78)	1.44	1.44	1.44	12,613.82	12,613.82	$789	$789	$862

Table G.1. Sample of Lighting Calculations Spreadsheet – Part I

Retro-Tech Systems, Inc

Lighting Inventory and Recommended Improvements for Carson City, NV

	BUILDING AND ROOM INFORMATION FOR OPTION 1											MAINTENANCE SAVING TOTALS				
ID No:	Project Phase	Rebate ($0.05 per kwh saved)	Facility Name or Code	Location in Facility	Room Type and Number	Energy Rate Code	Lighting Burn Hour Code	Lighting Code (Existing System)	Lighting Code (Upgraded System)	Lighting Description (Existing System)	Lighting Description (Upgraded System)	Total Maint. Cost (Existing System)	Total Maint. Cost (Upgraded System)	Total Maint. Savings (Labor Hours)	Total Maint. Savings (Labor Dollars)	Total Maint. Savings
88	INTERIOR	$ 534.60	COURTHOUSE	FLOOR 02	LOBBY	CRT	HALL	175MHCL-HARD	LED 17PAR38HO-BYPASS	EXISTING (1) LAMP 175 WATT METAL HALIDE LUMINAIRE	LED: SCREW IN LED LAMP	$133.04	$4.18	1.13	$0.00	$128.86
96	INTERIOR	$ 18.60	COURTHOUSE	FLOOR 02	RESTROOM WOMEN	CRT	RR	2ST-T8-COVE	LED R 2LT8[INT DRV]-HARD	EXISTING (2) LAMP F32T8 LUMINAIRE	RETROFIT: RETROFIT WITH LED T8 LAMPS WITH INTERNAL DRIVER	$2.65	$1.87	0.29	$0.00	$0.78
97	INTERIOR	$ 9.30	COURTHOUSE	FLOOR 02	RESTROOM WOMEN	CRT	RR	2S-T8-COVE	LED R 2LT8[INT DRV]-HARD	EXISTING (2) LAMP F32T8 LUMINAIRE	RETROFIT: RETROFIT WITH LED T8 LAMPS WITH INTERNAL DRIVER	$1.32	$0.94	0.15	$0.00	$0.39
123	INTERIOR	$ 141.00	COURTHOUSE	FLOOR 02	HALLWAY	CRT	HALL	3L-T8	LED R 3LT8[INT DRV]	EXISTING (3) LAMP F32T8 LUMINAIRE	RETROFIT: RETROFIT WITH LED T8 LAMPS WITH INTERNAL DRIVER	$27.25	$20.90	1.11	$0.00	$6.35
149	INTERIOR	$ 18.60	COURTHOUSE	FLOOR 02	OFFICE	CRT	O-EXST-OS	2LPRAH-T8	LED R 2LT8[INT DRV]	EXISTING (2) LAMP F32T8 LUMINAIRE, AIR HANDLING FIXTURE	RETROFIT: RETROFIT WITH LED T8 LAMPS WITH INTERNAL DRIVER	$1.91	$1.35	0.09	$0.00	$0.56
150	INTERIOR	$ 55.80	COURTHOUSE	FLOOR 02	OFFICE	CRT	O	2L-T8	LED R 2LT8[INT DRV]	EXISTING (2) LAMP F32T8 LUMINAIRE	RETROFIT: RETROFIT WITH LED T8 LAMPS WITH INTERNAL DRIVER	$7.41	$5.24	0.34	$0.00	$2.17
152	INTERIOR	$ 37.20	COURTHOUSE	FLOOR 02	OFFICE	CRT	O-EXST-OS	2LPRTAH-T8	LED R 2LT8[INT DRV]	EXISTING (2) LAMP F32T8 LUMINAIRE, AIR HANDLING FIXTURE	RETROFIT: RETROFIT WITH LED T8 LAMPS WITH INTERNAL DRIVER	$3.81	$2.70	0.18	$0.00	$1.12
153	INTERIOR	$ 18.60	COURTHOUSE	FLOOR 02	OFFICE	CRT	O-EXST-OS	2LPRAH-T8	LED R 2LT8[INT DRV]	EXISTING (2) LAMP F32T8 LUMINAIRE, AIR HANDLING FIXTURE	RETROFIT: RETROFIT WITH LED T8 LAMPS WITH INTERNAL DRIVER	$1.91	$1.35	0.09	$0.00	$0.56
154	INTERIOR	$ 18.60	COURTHOUSE	FLOOR 02	OFFICE	CRT	O-EXST-OS	2LPRAH-T8	LED R 2LT8[INT DRV]	EXISTING (2) LAMP F32T8 LUMINAIRE, AIR HANDLING FIXTURE	RETROFIT: RETROFIT WITH LED T8 LAMPS WITH INTERNAL DRIVER	$1.91	$1.35	0.09	$0.00	$0.56
155	INTERIOR	$ 18.60	COURTHOUSE	FLOOR 02	OFFICE	CRT	O-EXST-OS	2LPRAH-T8	LED R 2LT8[INT DRV]	EXISTING (2) LAMP F32T8 LUMINAIRE, AIR HANDLING FIXTURE	RETROFIT: RETROFIT WITH LED T8 LAMPS WITH INTERNAL DRIVER	$1.91	$1.35	0.09	$0.00	$0.56
156	INTERIOR	$ 18.60	COURTHOUSE	FLOOR 02	OFFICE	CRT	O-EXST-OS	2LPRAH-T8	LED R 2LT8[INT DRV]	EXISTING (2) LAMP F32T8 LUMINAIRE, AIR HANDLING FIXTURE	RETROFIT: RETROFIT WITH LED T8 LAMPS WITH INTERNAL DRIVER	$1.91	$1.35	0.09	$0.00	$0.56
157	INTERIOR	$ 18.60	COURTHOUSE	FLOOR 02	OFFICE	CRT	O-EXST-OS	2LPRAH-T8	LED R 2LT8[INT DRV]	EXISTING (2) LAMP F32T8 LUMINAIRE,	RETROFIT: RETROFIT WITH LED T8 LAMPS WITH INTERNAL DRIVER	$1.91	$1.35	0.09	$0.00	$0.56

										AIR HANDLING FIXTURE						
158	INTERIOR	$ 37.20	COURTHOUSE	FLOOR 02	OFFICE	CRT	O-EXST-OS	2LPRTAH-T8	LED R 2LT8[INT DRV]	EXISTING (2) LAMP F32T8 LUMINAIRE, AIR HANDLING FIXTURE	RETROFIT: RETROFIT WITH LED T8 LAMPS WITH INTERNAL DRIVER	$3.81	$2.70	0.18	$0.00	$1.12
162	INTERIOR	$ 195.30	COURTHOUSE	FLOOR 02	OFFICE	CRT	O	2LPR-T8	LED R 2LT8[INT DRV]	EXISTING (2) LAMP F32T8 LUMINAIRE	RETROFIT: RETROFIT WITH LED T8 LAMPS WITH INTERNAL DRIVER	$25.95	$18.34	1.20	$0.00	$7.61
175	INTERIOR	$ 18.60	COURTHOUSE	FLOOR 02	CONFERENCE ROOM	CRT	CONF-EXST-OS	2LPRAH-T8	LED R 2LT8[INT DRV]	EXISTING (2) LAMP F32T8 LUMINAIRE, AIR HANDLING FIXTURE	RETROFIT: RETROFIT WITH LED T8 LAMPS WITH INTERNAL DRIVER	$1.42	$1.00	0.07	$0.00	$0.42
176	INTERIOR	$ 18.60	COURTHOUSE	FLOOR 02	CONFERENCE ROOM	CRT	CONF-EXST-OS	2LPRAH-T8	LED R 2LT8[INT DRV]	EXISTING (2) LAMP F32T8 LUMINAIRE, AIR HANDLING FIXTURE	RETROFIT: RETROFIT WITH LED T8 LAMPS WITH INTERNAL DRIVER	$1.42	$1.00	0.07	$0.00	$0.42
177	INTERIOR	$ 97.50	COURTHOUSE	FLOOR 02	COURTROOM-JUSTICE DEPT. 1	CRT	CRT	2-18CFLCL8"-4P-HZ-DIM	LED R 13C6"-GR8"-DIM	EXISTING (2) LAMP 18 WATT PLUG IN COMPACT FLUORESCENT LUMINAIRE	RETROFIT: RETROFIT WITH LED	$68.08	$8.00	0.74	$0.00	$60.08
178	INTERIOR	$ 150.00	COURTHOUSE	FLOOR 02	COURTROOM-JUSTICE DEPT. 1	CRT	CRT	2-18CFLCL8"-4P-HZ-DIM-HARD	LED R 13C6"-GR8"-DIM-HARD	EXISTING (2) LAMP 18 WATT PLUG IN COMPACT FLUORESCENT LUMINAIRE	RETROFIT: RETROFIT WITH LED	$104.74	$12.30	0.62	$0.00	$92.44
180	INTERIOR	$ 10.80	COURTHOUSE	FLOOR 02	COURTROOM-JUSTICE DEPT. 1	CRT	CRT	1S-T8-COVE	LED R 1LT8[INT DRV]-HARD	EXISTING (1) LAMP F32T8 LUMINAIRE	RETROFIT: RETROFIT WITH LED T8 LAMPS WITH INTERNAL DRIVER	$1.82	$0.92	0.19	$0.00	$0.90
181	INTERIOR	$ 75.60	COURTHOUSE	FLOOR 02	COURTROOM-JUSTICE DEPT. 1	CRT	CRT	1ST-T8-COVE	LED R 1LT8[INT DRV]-HARD	EXISTING (1) LAMP F32T8 LUMINAIRE	RETROFIT: RETROFIT WITH LED T8 LAMPS WITH INTERNAL DRIVER	$12.72	$6.46	1.31	$0.00	$6.27
186	INTERIOR	$ 18.60	COURTHOUSE	FLOOR 02	HOLDING CELL	CRT	CELL	2W-T8-VAN-7W-2P-NL	LED R 2LT8[INT DRV]-HARD	EXISTING (2) LAMP F32T8 LUMINAIRE	RETROFIT: RETROFIT WITH LED T8 LAMPS WITH INTERNAL DRIVER	$4.87	$3.44	0.54	$0.00	$1.43
187	INTERIOR	$ 18.60	COURTHOUSE	FLOOR 02	HOLDING CELL	CRT	CELL	2W-T8-VAN-7W-2P-NL	LED R 2LT8[INT DRV]-HARD	EXISTING (2) LAMP F32T8 LUMINAIRE	RETROFIT: RETROFIT WITH LED T8 LAMPS WITH INTERNAL DRIVER	$4.87	$3.44	0.54	$0.00	$1.43
190	INTERIOR	$ 27.90	COURTHOUSE	FLOOR 01	JAIL VESTIBULE	CRT	Z	2L-T8	LED R 2LT8[INT DRV]	EXISTING (2) LAMP F32T8 LUMINAIRE	RETROFIT: RETROFIT WITH LED T8 LAMPS WITH INTERNAL DRIVER	$11.15	$7.88	0.52	$0.00	$3.27
191	INTERIOR	$ 9.30	COURTHOUSE	FLOOR 01	JAIL VESTIBULE	CRT	Z	2L-T8	LED R 2LT8[INT DRV]	EXISTING (2) LAMP F32T8 LUMINAIRE	RETROFIT: RETROFIT WITH LED T8 LAMPS WITH INTERNAL DRIVER	$3.72	$2.63	0.17	$0.00	$1.09
194	INTERIOR	$ 93.00	COURTHOUSE	FLOOR 01	BOOKING AREA	CRT	HALL	2L-T8	LED R 2LT8[INT DRV]	EXISTING (2) LAMP F32T8 LUMINAIRE	RETROFIT: RETROFIT WITH LED T8 LAMPS WITH INTERNAL DRIVER	$19.72	$13.94	0.91	$0.00	$5.78
213	INTERIOR	$ 37.20	COURTHOUSE	FLOOR 01	CELL	CRT	CELL	2S-T8-COVE	LED R 2LT8[INT DRV]-HARD	EXISTING (2) LAMP F32T8 LUMINAIRE	RETROFIT: RETROFIT WITH LED T8 LAMPS WITH INTERNAL DRIVER	$9.74	$6.88	1.08	$0.00	$2.85
217	INTERIOR	$ 9.30	COURTHOUSE	FLOOR 01	CELL	CRT	CELL	2L-T8	LED R 2LT8[INT DRV]	EXISTING (2) LAMP F32T8 LUMINAIRE	RETROFIT: RETROFIT WITH LED T8 LAMPS WITH INTERNAL DRIVER	$2.43	$1.72	0.11	$0.00	$0.71
225	INTERIOR	$ 93.00	COURTHOUSE	FLOOR 01	VISITATION BOOTHS 1-10	CRT	CELL	2L-T8-VAN	LED R 2LT8[INT DRV]-HARD	EXISTING (2) LAMP F32T8 LUMINAIRE	RETROFIT: RETROFIT WITH LED T8 LAMPS WITH INTERNAL DRIVER	$24.34	$17.21	2.70	$0.00	$7.14

229	INTERIOR	$ 169.20	COURTHOUSE	FLOOR 01	HOLDING CELL	CRT	CELL	3L-T8-VAN	LED R 3LT8[INT DRV]-HARD	EXISTING (3) LAMP F32T8 LUMINAIRE	RETROFIT: RETROFIT WITH LED T8 LAMPS WITH INTERNAL DRIVER	$40.37	$30.97	3.28	$0.00	$9.41
230	INTERIOR	$ 37.20	COURTHOUSE	FLOOR 01	HOLDING CELL	CRT	CELL	2L-1X4-T8-VAN	LED R 2LT8[INT DRV]-HARD	EXISTING (2) LAMP F32T8 LUMINAIRE	RETROFIT: RETROFIT WITH LED T8 LAMPS WITH INTERNAL DRIVER	$9.74	$6.88	1.08	$0.00	$2.85
233	INTERIOR	$ 4.50	COURTHOUSE	FLOOR 01	HOLDING CELL	CRT	CELL	2S2'-T8-COVE	LED R 2L2'T8[INT DRV]-HARD	EXISTING (2) LAMP F17T8 LUMINAIRE	RETROFIT: RETROFIT WITH LED T8 LAMPS WITH INTERNAL DRIVER	$2.63	$1.61	0.22	$0.00	$1.03
236	INTERIOR	$ 9.30	COURTHOUSE	FLOOR 01	OFFICE	CRT	O	2L-T8	LED R 2LT8[INT DRV]	EXISTING (2) LAMP F32T8 LUMINAIRE	RETROFIT: RETROFIT WITH LED T8 LAMPS WITH INTERNAL DRIVER	$1.24	$0.87	0.06	$0.00	$0.36
237	INTERIOR	$ 9.30	COURTHOUSE	FLOOR 01	OFFICE	CRT	O	2L-T8-BB	LED R 2LT8[INT DRV]-BB	EXISTING (2) LAMP F32T8 LUMINAIRE	RETROFIT: RETROFIT WITH LED T8 LAMPS WITH INTERNAL DRIVER	$1.24	$0.87	0.14	$0.00	$0.36
238	INTERIOR	$ 216.00	COURTHOUSE	FLOOR 01	DAYROOM	CRT	Z	250HPSB-ROUND	LED N 55VAN-2X2	EXISTING (1) LAMP 250 WATT HIGH PRESSURE SODIUM LUMINAIRE	NEW: LED LUMINAIRE	$70.70	$26.28	0.05	$0.00	$44.42
246	INTERIOR	$ 432.00	COURTHOUSE	FLOOR 01	DAYROOM	CRT	Z	250HPSB-ROUND	LED N 55VAN-2X2	EXISTING (1) LAMP 250 WATT HIGH PRESSURE SODIUM LUMINAIRE	NEW: LED LUMINAIRE	$141.40	$52.56	0.09	$0.00	$88.85
247	INTERIOR	$ 112.80	COURTHOUSE	FLOOR 01	DAYROOM	CRT	CELL	3L-T8-VAN	LED R 3LT8[INT DRV]-HARD	EXISTING (3) LAMP F32T8 LUMINAIRE	RETROFIT: RETROFIT WITH LED T8 LAMPS WITH INTERNAL DRIVER	$26.92	$20.65	2.19	$0.00	$6.27
254	INTERIOR	$ 18.60	COURTHOUSE	FLOOR 01	OFFICE	CRT	O	2L-T8	LED R 2LT8[INT DRV]	EXISTING (2) LAMP F32T8 LUMINAIRE	RETROFIT: RETROFIT WITH LED T8 LAMPS WITH INTERNAL DRIVER	$2.47	$1.75	0.11	$0.00	$0.72
257	INTERIOR	$ 504.00	COURTHOUSE	FLOOR 01	DAYROOM	CRT	Z	250HPSB-ROUND	LED N 55VAN-2X2	EXISTING (1) LAMP 250 WATT HIGH PRESSURE SODIUM LUMINAIRE	NEW: LED LUMINAIRE	$164.97	$61.32	0.11	$0.00	$103.65
258	INTERIOR	$ 84.60	COURTHOUSE	FLOOR 01	DAYROOM	CRT	CELL	3L-T8-VAN	LED R 3LT8[INT DRV]-HARD	EXISTING (3) LAMP F32T8 LUMINAIRE	RETROFIT: RETROFIT WITH LED T8 LAMPS WITH INTERNAL DRIVER	$20.19	$15.48	1.64	$0.00	$4.70
264	INTERIOR	$ 432.00	COURTHOUSE	FLOOR 01	DAYROOM	CRT	Z	250HPSB-ROUND	LED N 55VAN-2X2	EXISTING (1) LAMP 250 WATT HIGH PRESSURE SODIUM LUMINAIRE	NEW: LED LUMINAIRE	$141.40	$52.56	0.09	$0.00	$88.85
269	INTERIOR	$ 360.00	COURTHOUSE	FLOOR 01	DAYROOM	CRT	Z	250HPSB-ROUND	LED N 55VAN-2X2	EXISTING (1) LAMP 250 WATT HIGH PRESSURE SODIUM LUMINAIRE	NEW: LED LUMINAIRE	$117.84	$43.80	0.08	$0.00	$74.04
270	INTERIOR	$ 84.60	COURTHOUSE	FLOOR 01	DAYROOM	CRT	CELL	3L-T8-VAN	LED R 3LT8[INT DRV]-HARD	EXISTING (3) LAMP F32T8 LUMINAIRE	RETROFIT: RETROFIT WITH LED T8 LAMPS WITH INTERNAL DRIVER	$20.19	$15.48	1.64	$0.00	$4.70
276	INTERIOR	$ 1,512.00	COURTHOUSE	FLOOR 01	DAYROOM	CRT	Z	250HPSB-ROUND	LED N 55VAN-2X2	EXISTING (1) LAMP 250 WATT HIGH PRESSURE SODIUM LUMINAIRE	NEW: LED LUMINAIRE	$494.91	$183.95	0.32	$0.00	$310.96
277	INTERIOR	$ 267.90	COURTHOUSE	FLOOR 01	DAYROOM	CRT	CELL	3L-T8-VAN	LED R 3LT8[INT DRV]-HARD	EXISTING (3) LAMP F32T8 LUMINAIRE	RETROFIT: RETROFIT WITH LED T8 LAMPS WITH INTERNAL DRIVER	$63.93	$49.03	5.19	$0.00	$14.89
281	INTERIOR	$ 216.00	COURTHOUSE	FLOOR 01	CELL FIXTURES	CRT	CELL	7W-EMERGENCY-LIGHT	LED R 5PL-2P	EXISTING (1) LAMP7 WATT COMPACT	RETROFIT: RETROFIT WITH MAXLITE 5W LED 2PIN PL LAMP	$659.75	$597.17	13.21	$0.00	$62.58

										FLUORESCENT LUMINAIRE						
288	INTERIOR	$ 18.60	COURTHOUSE	FLOOR 01	OFFICE	CRT	O	2L-T8	LED R 2LT8[INT DRV]	EXISTING (2) LAMP F32T8 LUMINAIRE	RETROFIT: RETROFIT WITH LED T8 LAMPS WITH INTERNAL DRIVER	$2.47	$1.75	0.11	$0.00	$0.72
303	INTERIOR	$ 16.80	COURTHOUSE	FLOOR 01	OFFICE	CRT	O	4L-T8-VAN	LED R 4LT8[INT DRV]-HARD	EXISTING (4) LAMP F32T8 LUMINAIRE	RETROFIT: RETROFIT WITH LED T8 LAMPS WITH INTERNAL DRIVER	$2.16	$1.75	0.16	$0.00	$0.42
315	INTERIOR	$ 27.90	COURTHOUSE	FLOOR 01	HALLWAY	CRT	HALL	2L-T8	LED R 2LT8[INT DRV]	EXISTING (2) LAMP F32T8 LUMINAIRE	RETROFIT: RETROFIT WITH LED T8 LAMPS WITH INTERNAL DRIVER	$5.91	$4.18	0.27	$0.00	$1.73
322	INTERIOR	$ 93.00	COURTHOUSE	FLOOR 01	HALLWAY	CRT	HALL	2L-T8	LED R 2LT8[INT DRV]	EXISTING (2) LAMP F32T8 LUMINAIRE	RETROFIT: RETROFIT WITH LED T8 LAMPS WITH INTERNAL DRIVER	$19.72	$13.94	0.91	$0.00	$5.78
340	INTERIOR	$ 18.60	COURTHOUSE	FLOOR 01	OFFICE	CRT	O-EXST-OS	2LPRAH-T8	LED R 2LT8[INT DRV]	EXISTING (2) LAMP F32T8 LUMINAIRE, AIR HANDLING FIXTURE	RETROFIT: RETROFIT WITH LED T8 LAMPS WITH INTERNAL DRIVER	$1.91	$1.35	0.09	$0.00	$0.56
341	INTERIOR	$ 74.40	COURTHOUSE	FLOOR 01	VISITATION	CRT	HALL	2L-T8	LED R 2LT8[INT DRV]	EXISTING (2) LAMP F32T8 LUMINAIRE	RETROFIT: RETROFIT WITH LED T8 LAMPS WITH INTERNAL DRIVER	$15.77	$11.15	0.73	$0.00	$4.62
347	INTERIOR	$ 9.30	COURTHOUSE	FLOOR 01	RESTROOM WOMEN	CRT	RR	2S-T8-COVE	LED R 2LT8[INT DRV]-HARD	EXISTING (2) LAMP F32T8 LUMINAIRE	RETROFIT: RETROFIT WITH LED T8 LAMPS WITH INTERNAL DRIVER	$1.32	$0.94	0.15	$0.00	$0.39
355	INTERIOR	$ 55.80	COURTHOUSE	FLOOR 01	LOBBY	CRT	HALL	2ST-T8-COVE	LED R 2LT8[INT DRV]-HARD	EXISTING (2) LAMP F32T8 LUMINAIRE	RETROFIT: RETROFIT WITH LED T8 LAMPS WITH INTERNAL DRIVER	$11.83	$8.36	1.31	$0.00	$3.47
357	INTERIOR	$ 18.60	COURTHOUSE	FLOOR 01	OFFICE	CRT	O	2LPRAH-T8	LED R 2LT8[INT DRV]	EXISTING (2) LAMP F32T8 LUMINAIRE, AIR HANDLING FIXTURE	RETROFIT: RETROFIT WITH LED T8 LAMPS WITH INTERNAL DRIVER	$2.47	$1.75	0.11	$0.00	$0.72
365	INTERIOR	$ 130.20	COURTHOUSE	FLOOR 01	OFFICE	CRT	O	2LPRAH-T8	LED R 2LT8[INT DRV]	EXISTING (2) LAMP F32T8 LUMINAIRE, AIR HANDLING FIXTURE	RETROFIT: RETROFIT WITH LED T8 LAMPS WITH INTERNAL DRIVER	$17.30	$12.23	0.80	$0.00	$5.07
366	INTERIOR	$ 37.20	COURTHOUSE	FLOOR 01	OFFICE	CRT	O	2L-T8	LED R 2LT8[INT DRV]	EXISTING (2) LAMP F32T8 LUMINAIRE	RETROFIT: RETROFIT WITH LED T8 LAMPS WITH INTERNAL DRIVER	$4.94	$3.49	0.23	$0.00	$1.45
368	INTERIOR	$ 55.80	COURTHOUSE	FLOOR 01	OFFICE	CRT	O-EXST-OS	2LPRAH-T8	LED R 2LT8[INT DRV]	EXISTING (2) LAMP F32T8 LUMINAIRE, AIR HANDLING FIXTURE	RETROFIT: RETROFIT WITH LED T8 LAMPS WITH INTERNAL DRIVER	$5.72	$4.04	0.27	$0.00	$1.68
369	INTERIOR	$ 37.20	COURTHOUSE	FLOOR 01	OFFICE	CRT	O-EXST-OS	2LPRAH-T8	LED R 2LT8[INT DRV]	EXISTING (2) LAMP F32T8 LUMINAIRE, AIR HANDLING FIXTURE	RETROFIT: RETROFIT WITH LED T8 LAMPS WITH INTERNAL DRIVER	$3.81	$2.70	0.18	$0.00	$1.12
376	INTERIOR	$ 18.60	COURTHOUSE	FLOOR 01	OFFICE	CRT	O-EXST-OS	2LPRAH-T8	LED R 2LT8[INT DRV]	EXISTING (2) LAMP F32T8 LUMINAIRE, AIR HANDLING FIXTURE	RETROFIT: RETROFIT WITH LED T8 LAMPS WITH INTERNAL DRIVER	$1.91	$1.35	0.09	$0.00	$0.56
382	INTERIOR	$ 18.60	COURTHOUSE	FLOOR 01	RESTROOM WOMEN	CRT	RR-OS	2ST-T8-COVE	LED R 2LT8[INT DRV]-HARD	EXISTING (2) LAMP F32T8 LUMINAIRE	RETROFIT: RETROFIT WITH LED T8 LAMPS WITH INTERNAL DRIVER	$2.65	$1.40	0.31	$0.00	$1.24
383	INTERIOR	$ 9.30	COURTHOUSE	FLOOR 01	RESTROOM WOMEN	CRT	RR-OS	2S-T8-COVE	LED R 2LT8[INT DRV]-HARD	EXISTING (2) LAMP F32T8 LUMINAIRE	RETROFIT: RETROFIT WITH LED T8 LAMPS WITH INTERNAL DRIVER	$1.32	$0.70	0.15	$0.00	$0.62

384	INTERIOR	$ 12.00	COURTHOUSE	FLOOR 01	RESTROOM WOMEN	CRT	RR-OS	NO EXISTING CONTROL	ZZZ OS WIR	NO EXISTING LIGHTING CONTROL	NEW: OCCUPANCY SENSOR	$0.00	$0.00	-	$0.00	$0.00
393	INTERIOR	$ 9.30	COURTHOUSE	FLOOR 01	HALLWAY	CRT	HALL	2L-T8	LED R 2LT8[INT DRV]	EXISTING (2) LAMP F32T8 LUMINAIRE	RETROFIT: RETROFIT WITH LED T8 LAMPS WITH INTERNAL DRIVER	$1.97	$1.39	0.09	$0.00	$0.58
405	INTERIOR	$ 15.00	COURTHOUSE	FLOOR 01	RESTROOM WOMEN	CRT	RR	2-18CFLCL6"-4P-HZ	LED R 13C6"	EXISTING (2) LAMP 18 WATT PLUG IN COMPACT FLUORESCENT LUMINAIRE	RETROFIT: RETROFIT WITH LED	$10.62	$1.25	0.11	$0.00	$9.37
407	INTERIOR	$ 18.60	COURTHOUSE	FLOOR 01	RESTROOM WOMEN	CRT	RR-OS	2ST-T8-COVE	LED R 2LT8[INT DRV]-HARD	EXISTING (2) LAMP F32T8 LUMINAIRE	RETROFIT: RETROFIT WITH LED T8 LAMPS WITH INTERNAL DRIVER	$2.65	$1.40	0.31	$0.00	$1.24
408	INTERIOR	$ 9.30	COURTHOUSE	FLOOR 01	RESTROOM WOMEN	CRT	RR-OS	2S-T8-COVE	LED R 2LT8[INT DRV]-HARD	EXISTING (2) LAMP F32T8 LUMINAIRE	RETROFIT: RETROFIT WITH LED T8 LAMPS WITH INTERNAL DRIVER	$1.32	$0.70	0.15	$0.00	$0.62
409	INTERIOR	$ 30.00	COURTHOUSE	FLOOR 01	RESTROOM WOMEN	CRT	RR-OS	NO EXISTING CONTROL	ZZZ OS CUS-HARD	NO EXISTING LIGHTING CONTROL	NEW: OCCUPANCY SENSOR	$0.00	$0.00	-	$0.00	$0.00
410	INTERIOR	$ 27.90	COURTHOUSE	FLOOR 01	LOBBY	CRT	HALL	2L-T8	LED R 2LT8[INT DRV]	EXISTING (2) LAMP F32T8 LUMINAIRE	RETROFIT: RETROFIT WITH LED T8 LAMPS WITH INTERNAL DRIVER	$5.91	$4.18	0.27	$0.00	$1.73
412	INTERIOR	$ 247.50	COURTHOUSE	FLOOR 01	HALLWAY	CRT	HALL	2-18CFLCL6"-4P-HZ	LED R 13C6"	EXISTING (2) LAMP 18 WATT PLUG IN COMPACT FLUORESCENT LUMINAIRE	RETROFIT: RETROFIT WITH LED	$261.05	$30.66	2.82	$0.00	$230.40
415	INTERIOR	$ 82.50	COURTHOUSE	FLOOR 01	HALLWAY	CRT	HALL	2-18CFLCL6"-4P-HZ	LED R 13C6"	EXISTING (2) LAMP 18 WATT PLUG IN COMPACT FLUORESCENT LUMINAIRE	RETROFIT: RETROFIT WITH LED	$87.02	$10.22	0.94	$0.00	$76.80
417	INTERIOR	$ 74.40	COURTHOUSE	FLOOR 01	OFFICE	CRT	O	2LPRAH-T8	LED R 2LT8[INT DRV]	EXISTING (2) LAMP F32T8 LUMINAIRE, AIR HANDLING FIXTURE	RETROFIT: RETROFIT WITH LED T8 LAMPS WITH INTERNAL DRIVER	$9.89	$6.99	0.46	$0.00	$2.90
421	EXTERIOR	$ 201.25	COURTHOUSE	EXTERIOR	EXTERIOR BUILDING	CRT	X	100HPSWPK	LED N 23WPK-FC-27K-16'	EXISTING (1) LAMP 100 WATT HIGH PRESSURE SODIUM LUMINAIRE	NEW: LED LUMINAIRE	$67.29	$8.52	0.29	$0.00	$58.78
422	EXTERIOR	$ 40.00	COURTHOUSE	EXTERIOR	EXTERIOR BUILDING	CRT	X	70HPSWPK	LED N 15WPK-FC-27K	EXISTING (1) LAMP 70 WATT HIGH PRESSURE SODIUM LUMINAIRE	NEW: LED LUMINAIRE	$18.69	$2.43	0.08	$0.00	$16.25
423	EXTERIOR	$ 85.00	COURTHOUSE	EXTERIOR	EXTERIOR BUILDING	CRT	X	100WPK	LED N 15WPK-FC-27K	EXISTING (1) LAMP 100 WATT INCANDESCENT LUMINAIRE	NEW: LED LUMINAIRE	$31.15	$4.87	4.50	$0.00	$26.28
424	EXTERIOR	$ 233.00	COURTHOUSE	EXTERIOR	PARKING LOT	CRT	X	250HPSSB-10'	LED N 62SB-27K	EXISTING (1) LAMP 250 WATT HIGH PRESSURE SODIUM LUMINAIRE	NEW: LED LUMINAIRE	$47.13	$9.73	0.17	$0.00	$37.40
425	EXTERIOR	$ 116.50	COURTHOUSE	EXTERIOR	PARKING LOT	CRT	X	250HPSSB-20'	LED N 62SB-27K	EXISTING (1) LAMP 250 WATT HIGH PRESSURE SODIUM LUMINAIRE	NEW: LED LUMINAIRE	$23.57	$4.87	0.08	$0.00	$18.70
426	EXTERIOR	$ 132.00	COURTHOUSE	EXTERIOR	PARKING LOT	CRT	X	2-250HPSSB-6"-SQ-MT-SV-20'	LED N 62SB-SQP-SLV-27K	EXISTING (2) LAMP 250 WATT HIGH	NEW: LED LUMINAIRE	$23.57	$2.43	0.13	$0.00	$21.13

										PRESSURE SODIUM LUMINAIRE							
633	INTERIOR	$ 163.80	CITY HALL	FLOOR 01	LOBBY	CTY	HALL	6BPR-T8	LED R 6LT8[INT DRV]	EXISTING (6) LAMP F32T8 LUMINAIRE	RETROFIT: RETROFIT WITH LED T8 LAMPS WITH INTERNAL DRIVER	$32.70	$25.08	1.34	$0.00	$7.62
634	INTERIOR	$ 595.20	CITY HALL	FLOOR 01	LOBBY	CTY	HALL	2ST-T8-COVE	LED R 2LT8[INT DRV]-HARD	EXISTING (2) LAMP F32T8 LUMINAIRE	RETROFIT: RETROFIT WITH LED T8 LAMPS WITH INTERNAL DRIVER	$126.18	$89.18	13.97	$0.00	$36.99
635	INTERIOR	$ 9.30	CITY HALL	FLOOR 01	LOBBY	CTY	HALL	2S-T8-COVE	LED R 2LT8[INT DRV]-HARD	EXISTING (2) LAMP F32T8 LUMINAIRE	RETROFIT: RETROFIT WITH LED T8 LAMPS WITH INTERNAL DRIVER	$1.97	$1.39	0.22	$0.00	$0.58
639	INTERIOR	$ 28.80	CITY HALL	FLOOR 01	OFFICE	CTY	O	3LDS-T8	LED R 3LT8[INT DRV]	EXISTING (3) LAMP F32T8 LUMINAIRE, DOUBLE SWITCHED	RETROFIT: RETROFIT WITH LED T8 LAMPS WITH INTERNAL DRIVER	$4.19	$2.62	0.20	$0.00	$1.57
641	INTERIOR	$ 57.60	CITY HALL	FLOOR 01	OFFICE	CTY	O	3LDS-T8	LED R 3LT8[INT DRV]	EXISTING (3) LAMP F32T8 LUMINAIRE, DOUBLE SWITCHED	RETROFIT: RETROFIT WITH LED T8 LAMPS WITH INTERNAL DRIVER	$8.39	$5.24	0.41	$0.00	$3.14
644	INTERIOR	$ 57.60	CITY HALL	FLOOR 01	OFFICE	CTY	O	3LDS-T8	LED R 3LT8[INT DRV]	EXISTING (3) LAMP F32T8 LUMINAIRE, DOUBLE SWITCHED	RETROFIT: RETROFIT WITH LED T8 LAMPS WITH INTERNAL DRIVER	$8.39	$5.24	0.41	$0.00	$3.14
646	INTERIOR	$ 43.20	CITY HALL	FLOOR 01	OFFICE	CTY	O	3LDS-T8	LED R 3LT8[INT DRV]	EXISTING (3) LAMP F32T8 LUMINAIRE, DOUBLE SWITCHED	RETROFIT: RETROFIT WITH LED T8 LAMPS WITH INTERNAL DRIVER	$6.29	$3.93	0.31	$0.00	$2.36
648	INTERIOR	$ 72.00	CITY HALL	FLOOR 01	OFFICE	CTY	O	3LDS-T8	LED R 3LT8[INT DRV]	EXISTING (3) LAMP F32T8 LUMINAIRE, DOUBLE SWITCHED	RETROFIT: RETROFIT WITH LED T8 LAMPS WITH INTERNAL DRIVER	$10.48	$6.55	0.51	$0.00	$3.93
650	INTERIOR	$ 57.60	CITY HALL	FLOOR 01	OFFICE	CTY	O	3LDS-T8	LED R 3LT8[INT DRV]	EXISTING (3) LAMP F32T8 LUMINAIRE, DOUBLE SWITCHED	RETROFIT: RETROFIT WITH LED T8 LAMPS WITH INTERNAL DRIVER	$8.39	$5.24	0.41	$0.00	$3.14
694	INTERIOR	$ 9.30	CITY HALL	FLOOR 02	HALLWAY	CTY	HALL	2L-T8-HARD	LED R 2LT8[INT DRV]-HARD	EXISTING (2) LAMP F32T8 LUMINAIRE	RETROFIT: RETROFIT WITH LED T8 LAMPS WITH INTERNAL DRIVER	$1.97	$1.39	0.22	$0.00	$0.58
702	INTERIOR	$ 9.30	CITY HALL	FLOOR 02	RESTROOM WOMEN	CTY	RR-OS	2B(L)-1X4-T8	LED R 2LT8[INT DRV](L)	EXISTING (2) LAMP F40T12 LUMINAIRE	RETROFIT: RETROFIT WITH LED T8 LAMPS WITH INTERNAL DRIVER	$1.55	$0.70	0.07	$0.00	$0.85
704	INTERIOR	$ 12.00	CITY HALL	FLOOR 02	RESTROOM WOMEN	CTY	RR-OS	NO EXISTING CONTROL	ZZZ OS WIR	NO EXISTING LIGHTING CONTROL	NEW: OCCUPANCY SENSOR	$0.00	$0.00	-	$0.00	$0.00
714	INTERIOR	$ 28.80	CITY HALL	FLOOR 02	OFFICE	CTY	O	3LDS-T8	LED R 3LT8[INT DRV]	EXISTING (3) LAMP F32T8 LUMINAIRE, DOUBLE SWITCHED	RETROFIT: RETROFIT WITH LED T8 LAMPS WITH INTERNAL DRIVER	$4.19	$2.62	0.20	$0.00	$1.57
722	INTERIOR	$ 28.80	CITY HALL	FLOOR 02	OFFICE	CTY	O	3LDS-T8	LED R 3LT8[INT DRV]	EXISTING (3) LAMP F32T8 LUMINAIRE, DOUBLE SWITCHED	RETROFIT: RETROFIT WITH LED T8 LAMPS WITH INTERNAL DRIVER	$4.19	$2.62	0.20	$0.00	$1.57
724	INTERIOR	$ 144.00	CITY HALL	FLOOR 02	OFFICE	CTY	O	3LDS-T8	LED R 3LT8[INT DRV]	EXISTING (3) LAMP F32T8 LUMINAIRE, DOUBLE SWITCHED	RETROFIT: RETROFIT WITH LED T8 LAMPS WITH INTERNAL DRIVER	$20.96	$13.10	1.02	$0.00	$7.86
741	INTERIOR	$ 28.80	CITY HALL	FLOOR 02	OFFICE	CTY	O	3LDS-T8	LED R 3LT8[INT DRV]	EXISTING (3) LAMP F32T8 LUMINAIRE, DOUBLE SWITCHED	RETROFIT: RETROFIT WITH LED T8 LAMPS WITH INTERNAL DRIVER	$4.19	$2.62	0.20	$0.00	$1.57
743	INTERIOR	$ 43.20	CITY HALL	FLOOR 02	OFFICE	CTY	O	3LDS-T8	LED R 3LT8[INT DRV]	EXISTING (3) LAMP F32T8 LUMINAIRE, DOUBLE SWITCHED	RETROFIT: RETROFIT WITH LED T8 LAMPS WITH INTERNAL DRIVER	$6.29	$3.93	0.31	$0.00	$2.36
758	EXTERIOR	$ 80.50	CITY HALL	EXTERIOR	EXTERIOR BUILDING	CTY	X	175MHWPK-DECO	LED N 54PT-LANTERN-27K	EXISTING (1) LAMP 175 WATT METAL HALIDE LUMINAIRE	NEW: LED LUMINAIRE	$27.88	$4.87	0.19	$0.00	$23.01
838	INTERIOR	$ 172.80	AQUATIC FACILITY	FLOOR 01	LOBBY	AQF	LO	2-50PAR30-CYL	LED 2-14PAR30	EXISTING (2) LAMP 50 WATT	LED: SCREW IN LED LAMP	$141.27	$9.66	3.28	$0.00	$131.61

										INCANDESCENT LUMINAIRE						
839	INTERIOR	$ 34.80	AQUATIC FACILITY	FLOOR 01	LOBBY	AQF	HALL	3L2'(L)-T8	LED RF 2LR2'T8-WHT[INT DRV](L)	EXISTING (3) LAMP F17T8 LUMINAIRE	RETROFIT: RETROFIT WITH LED T8 LAMPS WITH INTERNAL DRIVER	$11.86	$5.20	0.52	$0.00	$6.66
850	INTERIOR	$ 396.00	AQUATIC FACILITY	FLOOR 01	THERAPY POOL	AQF	POOL	3IDPT-T8	LED N 34DID-PEN	EXISTING (3) LAMP F32T8 LUMINAIRE	NEW: LED LUMINAIRE	$49.76	$21.20	2.31	$0.00	$28.55
852	INTERIOR	$ 7,501.20	AQUATIC FACILITY	FLOOR 01	OLYMPIC POOL	AQF	POOL	1000MHB-INDIRECT	LED N 187POOL-ID	EXISTING (1) LAMP 1000 WATT METAL HALIDE LUMINAIRE	NEW: LED LUMINAIRE, THE LIGHT EDGE BLK4-HO-4-200-40-MVD-BACC6-LAE-CU6	$646.53	$49.48	1.87	$0.00	$597.05
853	INTERIOR	$ 1,071.60	AQUATIC FACILITY	FLOOR 01	OLYMPIC POOL	AQF	POOL	1000MHB-INDIRECT-CORNERS	LED N 187POOL-ID	EXISTING (1) LAMP 1000 WATT METAL HALIDE LUMINAIRE	NEW: LED LUMINAIRE, THE LIGHT EDGE BLK4-HO-4-200-40-MVD-BACC6-LAE-CU6	$92.36	$7.07	0.27	$0.00	$85.29
854	INTERIOR	$ 92.70	AQUATIC FACILITY	FLOOR 01	OLYMPIC POOL	AQF	POOL	100MHWPK-ROUND	LED N 25RNDWPK-WHT-HALF-27K	EXISTING (1) LAMP 100 WATT METAL HALIDE LUMINAIRE	NEW: LED LUMINAIRE	$27.20	$2.95	0.12	$0.00	$24.26
858	INTERIOR	$ 27.90	AQUATIC FACILITY	FLOOR 01	OFFICE	AQF	O	2WWP(WP)-T8	LED R 2LT8[INT DRV](WP)	EXISTING (2) LAMP F32T8 LUMINAIRE	RETROFIT: RETROFIT WITH LED T8 LAMPS WITH INTERNAL DRIVER	$3.71	$2.62	0.17	$0.00	$1.09
863	EXTERIOR	$ 288.75	AQUATIC FACILITY	EXTERIOR	EXTERIOR BUILDING	AQF	X	150HPSWPK	LED N 23WPK-FC-27K	EXISTING (1) LAMP 150 WATT HIGH PRESSURE SODIUM LUMINAIRE	NEW: LED LUMINAIRE	$70.75	$8.52	0.29	$0.00	$62.24

Table G.2. Sample of Lighting Calculations Spreadsheet – Part II

	ROOM INFORMATION					EXISTING LIGHTING SYSTEM ENERGY CALCULATIONS (WINTER)							EXISTING LIGHTING SYSTEM ENERGY CALCULATIONS (SUMMER)						
ID No:	Facility Name or Code	Room Type and Number	Foot-Candle Level (Measured)	Quantity of Luminaires (Existing System)	Input Watts (Existing System)	Total kW Used (Existing System)	Total kW Used (Existing System) (w/o D.F.) MAXIMUM POTENTIAL	Total Cost of kW in Winter (Existing System)	kWh Used On-Peak in Winter (Existing System)	kWh Used Off-Peak in Winter (Existing System)	Total Cost of kWh in Winter (Existing System)	Total Energy Cost in Winter (Existing System)	Total Cost of kW in Summer (Existing System)	kWh Used On-Peak in Summer	kWh Used Off-Peak in Summer	Total Cost of kWh in Summer (Existing System)	Total Energy Cost in Summer (Existing System)	Total kWh Used (Existing System)	Total Energy Cost (Existing System)
88	COURTHOUSE	LOBBY	25' MH	9	210.00	1.80	1.89	$145.65	2,630.88	3,221.82	$284.68	$430.33	72.83	1,315.44	1,610.91	$142.34	$215.16	8,779.05	$645.49
96	COURTHOUSE	RESTROOM WOMEN		2	58.00	0.11	0.12	$8.94	161.47	79.58	$11.72	$20.66	4.47	80.74	39.79	$5.86	$10.33	361.57	$31.00
97	COURTHOUSE	RESTROOM WOMEN		1	58.00	0.06	0.06	$4.47	80.74	39.79	$5.86	$10.33	2.23	40.37	19.89	$2.93	$5.17	180.79	$15.50
123	COURTHOUSE	HALLWAY		10	86.00	0.82	0.86	$66.28	1,197.12	1,466.01	$129.53	$195.81	33.14	598.56	733.01	$64.77	$97.90	3,994.70	$293.71
149	COURTHOUSE	OFFICE		2	58.00	0.10	0.12	$8.47	109.10	64.59	$8.45	$16.92	4.23	54.55	32.29	$4.22	$8.46	260.54	$25.38
150	COURTHOUSE	OFFICE		6	58.00	0.33	0.35	$26.82	484.42	191.10	$32.86	$59.68	13.41	242.21	95.49	$16.43	$29.83	1,013.22	$89.51
152	COURTHOUSE	OFFICE		4	58.00	0.21	0.23	$16.94	218.20	129.18	$16.90	$33.83	8.47	109.10	64.59	$8.45	$16.92	521.07	$50.75
153	COURTHOUSE	OFFICE		2	58.00	0.10	0.12	$8.47	109.10	64.59	$8.45	$16.92	4.23	54.55	32.29	$4.22	$8.46	260.54	$25.38
154	COURTHOUSE	OFFICE		2	58.00	0.10	0.12	$8.47	109.10	64.59	$8.45	$16.92	4.23	54.55	32.29	$4.22	$8.46	260.54	$25.38
155	COURTHOUSE	OFFICE		2	58.00	0.10	0.12	$8.47	109.10	64.59	$8.45	$16.92	4.23	54.55	32.29	$4.22	$8.46	260.54	$25.38
156	COURTHOUSE	OFFICE		2	58.00	0.10	0.12	$8.47	109.10	64.59	$8.45	$16.92	4.23	54.55	32.29	$4.22	$8.46	260.54	$25.38
157	COURTHOUSE	OFFICE		2	58.00	0.10	0.12	$8.47	109.10	64.59	$8.45	$16.92	4.23	54.55	32.29	$4.22	$8.46	260.54	$25.38
158	COURTHOUSE	OFFICE		4	58.00	0.21	0.23	$16.94	218.20	129.18	$16.90	$33.83	8.47	109.10	64.59	$8.45	$16.92	521.07	$50.75
162	COURTHOUSE	OFFICE	35	21	58.00	1.16	1.22	$93.86	1,695.46	668.86	$115.00	$208.86	46.93	847.73	334.22	$57.49	$104.42	3,546.26	$313.29
175	COURTHOUSE	CONFERENCE ROOM		2	58.00	0.10	0.12	$8.47	96.88	32.29	$6.28	$14.75	4.23	48.44	16.15	$3.14	$7.38	193.77	$22.13
176	COURTHOUSE	CONFERENCE ROOM		2	58.00	0.10	0.12	$8.47	96.88	32.29	$6.28	$14.75	4.23	48.44	16.15	$3.14	$7.38	193.77	$22.13
177	COURTHOUSE	COURTROOM-JUSTICE DEPT. 1		13	38.00	0.47	0.49	$38.07	574.32	438.38	$49.26	$87.33	19.03	287.16	219.19	$24.63	$43.66	1,519.05	$130.99
178	COURTHOUSE	COURTROOM-JUSTICE DEPT. 1		20	38.00	0.72	0.76	$58.57	883.58	674.42	$75.78	$134.35	29.28	441.79	337.21	$37.89	$67.17	2,337.00	$201.52
180	COURTHOUSE	COURTROOM-JUSTICE DEPT. 1		2	32.00	0.06	0.06	$4.93	74.41	56.79	$6.38	$11.31	2.47	37.20	28.40	$3.19	$5.66	196.80	$16.97
181	COURTHOUSE	COURTROOM-JUSTICE DEPT. 1		14	32.00	0.43	0.45	$34.52	520.84	397.56	$44.67	$79.20	17.26	260.42	198.78	$22.34	$39.60	1,377.60	$118.79
186	COURTHOUSE	HOLDING CELL		2	58.00	0.11	0.12	$8.94	161.47	282.03	$21.57	$30.51	4.47	80.74	141.02	$10.79	$15.26	665.26	$45.77

187	COURTHOUSE	HOLDING CELL		2	58.00	0.11	0.12	$8.94	161.47	282.03	$21.57	$30.51	4.47	80.74	141.02	$10.79	$15.26	665.26	$45.77
190	COURTHOUSE	JAIL VESTIBULE		3	58.00	0.17	0.17	$14.11	241.77	774.63	$49.44	$63.55	7.06	120.67	387.10	$24.70	$31.76	1,524.17	$95.31
191	COURTHOUSE	JAIL VESTIBULE		1	58.00	0.06	0.06	$4.70	80.59	258.21	$16.48	$21.18	2.35	40.22	129.03	$8.23	$10.59	508.06	$31.77
194	COURTHOUSE	BOOKING AREA		10	58.00	0.55	0.58	$44.70	807.36	988.71	$87.36	$132.06	22.35	403.68	494.35	$43.68	$66.03	2,694.10	$198.09
213	COURTHOUSE	CELL		4	58.00	0.22	0.23	$17.88	322.94	564.07	$43.14	$61.02	8.94	161.47	282.03	$21.57	$30.51	1,330.52	$91.53
217	COURTHOUSE	CELL		1	58.00	0.06	0.06	$4.47	80.74	141.02	$10.79	$15.26	2.23	40.37	70.51	$5.39	$7.63	332.63	$22.88
225	COURTHOUSE	VISITATION BOOTHS 1-10		10	58.00	0.55	0.58	$44.70	807.36	1,410.17	$107.86	$152.56	22.35	403.68	705.09	$53.93	$76.28	3,326.30	$228.84
229	COURTHOUSE	HOLDING CELL		12	86.00	0.98	1.03	$79.53	1,436.54	2,509.14	$191.92	$271.45	39.77	718.27	1,254.57	$95.96	$135.72	5,918.52	$407.17
230	COURTHOUSE	HOLDING CELL		4	58.00	0.22	0.23	$17.88	322.94	564.07	$43.14	$61.02	8.94	161.47	282.03	$21.57	$30.51	1,330.52	$91.53
233	COURTHOUSE	HOLDING CELL		1	35.00	0.03	0.04	$2.70	48.72	85.10	$6.51	$9.21	1.35	24.36	42.55	$3.25	$4.60	200.73	$13.81
236	COURTHOUSE	OFFICE		1	58.00	0.06	0.06	$4.47	80.74	31.85	$5.48	$9.95	2.23	40.37	15.92	$2.74	$4.97	168.87	$14.92
237	COURTHOUSE	OFFICE		1	58.00	0.06	0.06	$4.47	80.74	31.85	$5.48	$9.95	2.23	40.37	15.92	$2.74	$4.97	168.87	$14.92
238	COURTHOUSE	DAYROOM		3	295.00	0.89	0.89	$71.79	1,229.71	3,939.93	$251.45	$323.24	35.90	613.75	1,968.86	$125.62	$161.51	7,752.25	$484.76
246	COURTHOUSE	DAYROOM	77	6	295.00	1.77	1.77	$143.58	2,459.42	7,879.86	$502.90	$646.48	71.79	1,227.50	3,937.72	$251.24	$323.03	15,504.49	$969.51
247	COURTHOUSE	DAYROOM	77	8	86.00	0.65	0.69	$53.02	957.70	1,672.76	$127.95	$180.97	26.51	478.85	836.38	$63.97	$90.48	3,945.68	$271.45
254	COURTHOUSE	OFFICE		2	58.00	0.11	0.12	$8.94	161.47	63.70	$10.95	$19.89	4.47	80.74	31.83	$5.48	$9.94	337.74	$29.84
257	COURTHOUSE	DAYROOM		7	295.00	2.07	2.07	$167.51	2,869.32	9,193.17	$586.72	$754.23	83.76	1,432.08	4,594.01	$293.11	$376.87	18,088.57	$1,131.10
258	COURTHOUSE	DAYROOM		6	86.00	0.49	0.52	$39.77	718.27	1,254.57	$95.96	$135.72	19.88	359.14	627.28	$47.98	$67.86	2,959.26	$203.59
264	COURTHOUSE	DAYROOM		6	295.00	1.77	1.77	$143.58	2,459.42	7,879.86	$502.90	$646.48	71.79	1,227.50	3,937.72	$251.24	$323.03	15,504.49	$969.51
269	COURTHOUSE	DAYROOM		5	295.00	1.48	1.48	$119.65	2,049.51	6,566.55	$419.09	$538.74	59.83	1,022.91	3,281.43	$209.36	$269.19	12,920.41	$807.93
270	COURTHOUSE	DAYROOM		6	86.00	0.49	0.52	$39.77	718.27	1,254.57	$95.96	$135.72	19.88	359.14	627.28	$47.98	$67.86	2,959.26	$203.59
276	COURTHOUSE	DAYROOM		21	295.00	6.20	6.20	$502.54	8,607.95	27,579.52	$1,760.16	$2,262.70	251.27	4,296.23	13,782.02	$879.33	$1,130.60	54,265.72	$3,393.29
277	COURTHOUSE	DAYROOM		19	86.00	1.55	1.63	$125.92	2,274.53	3,972.80	$303.87	$429.79	62.96	1,137.26	1,986.40	$151.93	$214.90	9,370.99	$644.69
281	COURTHOUSE	CELL FIXTURES		144	8.00	1.09	1.15	$88.78	1,603.58	2,800.90	$214.23	$303.01	44.39	801.79	1,400.45	$107.12	$151.51	6,606.72	$454.52
288	COURTHOUSE	OFFICE		2	58.00	0.11	0.12	$8.94	161.47	63.70	$10.95	$19.89	4.47	80.74	31.83	$5.48	$9.94	337.74	$29.84
303	COURTHOUSE	OFFICE		1	111.00	0.11	0.11	$8.55	154.51	60.95	$10.48	$19.03	4.28	77.26	30.46	$5.24	$9.52	323.18	$28.55
315	COURTHOUSE	HALLWAY		3	58.00	0.17	0.17	$13.41	242.21	296.61	$26.21	$39.62	6.70	121.10	148.31	$13.10	$19.81	808.23	$59.43
322	COURTHOUSE	HALLWAY		10	58.00	0.55	0.58	$44.70	807.36	988.71	$87.36	$132.06	22.35	403.68	494.35	$43.68	$66.03	2,694.10	$198.09

340	COURTHOUSE	OFFICE		2	58.00	0.10	0.12	$8.47	109.10	64.59	$8.45	$16.92	4.23	54.55	32.29	$4.22	$8.46	260.54	$25.38
341	COURTHOUSE	VISITATION		8	58.00	0.44	0.46	$35.76	645.89	790.97	$69.89	$105.65	17.88	322.94	395.48	$34.94	$52.82	2,155.28	$158.47
347	COURTHOUSE	RESTROOM WOMEN		1	58.00	0.06	0.06	$4.47	80.74	39.79	$5.86	$10.33	2.23	40.37	19.89	$2.93	$5.17	180.79	$15.50
355	COURTHOUSE	LOBBY		6	58.00	0.33	0.35	$26.82	484.42	593.22	$52.42	$79.23	13.41	242.21	296.61	$26.21	$39.62	1,616.46	$118.85
357	COURTHOUSE	OFFICE		2	58.00	0.11	0.12	$8.94	161.47	63.70	$10.95	$19.89	4.47	80.74	31.83	$5.48	$9.94	337.74	$29.84
365	COURTHOUSE	OFFICE		14	58.00	0.77	0.81	$62.58	1,130.30	445.90	$76.67	$139.24	31.29	565.15	222.81	$38.33	$69.61	2,364.17	$208.86
366	COURTHOUSE	OFFICE		4	58.00	0.22	0.23	$17.88	322.94	127.40	$21.90	$39.78	8.94	161.47	63.66	$10.95	$19.89	675.48	$59.67
368	COURTHOUSE	OFFICE		6	58.00	0.31	0.35	$25.41	327.31	193.77	$25.34	$50.75	12.70	163.65	96.88	$12.67	$25.38	781.61	$76.13
369	COURTHOUSE	OFFICE		4	58.00	0.21	0.23	$16.94	218.20	129.18	$16.90	$33.83	8.47	109.10	64.59	$8.45	$16.92	521.07	$50.75
376	COURTHOUSE	OFFICE		2	58.00	0.10	0.12	$8.47	109.10	64.59	$8.45	$16.92	4.23	54.55	32.29	$4.22	$8.46	260.54	$25.38
382	COURTHOUSE	RESTROOM WOMEN		2	58.00	0.11	0.12	$8.94	161.47	79.58	$11.72	$20.66	4.47	80.74	39.79	$5.86	$10.33	361.57	$31.00
383	COURTHOUSE	RESTROOM WOMEN		1	58.00	0.06	0.06	$4.47	80.74	39.79	$5.86	$10.33	2.23	40.37	19.89	$2.93	$5.17	180.79	$15.50
384	COURTHOUSE	RESTROOM WOMEN		1	0.00	-	-	$0.00	0.00	0.00	$0.00	$0.00	0.00	0.00	0.00	$0.00	$0.00	0.00	$0.00
393	COURTHOUSE	HALLWAY		1	58.00	0.06	0.06	$4.47	80.74	98.87	$8.74	$13.21	2.23	40.37	49.44	$4.37	$6.60	269.41	$19.81
405	COURTHOUSE	RESTROOM WOMEN		2	38.00	0.07	0.08	$5.86	105.79	52.14	$7.68	$13.54	2.93	52.90	26.07	$3.84	$6.77	236.89	$20.31
407	COURTHOUSE	RESTROOM WOMEN		2	58.00	0.11	0.12	$8.94	161.47	79.58	$11.72	$20.66	4.47	80.74	39.79	$5.86	$10.33	361.57	$31.00
408	COURTHOUSE	RESTROOM WOMEN		1	58.00	0.06	0.06	$4.47	80.74	39.79	$5.86	$10.33	2.23	40.37	19.89	$2.93	$5.17	180.79	$15.50
409	COURTHOUSE	RESTROOM WOMEN		1	0.00	-	-	$0.00	0.00	0.00	$0.00	$0.00	0.00	0.00	0.00	$0.00	$0.00	0.00	$0.00
410	COURTHOUSE	LOBBY		3	58.00	0.17	0.17	$13.41	242.21	296.61	$26.21	$39.62	6.70	121.10	148.31	$13.10	$19.81	808.23	$59.43
412	COURTHOUSE	HALLWAY		33	38.00	1.19	1.25	$96.64	1,745.57	2,137.65	$188.88	$285.52	48.32	872.78	1,068.83	$94.44	$142.76	5,824.83	$428.28
415	COURTHOUSE	HALLWAY		11	38.00	0.40	0.42	$32.21	581.86	712.55	$62.96	$95.17	16.11	290.93	356.28	$31.48	$47.59	1,941.61	$142.76
417	COURTHOUSE	OFFICE		8	58.00	0.44	0.46	$35.76	645.89	254.80	$43.81	$79.57	17.88	322.94	127.32	$21.90	$39.78	1,350.96	$119.35
421	COURTHOUSE	EXTERIOR BUILDING		7	130.00	0.09	0.91	$7.38	0.00	2,657.84	$129.28	$136.66	3.69	0.00	1,327.78	$64.58	$68.27	3,985.62	$204.93
422	COURTHOUSE	EXTERIOR BUILDING		2	91.00	0.02	0.18	$1.48	0.00	531.57	$25.86	$27.33	0.74	0.00	265.56	$12.92	$13.65	797.12	$40.99
423	COURTHOUSE	EXTERIOR BUILDING		4	100.00	0.04	0.40	$3.24	0.00	1,168.28	$56.83	$60.07	1.62	0.00	583.64	$28.39	$30.01	1,751.92	$90.08
424	COURTHOUSE	PARKING LOT		4	295.00	0.12	1.18	$9.57	0.00	3,446.43	$167.63	$177.21	4.79	0.00	1,721.74	$83.75	$88.53	5,168.16	$265.74
425	COURTHOUSE	PARKING LOT		2	295.00	0.06	0.59	$4.79	0.00	1,723.21	$83.82	$88.60	2.39	0.00	860.87	$41.87	$44.27	2,584.08	$132.87
426	COURTHOUSE	PARKING LOT		1	550.00	0.06	0.55	$4.46	0.00	1,606.39	$78.13	$82.60	2.23	0.00	802.51	$39.03	$41.26	2,408.89	$123.86

633	CITY HALL	LOBBY		6	172.00	0.98	1.03	$79.53	1,436.54	1,759.22	$155.44	$234.97	39.77	718.27	879.61	$77.72	$117.49	4,793.64	$352.46
634	CITY HALL	LOBBY		64	58.00	3.53	3.71	$286.06	5,167.10	6,327.72	$559.11	$845.17	143.03	2,583.55	3,163.86	$279.55	$422.58	17,242.24	$1,267.75
635	CITY HALL	LOBBY		1	58.00	0.06	0.06	$4.47	80.74	98.87	$8.74	$13.21	2.23	40.37	49.44	$4.37	$6.60	269.41	$19.81
639	CITY HALL	OFFICE		2	90.00	0.17	0.18	$13.87	250.56	98.85	$17.00	$30.87	6.94	125.28	49.39	$8.50	$15.43	524.08	$46.30
641	CITY HALL	OFFICE		4	90.00	0.34	0.36	$27.74	501.12	197.69	$33.99	$61.73	13.87	250.56	98.78	$16.99	$30.86	1,048.16	$92.60
644	CITY HALL	OFFICE		4	90.00	0.34	0.36	$27.74	501.12	197.69	$33.99	$61.73	13.87	250.56	98.78	$16.99	$30.86	1,048.16	$92.60
646	CITY HALL	OFFICE		3	90.00	0.26	0.27	$20.81	375.84	148.27	$25.49	$46.30	10.40	187.92	74.09	$12.74	$23.15	786.12	$69.45
648	CITY HALL	OFFICE		5	90.00	0.43	0.45	$34.68	626.40	247.11	$42.49	$77.17	17.34	313.20	123.48	$21.24	$38.58	1,310.19	$115.75
650	CITY HALL	OFFICE		4	90.00	0.34	0.36	$27.74	501.12	197.69	$33.99	$61.73	13.87	250.56	98.78	$16.99	$30.86	1,048.16	$92.60
694	CITY HALL	HALLWAY		1	58.00	0.06	0.06	$4.47	80.74	98.87	$8.74	$13.21	2.23	40.37	49.44	$4.37	$6.60	269.41	$19.81
702	CITY HALL	RESTROOM WOMEN		1	72.00	0.07	0.07	$5.55	100.22	49.39	$7.28	$12.83	2.77	50.11	24.70	$3.64	$6.41	224.42	$19.24
704	CITY HALL	RESTROOM WOMEN		1	0.00	-	-	$0.00	0.00	0.00	$0.00	$0.00	0.00	0.00	0.00	$0.00	$0.00	0.00	$0.00
714	CITY HALL	OFFICE		2	90.00	0.17	0.18	$13.87	250.56	98.85	$17.00	$30.87	6.94	125.28	49.39	$8.50	$15.43	524.08	$46.30
722	CITY HALL	OFFICE		2	90.00	0.17	0.18	$13.87	250.56	98.85	$17.00	$30.87	6.94	125.28	49.39	$8.50	$15.43	524.08	$46.30
724	CITY HALL	OFFICE		10	90.00	0.86	0.90	$69.36	1,252.80	494.23	$84.98	$154.33	34.68	626.40	246.96	$42.48	$77.16	2,620.39	$231.49
741	CITY HALL	OFFICE		2	90.00	0.17	0.18	$13.87	250.56	98.85	$17.00	$30.87	6.94	125.28	49.39	$8.50	$15.43	524.08	$46.30
743	CITY HALL	OFFICE		3	90.00	0.26	0.27	$20.81	375.84	148.27	$25.49	$46.30	10.40	187.92	74.09	$12.74	$23.15	786.12	$69.45
758	CITY HALL	EXTERIOR BUILDING		2	210.00	0.04	0.42	$3.41	0.00	1,226.69	$59.67	$63.07	1.70	0.00	612.82	$29.81	$31.51	1,839.52	$94.58
838	AQUATIC FACILITY	LOBBY		8	100.00	0.76	0.80	$61.65	1,113.60	946.56	$100.21	$161.86	30.83	556.80	473.28	$50.10	$80.93	3,090.24	$242.79
839	AQUATIC FACILITY	LOBBY		4	47.00	0.18	0.19	$14.49	261.70	320.48	$28.32	$42.80	7.24	130.85	160.24	$14.16	$21.40	873.26	$64.21
850	AQUATIC FACILITY	THERAPY POOL		24	86.00	1.96	2.06	$159.06	2,873.09	1,989.70	$236.53	$395.59	79.53	1,436.54	994.85	$118.26	$197.79	7,294.18	$593.38
852	AQUATIC FACILITY	OLYMPIC POOL	20-25 NIGHT	28	1100.00	29.26	30.80	$2,373.57	42,873.60	29,691.20	$3,529.55	$5,903.12	1,186.79	21,436.80	14,845.60	$1,764.78	$2,951.56	108,847.20	$8,854.68
853	AQUATIC FACILITY	OLYMPIC POOL		4	1100.00	4.18	4.40	$339.08	6,124.80	4,241.60	$504.22	$843.30	169.54	3,062.40	2,120.80	$252.11	$421.65	15,549.60	$1,264.95
854	AQUATIC FACILITY	OLYMPIC POOL		3	129.00	0.37	0.39	$29.82	538.70	373.07	$44.35	$74.17	14.91	269.35	186.53	$22.17	$37.09	1,367.66	$111.26
858	AQUATIC FACILITY	OFFICE		3	58.00	0.17	0.17	$13.41	242.21	95.55	$16.43	$29.84	6.70	121.10	47.75	$8.21	$14.92	506.61	$44.76
863	AQUATIC FACILITY	EXTERIOR BUILDING		7	188.00	0.13	1.32	$10.68	0.00	3,843.64	$186.95	$197.63	5.34	0.00	1,920.18	$93.40	$98.74	5,763.82	$296.37

Table G.3. Sample of Lighting Calculations Spreadsheet – Part III

							UPGRADED LIGHTING SYSTEM ENERGY CALCULATIONS (WINTER)					UPGRADED LIGHTING SYSTEM ENERGY CALCULATIONS (SUMMER)						
ID No:	Facility Name or Code	Room Type and Number	Quantity of Luminaires (Upgraded System)	Input Watts (Upgraded System)	Total kW Used (Upgraded System)	Total kW Used (Upgraded System) (w/o D.F.) MAXIMUM POTENTIAL	Total Cost of kW in Winter (Upgraded System)	kWh Used On-Peak in Winter (Upgraded System)	kWh Used Off-Peak in Winter (Upgraded System)	Total Cost of kWh in Winter (Upgraded System)	Total Energy Cost in Winter (Upgraded System)	Total Cost of kW in Summer (Upgraded System)	kWh Used On-Peak in Summer	kWh Used Off-Peak in Summer	Total Cost of kWh in Summer (Upgraded System)	Total Energy Cost in Summer (Upgraded System)	Total kWh Used (Upgraded System)	Total Energy Cost (Upgraded System)
88	COURTHOUSE	LOBBY	9	17.00	0.145	0.153	$11.79	212.98	260.81	$23.05	$34.84	$5.90	106.49	130.41	$11.52	$17.42	710.69	9
96	COURTHOUSE	RESTROOM WOMEN	2	28.00	0.053	0.056	$4.32	77.95	38.42	$5.66	$9.98	$2.16	38.98	19.21	$2.83	$4.99	174.55	2
97	COURTHOUSE	RESTROOM WOMEN	1	28.00	0.027	0.028	$2.16	38.98	19.21	$2.83	$4.99	$1.08	19.49	9.60	$1.42	$2.49	87.28	1
123	COURTHOUSE	HALLWAY	10	42.00	0.399	0.420	$32.37	584.64	715.96	$63.26	$95.63	$16.18	292.32	357.98	$31.63	$47.81	1,950.90	10
149	COURTHOUSE	OFFICE	2	28.00	0.050	0.056	$4.09	52.67	31.18	$4.08	$8.17	$2.04	26.33	15.59	$2.04	$4.08	125.78	2
150	COURTHOUSE	OFFICE	6	28.00	0.160	0.168	$12.95	233.86	92.26	$15.86	$28.81	$6.47	116.93	46.10	$7.93	$14.40	489.14	6
152	COURTHOUSE	OFFICE	4	28.00	0.101	0.112	$8.18	105.34	62.36	$8.16	$16.33	$4.09	52.67	31.18	$4.08	$8.17	251.55	4
153	COURTHOUSE	OFFICE	2	28.00	0.050	0.056	$4.09	52.67	31.18	$4.08	$8.17	$2.04	26.33	15.59	$2.04	$4.08	125.78	2
154	COURTHOUSE	OFFICE	2	28.00	0.050	0.056	$4.09	52.67	31.18	$4.08	$8.17	$2.04	26.33	15.59	$2.04	$4.08	125.78	2
155	COURTHOUSE	OFFICE	2	28.00	0.050	0.056	$4.09	52.67	31.18	$4.08	$8.17	$2.04	26.33	15.59	$2.04	$4.08	125.78	2
156	COURTHOUSE	OFFICE	2	28.00	0.050	0.056	$4.09	52.67	31.18	$4.08	$8.17	$2.04	26.33	15.59	$2.04	$4.08	125.78	2
157	COURTHOUSE	OFFICE	2	28.00	0.050	0.056	$4.09	52.67	31.18	$4.08	$8.17	$2.04	26.33	15.59	$2.04	$4.08	125.78	2
158	COURTHOUSE	OFFICE	4	28.00	0.101	0.112	$8.18	105.34	62.36	$8.16	$16.33	$4.09	52.67	31.18	$4.08	$8.17	251.55	4
162	COURTHOUSE	OFFICE	21	28.00	0.559	0.588	$45.31	818.50	322.90	$55.52	$100.83	$22.66	409.25	161.35	$27.75	$50.41	1,711.99	21
175	COURTHOUSE	CONFERENCE ROOM	2	28.00	0.050	0.056	$4.09	46.77	15.59	$3.03	$7.12	$2.04	23.39	7.80	$1.52	$3.56	93.54	2
176	COURTHOUSE	CONFERENCE ROOM	2	28.00	0.050	0.056	$4.09	46.77	15.59	$3.03	$7.12	$2.04	23.39	7.80	$1.52	$3.56	93.54	2
177	COURTHOUSE	COURTROOM-JUSTICE DEPT. 1	13	13.00	0.161	0.169	$13.02	196.48	149.97	$16.85	$29.88	$6.51	98.24	74.99	$8.43	$14.94	519.68	13
178	COURTHOUSE	COURTROOM-JUSTICE DEPT. 1	20	13.00	0.247	0.260	$20.04	302.28	230.72	$25.93	$45.96	$10.02	151.14	115.36	$12.96	$22.98	799.50	20
180	COURTHOUSE	COURTROOM-JUSTICE DEPT. 1	2	14.00	0.027	0.028	$2.16	32.55	24.85	$2.79	$4.95	$1.08	16.28	12.42	$1.40	$2.47	86.10	2
181	COURTHOUSE	COURTROOM-JUSTICE DEPT. 1	14	14.00	0.186	0.196	$15.10	227.87	173.93	$19.54	$34.65	$7.55	113.93	86.97	$9.77	$17.32	602.70	14
186	COURTHOUSE	HOLDING CELL	2	28.00	0.053	0.056	$4.32	77.95	136.15	$10.41	$14.73	$2.16	38.98	68.08	$5.21	$7.36	321.16	2
187	COURTHOUSE	HOLDING CELL	2	28.00	0.053	0.056	$4.32	77.95	136.15	$10.41	$14.73	$2.16	38.98	68.08	$5.21	$7.36	321.16	2

190	COURTHOUSE	JAIL VESTIBULE	3	28.00	0.084	0.084	$6.81	116.72	373.96	$23.87	$30.68	$3.41	58.25	186.87	$11.92	$15.33	735.81	3
191	COURTHOUSE	JAIL VESTIBULE	1	28.00	0.028	0.028	$2.27	38.91	124.65	$7.96	$10.23	$1.14	19.42	62.29	$3.97	$5.11	245.27	1
194	COURTHOUSE	BOOKING AREA	10	28.00	0.266	0.280	$21.58	389.76	477.31	$42.17	$63.75	$10.79	194.88	238.65	$21.09	$31.88	1,300.60	10
213	COURTHOUSE	CELL	4	28.00	0.106	0.112	$8.63	155.90	272.31	$20.83	$29.46	$4.32	77.95	136.15	$10.41	$14.73	642.32	4
217	COURTHOUSE	CELL	1	28.00	0.027	0.028	$2.16	38.98	68.08	$5.21	$7.36	$1.08	19.49	34.04	$2.60	$3.68	160.58	1
225	COURTHOUSE	VISITATION BOOTHS 1-10	10	28.00	0.266	0.280	$21.58	389.76	680.77	$52.07	$73.65	$10.79	194.88	340.39	$26.04	$36.82	1,605.80	10
229	COURTHOUSE	HOLDING CELL	12	42.00	0.479	0.504	$38.84	701.57	1,225.39	$93.73	$132.57	$19.42	350.78	612.70	$46.86	$66.28	2,890.44	12
230	COURTHOUSE	HOLDING CELL	4	28.00	0.106	0.112	$8.63	155.90	272.31	$20.83	$29.46	$4.32	77.95	136.15	$10.41	$14.73	642.32	4
233	COURTHOUSE	HOLDING CELL	1	18.00	0.017	0.018	$1.39	25.06	43.76	$3.35	$4.73	$0.69	12.53	21.88	$1.67	$2.37	103.23	1
236	COURTHOUSE	OFFICE	1	28.00	0.027	0.028	$2.16	38.98	15.38	$2.64	$4.80	$1.08	19.49	7.68	$1.32	$2.40	81.52	1
237	COURTHOUSE	OFFICE	1	28.00	0.027	0.028	$2.16	38.98	15.38	$2.64	$4.80	$1.08	19.49	7.68	$1.32	$2.40	81.52	1
238	COURTHOUSE	DAYROOM	3	55.00	0.165	0.165	$13.38	229.27	734.56	$46.88	$60.27	$6.69	114.43	367.08	$23.42	$30.11	1,445.33	3
246	COURTHOUSE	DAYROOM	6	55.00	0.330	0.330	$26.77	458.54	1,469.13	$93.76	$120.53	$13.38	228.86	734.15	$46.84	$60.23	2,890.67	6
247	COURTHOUSE	DAYROOM	8	42.00	0.319	0.336	$25.89	467.71	816.93	$62.48	$88.38	$12.95	233.86	408.46	$31.24	$44.19	1,926.96	8
254	COURTHOUSE	OFFICE	2	28.00	0.053	0.056	$4.32	77.95	30.75	$5.29	$9.60	$2.16	38.98	15.37	$2.64	$4.80	163.05	2
257	COURTHOUSE	DAYROOM	7	55.00	0.385	0.385	$31.23	534.96	1,713.98	$109.39	$140.62	$15.62	267.00	856.51	$54.65	$70.26	3,372.45	7
258	COURTHOUSE	DAYROOM	6	42.00	0.239	0.252	$19.42	350.78	612.70	$46.86	$66.28	$9.71	175.39	306.35	$23.43	$33.14	1,445.22	6
264	COURTHOUSE	DAYROOM	6	55.00	0.330	0.330	$26.77	458.54	1,469.13	$93.76	$120.53	$13.38	228.86	734.15	$46.84	$60.23	2,890.67	6
269	COURTHOUSE	DAYROOM	5	55.00	0.275	0.275	$22.31	382.11	1,224.27	$78.13	$100.44	$11.15	190.71	611.79	$39.03	$50.19	2,408.89	5
270	COURTHOUSE	DAYROOM	6	42.00	0.239	0.252	$19.42	350.78	612.70	$46.86	$66.28	$9.71	175.39	306.35	$23.43	$33.14	1,445.22	6
276	COURTHOUSE	DAYROOM	21	55.00	1.155	1.155	$93.69	1,604.87	5,141.94	$328.17	$421.86	$46.85	800.99	2,569.53	$163.94	$210.79	10,117.34	21
277	COURTHOUSE	DAYROOM	19	42.00	0.758	0.798	$61.50	1,110.82	1,940.20	$148.40	$209.90	$30.75	555.41	970.10	$74.20	$104.95	4,576.53	19
281	COURTHOUSE	CELL FIXTURES	144	5.00	0.684	0.720	$55.49	1,002.24	1,750.56	$133.90	$189.38	$27.74	501.12	875.28	$66.95	$94.69	4,129.20	144
288	COURTHOUSE	OFFICE	2	28.00	0.053	0.056	$4.32	77.95	30.75	$5.29	$9.60	$2.16	38.98	15.37	$2.64	$4.80	163.05	2
303	COURTHOUSE	OFFICE	1	56.00	0.053	0.056	$4.32	77.95	30.75	$5.29	$9.60	$2.16	38.98	15.37	$2.64	$4.80	163.05	1
315	COURTHOUSE	HALLWAY	3	28.00	0.080	0.084	$6.47	116.93	143.19	$12.65	$19.13	$3.24	58.46	71.60	$6.33	$9.56	390.18	3
322	COURTHOUSE	HALLWAY	10	28.00	0.266	0.280	$21.58	389.76	477.31	$42.17	$63.75	$10.79	194.88	238.65	$21.09	$31.88	1,300.60	10
340	COURTHOUSE	OFFICE	2	28.00	0.050	0.056	$4.09	52.67	31.18	$4.08	$8.17	$2.04	26.33	15.59	$2.04	$4.08	125.78	2
341	COURTHOUSE	VISITATION	8	28.00	0.213	0.224	$17.26	311.81	381.85	$33.74	$51.00	$8.63	155.90	190.92	$16.87	$25.50	1,040.48	8
347	COURTHOUSE	RESTROOM WOMEN	1	28.00	0.027	0.028	$2.16	38.98	19.21	$2.83	$4.99	$1.08	19.49	9.60	$1.42	$2.49	87.28	1
355	COURTHOUSE	LOBBY	6	28.00	0.160	0.168	$12.95	233.86	286.38	$25.30	$38.25	$6.47	116.93	143.19	$12.65	$19.13	780.36	6

357	COURTHOUSE	OFFICE	2	28.00	0.053	0.056	$4.32	77.95	30.75	$5.29	$9.60	$2.16	38.98	15.37	$2.64	$4.80	163.05	2
365	COURTHOUSE	OFFICE	14	28.00	0.372	0.392	$30.21	545.66	215.26	$37.01	$67.22	$15.10	272.83	107.56	$18.50	$33.61	1,141.32	14
366	COURTHOUSE	OFFICE	4	28.00	0.106	0.112	$8.63	155.90	61.50	$10.57	$19.21	$4.32	77.95	30.73	$5.29	$9.60	326.09	4
368	COURTHOUSE	OFFICE	6	28.00	0.151	0.168	$12.27	158.01	93.54	$12.24	$24.50	$6.13	79.00	46.77	$6.12	$12.25	377.33	6
369	COURTHOUSE	OFFICE	4	28.00	0.101	0.112	$8.18	105.34	62.36	$8.16	$16.33	$4.09	52.67	31.18	$4.08	$8.17	251.55	4
376	COURTHOUSE	OFFICE	2	28.00	0.050	0.056	$4.09	52.67	31.18	$4.08	$8.17	$2.04	26.33	15.59	$2.04	$4.08	125.78	2
382	COURTHOUSE	RESTROOM WOMEN	2	28.00	0.048	0.056	$3.86	58.46	28.81	$4.25	$8.11	$1.93	29.23	14.41	$2.12	$4.05	130.91	2
383	COURTHOUSE	RESTROOM WOMEN	1	28.00	0.024	0.028	$1.93	29.23	14.41	$2.12	$4.05	$0.97	14.62	7.20	$1.06	$2.03	65.46	1
384	COURTHOUSE	RESTROOM WOMEN	1	0.00	0.000	0.000	$0.00	0.00	0.00	$0.00	$0.00	$0.00	0.00	0.00	$0.00	$0.00	0.00	1
393	COURTHOUSE	HALLWAY	1	28.00	0.027	0.028	$2.16	38.98	47.73	$4.22	$6.38	$1.08	19.49	23.87	$2.11	$3.19	130.06	1
405	COURTHOUSE	RESTROOM WOMEN	2	13.00	0.025	0.026	$2.00	36.19	17.84	$2.63	$4.63	$1.00	18.10	8.92	$1.31	$2.32	81.04	2
407	COURTHOUSE	RESTROOM WOMEN	2	28.00	0.048	0.056	$3.86	58.46	28.81	$4.25	$8.11	$1.93	29.23	14.41	$2.12	$4.05	130.91	2
408	COURTHOUSE	RESTROOM WOMEN	1	28.00	0.024	0.028	$1.93	29.23	14.41	$2.12	$4.05	$0.97	14.62	7.20	$1.06	$2.03	65.46	1
409	COURTHOUSE	RESTROOM WOMEN	1	0.00	0.000	0.000	$0.00	0.00	0.00	$0.00	$0.00	$0.00	0.00	0.00	$0.00	$0.00	0.00	1
410	COURTHOUSE	LOBBY	3	28.00	0.080	0.084	$6.47	116.93	143.19	$12.65	$19.13	$3.24	58.46	71.60	$6.33	$9.56	390.18	3
412	COURTHOUSE	HALLWAY	33	13.00	0.408	0.429	$33.06	597.17	731.30	$64.62	$97.68	$16.53	298.58	365.65	$32.31	$48.84	1,992.71	33
415	COURTHOUSE	HALLWAY	11	13.00	0.136	0.143	$11.02	199.06	243.77	$21.54	$32.56	$5.51	99.53	121.88	$10.77	$16.28	664.24	11
417	COURTHOUSE	OFFICE	8	28.00	0.213	0.224	$17.26	311.81	123.01	$21.15	$38.41	$8.63	155.90	61.47	$10.57	$19.20	652.19	8
421	COURTHOUSE	EXTERIOR BUILDING	7	23.00	0.016	0.161	$1.31	0.00	470.23	$22.87	$24.18	$0.65	0.00	234.92	$11.43	$12.08	705.15	7
422	COURTHOUSE	EXTERIOR BUILDING	2	15.00	0.003	0.030	$0.24	0.00	87.62	$4.26	$4.51	$0.12	0.00	43.77	$2.13	$2.25	131.39	2
423	COURTHOUSE	EXTERIOR BUILDING	4	15.00	0.006	0.060	$0.49	0.00	175.24	$8.52	$9.01	$0.24	0.00	87.55	$4.26	$4.50	262.79	4
424	COURTHOUSE	PARKING LOT	4	62.00	0.025	0.248	$2.01	0.00	724.33	$35.23	$37.24	$1.01	0.00	361.86	$17.60	$18.61	1,086.19	4
425	COURTHOUSE	PARKING LOT	2	62.00	0.012	0.124	$1.01	0.00	362.17	$17.62	$18.62	$0.50	0.00	180.93	$8.80	$9.30	543.10	2
426	COURTHOUSE	PARKING LOT	1	62.00	0.006	0.062	$0.50	0.00	181.08	$8.81	$9.31	$0.25	0.00	90.46	$4.40	$4.65	271.55	1
633	CITY HALL	LOBBY	6	84.00	0.479	0.504	$38.84	701.57	859.15	$75.91	$114.75	$19.42	350.78	429.58	$37.96	$57.38	2,341.08	6
634	CITY HALL	LOBBY	64	28.00	1.702	1.792	$138.10	2,494.46	3,054.76	$269.91	$408.01	$69.05	1,247.23	1,527.38	$134.96	$204.01	8,323.84	64
635	CITY HALL	LOBBY	1	28.00	0.027	0.028	$2.16	38.98	47.73	$4.22	$6.38	$1.08	19.49	23.87	$2.11	$3.19	130.06	1
639	CITY HALL	OFFICE	2	42.00	0.080	0.084	$6.47	116.93	46.13	$7.93	$14.40	$3.24	58.46	23.05	$3.96	$7.20	244.57	2
641	CITY HALL	OFFICE	4	42.00	0.160	0.168	$12.95	233.86	92.26	$15.86	$28.81	$6.47	116.93	46.10	$7.93	$14.40	489.14	4
644	CITY HALL	OFFICE	4	42.00	0.160	0.168	$12.95	233.86	92.26	$15.86	$28.81	$6.47	116.93	46.10	$7.93	$14.40	489.14	4

646	CITY HALL	OFFICE	3	42.00	0.120	0.126	$9.71	175.39	69.19	$11.90	$21.61	$4.86	87.70	34.57	$5.95	$10.80	366.85	3
648	CITY HALL	OFFICE	5	42.00	0.200	0.210	$16.18	292.32	115.32	$19.83	$36.01	$8.09	146.16	57.62	$9.91	$18.00	611.42	5
650	CITY HALL	OFFICE	4	42.00	0.160	0.168	$12.95	233.86	92.26	$15.86	$28.81	$6.47	116.93	46.10	$7.93	$14.40	489.14	4
694	CITY HALL	HALLWAY	1	28.00	0.027	0.028	$2.16	38.98	47.73	$4.22	$6.38	$1.08	19.49	23.87	$2.11	$3.19	130.06	1
702	CITY HALL	RESTROOM WOMEN	1	28.00	0.024	0.028	$1.93	29.23	14.41	$2.12	$4.05	$0.97	14.62	7.20	$1.06	$2.03	65.46	1
704	CITY HALL	RESTROOM WOMEN	1	0.00	0.000	0.000	$0.00	0.00	0.00	$0.00	$0.00	$0.00	0.00	0.00	$0.00	$0.00	0.00	1
714	CITY HALL	OFFICE	2	42.00	0.080	0.084	$6.47	116.93	46.13	$7.93	$14.40	$3.24	58.46	23.05	$3.96	$7.20	244.57	2
722	CITY HALL	OFFICE	2	42.00	0.080	0.084	$6.47	116.93	46.13	$7.93	$14.40	$3.24	58.46	23.05	$3.96	$7.20	244.57	2
724	CITY HALL	OFFICE	10	42.00	0.399	0.420	$32.37	584.64	230.64	$39.66	$72.02	$16.18	292.32	115.25	$19.82	$36.01	1,222.85	10
741	CITY HALL	OFFICE	2	42.00	0.080	0.084	$6.47	116.93	46.13	$7.93	$14.40	$3.24	58.46	23.05	$3.96	$7.20	244.57	2
743	CITY HALL	OFFICE	3	42.00	0.120	0.126	$9.71	175.39	69.19	$11.90	$21.61	$4.86	87.70	34.57	$5.95	$10.80	366.85	3
758	CITY HALL	EXTERIOR BUILDING	2	54.00	0.011	0.108	$0.88	0.00	315.44	$15.34	$16.22	$0.44	0.00	157.58	$7.66	$8.10	473.02	2
838	AQUATIC FACILITY	LOBBY	8	28.00	0.213	0.224	$17.26	311.81	265.04	$28.06	$45.32	$8.63	155.90	132.52	$14.03	$22.66	865.27	8
839	AQUATIC FACILITY	LOBBY	4	18.00	0.068	0.072	$5.55	100.22	122.74	$10.84	$16.39	$2.77	50.11	61.37	$5.42	$8.20	334.44	4
850	AQUATIC FACILITY	THERAPY POOL	24	34.00	0.775	0.816	$62.88	1,135.87	786.62	$93.51	$156.39	$31.44	567.94	393.31	$46.76	$78.20	2,883.74	24
852	AQUATIC FACILITY	OLYMPIC POOL	28	187.00	4.974	5.236	$403.51	7,288.51	5,047.50	$600.02	$1,003.53	$201.75	3,644.26	2,523.75	$300.01	$501.77	18,504.02	28
853	AQUATIC FACILITY	OLYMPIC POOL	4	187.00	0.711	0.748	$57.64	1,041.22	721.07	$85.72	$143.36	$28.82	520.61	360.54	$42.86	$71.68	2,643.43	4
854	AQUATIC FACILITY	OLYMPIC POOL	3	25.00	0.071	0.075	$5.78	104.40	72.30	$8.59	$14.37	$2.89	52.20	36.15	$4.30	$7.19	265.05	3
858	AQUATIC FACILITY	OFFICE	3	28.00	0.080	0.084	$6.47	116.93	46.13	$7.93	$14.40	$3.24	58.46	23.05	$3.96	$7.20	244.57	3
863	AQUATIC FACILITY	EXTERIOR BUILDING	7	23.00	0.016	0.161	$1.31	0.00	470.23	$22.87	$24.18	$0.65	0.00	234.92	$11.43	$12.08	705.15	7

Table G.4. Sample of Lighting Calculations Spreadsheet – Part IV

			SENSOR SAVINGS AND BREAKOUTS									
ID No:	Facility Name or Code	Room Type and Number	kW Reduction from Occupancy Sensors	Occupancy Sensor Savings From kW Reduction	Occupancy Sensor Savings kWh On-Peak Winter	Occupancy Sensor Savings kWh On-Peak Summer	Occupancy Sensor Savings kWh Off-Peak Winter	Occupancy Sensor Savings kWh Off-Peak Summer	Occupancy Sensor Savings Cost On-Peak	Occupancy Sensor Savings Cost Off-Peak	Occupancy Sensor Savings Total kWh	Occupancy Sensor Savings
88	COURTHOUSE	LOBBY	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
96	COURTHOUSE	RESTROOM WOMEN	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
97	COURTHOUSE	RESTROOM WOMEN	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
123	COURTHOUSE	HALLWAY	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
149	COURTHOUSE	OFFICE	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
150	COURTHOUSE	OFFICE	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
152	COURTHOUSE	OFFICE	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
153	COURTHOUSE	OFFICE	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
154	COURTHOUSE	OFFICE	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
155	COURTHOUSE	OFFICE	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
156	COURTHOUSE	OFFICE	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
157	COURTHOUSE	OFFICE	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
158	COURTHOUSE	OFFICE	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
162	COURTHOUSE	OFFICE	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
175	COURTHOUSE	CONFERENCE ROOM	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
176	COURTHOUSE	CONFERENCE ROOM	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
177	COURTHOUSE	COURTROOM-JUSTICE DEPT. 1	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
178	COURTHOUSE	COURTROOM-JUSTICE DEPT. 1	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
180	COURTHOUSE	COURTROOM-JUSTICE DEPT. 1	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
181	COURTHOUSE	COURTROOM-JUSTICE DEPT. 1	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
186	COURTHOUSE	HOLDING CELL	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
187	COURTHOUSE	HOLDING CELL	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
190	COURTHOUSE	JAIL VESTIBULE	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
191	COURTHOUSE	JAIL VESTIBULE	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
194	COURTHOUSE	BOOKING AREA	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
213	COURTHOUSE	CELL	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
217	COURTHOUSE	CELL	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
225	COURTHOUSE	VISITATION BOOTHS 1-10	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
229	COURTHOUSE	HOLDING CELL	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
230	COURTHOUSE	HOLDING CELL	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
233	COURTHOUSE	HOLDING CELL	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
236	COURTHOUSE	OFFICE	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00

237	COURTHOUSE	OFFICE	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
238	COURTHOUSE	DAYROOM	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
246	COURTHOUSE	DAYROOM	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
247	COURTHOUSE	DAYROOM	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
254	COURTHOUSE	OFFICE	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
257	COURTHOUSE	DAYROOM	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
258	COURTHOUSE	DAYROOM	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
264	COURTHOUSE	DAYROOM	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
269	COURTHOUSE	DAYROOM	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
270	COURTHOUSE	DAYROOM	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
276	COURTHOUSE	DAYROOM	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
277	COURTHOUSE	DAYROOM	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
281	COURTHOUSE	CELL FIXTURES	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
288	COURTHOUSE	OFFICE	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
303	COURTHOUSE	OFFICE	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
315	COURTHOUSE	HALLWAY	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
322	COURTHOUSE	HALLWAY	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
340	COURTHOUSE	OFFICE	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
341	COURTHOUSE	VISITATION	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
347	COURTHOUSE	RESTROOM WOMEN	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
355	COURTHOUSE	LOBBY	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
357	COURTHOUSE	OFFICE	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
365	COURTHOUSE	OFFICE	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
366	COURTHOUSE	OFFICE	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
368	COURTHOUSE	OFFICE	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
369	COURTHOUSE	OFFICE	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
376	COURTHOUSE	OFFICE	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
382	COURTHOUSE	RESTROOM WOMEN	0.01	$0.68	19.49	9.74	9.60	4.80	$1.42	$0.70	43.64	$2.80
383	COURTHOUSE	RESTROOM WOMEN	0.00	$0.34	9.74	4.87	4.80	2.40	$0.71	$0.35	21.82	$1.40
384	COURTHOUSE	RESTROOM WOMEN	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
393	COURTHOUSE	HALLWAY	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
405	COURTHOUSE	RESTROOM WOMEN	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
407	COURTHOUSE	RESTROOM WOMEN	0.01	$0.68	19.49	9.74	9.60	4.80	$1.42	$0.70	43.64	$2.80
408	COURTHOUSE	RESTROOM WOMEN	0.00	$0.34	9.74	4.87	4.80	2.40	$0.71	$0.35	21.82	$1.40
409	COURTHOUSE	RESTROOM WOMEN	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
410	COURTHOUSE	LOBBY	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
412	COURTHOUSE	HALLWAY	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
415	COURTHOUSE	HALLWAY	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
417	COURTHOUSE	OFFICE	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
421	COURTHOUSE	EXTERIOR BUILDING	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
422	COURTHOUSE	EXTERIOR BUILDING	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
423	COURTHOUSE	EXTERIOR BUILDING	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
424	COURTHOUSE	PARKING LOT	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00

425	COURTHOUSE	PARKING LOT	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
426	COURTHOUSE	PARKING LOT	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
633	CITY HALL	LOBBY	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
634	CITY HALL	LOBBY	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
635	CITY HALL	LOBBY	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
639	CITY HALL	OFFICE	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
641	CITY HALL	OFFICE	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
644	CITY HALL	OFFICE	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
646	CITY HALL	OFFICE	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
648	CITY HALL	OFFICE	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
650	CITY HALL	OFFICE	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
694	CITY HALL	HALLWAY	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
702	CITY HALL	RESTROOM WOMEN	0.00	$0.34	9.74	4.87	4.80	2.40	$0.71	$0.35	21.82	$1.40
704	CITY HALL	RESTROOM WOMEN	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
714	CITY HALL	OFFICE	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
722	CITY HALL	OFFICE	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
724	CITY HALL	OFFICE	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
741	CITY HALL	OFFICE	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
743	CITY HALL	OFFICE	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
758	CITY HALL	EXTERIOR BUILDING	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
838	AQUATIC FACILITY	LOBBY	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
839	AQUATIC FACILITY	LOBBY	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
850	AQUATIC FACILITY	THERAPY POOL	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
852	AQUATIC FACILITY	OLYMPIC POOL	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
853	AQUATIC FACILITY	OLYMPIC POOL	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
854	AQUATIC FACILITY	OLYMPIC POOL	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
858	AQUATIC FACILITY	OFFICE	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00
863	AQUATIC FACILITY	EXTERIOR BUILDING	-	$-	-	-	-	-	$0.00	$0.00	-	$0.00

Table G.5. Sample of Lighting Calculations Spreadsheet – Part V

Retro-Tech Systems, Inc
Lighting Inventory and Recommended Improvements for Carson City, NV

			HVAC INTERACTION									
ID No:	Facility Name or Code	Room Type and Number	HVAC Multiplier	HVAC Penalty or Savings	Total kW Saved (w/o Occupancy Sensors)	Total kW Saved MAXIMUM POTENTIAL	Total kW Saved	Total kWh Saved (w/o Occupancy Sensors)	Total kWh Saved	Total Savings (Energy) w/o Occupancy Sensors	Total Savings (Energy)	Total Savings (Maint, HVAC, Energy)
88	COURTHOUSE	LOBBY	(0.02)	($11.86)	1.65	1.74	1.65	8,068.37	8,068.37	$593	$593	$710
96	COURTHOUSE	RESTROOM WOMEN	(0.02)	($0.32)	0.06	0.06	0.06	187.02	187.02	$16	$16	$16
97	COURTHOUSE	RESTROOM WOMEN	(0.02)	($0.16)	0.03	0.03	0.03	93.51	93.51	$8	$8	$8
123	COURTHOUSE	HALLWAY	(0.02)	($3.01)	0.42	0.44	0.42	2,043.80	2,043.80	$150	$150	$154
149	COURTHOUSE	OFFICE	(0.02)	($0.26)	0.05	0.06	0.05	134.76	134.76	$13	$13	$13
150	COURTHOUSE	OFFICE	(0.02)	($0.93)	0.17	0.18	0.17	524.08	524.08	$46	$46	$48
152	COURTHOUSE	OFFICE	(0.02)	($0.53)	0.11	0.12	0.11	269.52	269.52	$26	$26	$27
153	COURTHOUSE	OFFICE	(0.02)	($0.26)	0.05	0.06	0.05	134.76	134.76	$13	$13	$13
154	COURTHOUSE	OFFICE	(0.02)	($0.26)	0.05	0.06	0.05	134.76	134.76	$13	$13	$13
155	COURTHOUSE	OFFICE	(0.02)	($0.26)	0.05	0.06	0.05	134.76	134.76	$13	$13	$13
156	COURTHOUSE	OFFICE	(0.02)	($0.26)	0.05	0.06	0.05	134.76	134.76	$13	$13	$13
157	COURTHOUSE	OFFICE	(0.02)	($0.26)	0.05	0.06	0.05	134.76	134.76	$13	$13	$13
158	COURTHOUSE	OFFICE	(0.02)	($0.53)	0.11	0.12	0.11	269.52	269.52	$26	$26	$27
162	COURTHOUSE	OFFICE	(0.02)	($3.24)	0.60	0.63	0.60	1,834.27	1,834.27	$162	$162	$166
175	COURTHOUSE	CONFERENCE ROOM	(0.02)	($0.23)	0.05	0.06	0.05	100.22	100.22	$11	$11	$12
176	COURTHOUSE	CONFERENCE ROOM	(0.02)	($0.23)	0.05	0.06	0.05	100.22	100.22	$11	$11	$12
177	COURTHOUSE	COURTROOM-JUSTICE DEPT. 1	(0.02)	($1.72)	0.31	0.33	0.31	999.38	999.38	$86	$86	$145
178	COURTHOUSE	COURTROOM-JUSTICE DEPT. 1	(0.02)	($2.65)	0.48	0.50	0.48	1,537.50	1,537.50	$133	$133	$222
180	COURTHOUSE	COURTROOM-JUSTICE DEPT. 1	(0.02)	($0.19)	0.03	0.04	0.03	110.70	110.70	$10	$10	$10
181	COURTHOUSE	COURTROOM-JUSTICE DEPT. 1	(0.02)	($1.34)	0.24	0.25	0.24	774.90	774.90	$67	$67	$72
186	COURTHOUSE	HOLDING CELL	(0.02)	($0.47)	0.06	0.06	0.06	344.10	344.10	$24	$24	$25
187	COURTHOUSE	HOLDING CELL	(0.02)	($0.47)	0.06	0.06	0.06	344.10	344.10	$24	$24	$25
190	COURTHOUSE	JAIL VESTIBULE	(0.02)	($0.99)	0.09	0.09	0.09	788.36	788.36	$49	$49	$52
191	COURTHOUSE	JAIL VESTIBULE	(0.02)	($0.33)	0.03	0.03	0.03	262.79	262.79	$16	$16	$17
194	COURTHOUSE	BOOKING AREA	(0.02)	($2.05)	0.29	0.30	0.29	1,393.50	1,393.50	$102	$102	$106
213	COURTHOUSE	CELL	(0.02)	($0.95)	0.11	0.12	0.11	688.20	688.20	$47	$47	$49
217	COURTHOUSE	CELL	(0.02)	($0.24)	0.03	0.03	0.03	172.05	172.05	$12	$12	$12
225	COURTHOUSE	VISITATION BOOTHS 1-10	(0.02)	($2.37)	0.29	0.30	0.29	1,720.50	1,720.50	$118	$118	$123
229	COURTHOUSE	HOLDING CELL	(0.02)	($4.17)	0.50	0.53	0.50	3,028.08	3,028.08	$208	$208	$214
230	COURTHOUSE	HOLDING CELL	(0.02)	($0.95)	0.11	0.12	0.11	688.20	688.20	$47	$47	$49
233	COURTHOUSE	HOLDING CELL	(0.02)	($0.13)	0.02	0.02	0.02	97.50	97.50	$7	$7	$8
236	COURTHOUSE	OFFICE	(0.02)	($0.15)	0.03	0.03	0.03	87.35	87.35	$8	$8	$8
237	COURTHOUSE	OFFICE	(0.02)	($0.15)	0.03	0.03	0.03	87.35	87.35	$8	$8	$8
238	COURTHOUSE	DAYROOM	(0.02)	($7.89)	0.72	0.72	0.72	6,306.91	6,306.91	$394	$394	$431
246	COURTHOUSE	DAYROOM	(0.02)	($15.78)	1.44	1.44	1.44	12,613.82	12,613.82	$789	$789	$862
247	COURTHOUSE	DAYROOM	(0.02)	($2.78)	0.33	0.35	0.33	2,018.72	2,018.72	$139	$139	$142
254	COURTHOUSE	OFFICE	(0.02)	($0.31)	0.06	0.06	0.06	174.69	174.69	$15	$15	$16

257	COURTHOUSE	DAYROOM	(0.02)	($18.40)	1.68	1.68	1.68	14,716.13	14,716.13	$920	$920	$1,005
258	COURTHOUSE	DAYROOM	(0.02)	($2.08)	0.25	0.26	0.25	1,514.04	1,514.04	$104	$104	$107
264	COURTHOUSE	DAYROOM	(0.02)	($15.78)	1.44	1.44	1.44	12,613.82	12,613.82	$789	$789	$862
269	COURTHOUSE	DAYROOM	(0.02)	($13.15)	1.20	1.20	1.20	10,511.52	10,511.52	$657	$657	$718
270	COURTHOUSE	DAYROOM	(0.02)	($2.08)	0.25	0.26	0.25	1,514.04	1,514.04	$104	$104	$107
276	COURTHOUSE	DAYROOM	(0.02)	($55.21)	5.04	5.04	5.04	44,148.38	44,148.38	$2,761	$2,761	$3,016
277	COURTHOUSE	DAYROOM	(0.02)	($6.60)	0.79	0.84	0.79	4,794.46	4,794.46	$330	$330	$338
281	COURTHOUSE	CELL FIXTURES	(0.02)	($3.41)	0.41	0.43	0.41	2,477.52	2,477.52	$170	$170	$230
288	COURTHOUSE	OFFICE	(0.02)	($0.31)	0.06	0.06	0.06	174.69	174.69	$15	$15	$16
303	COURTHOUSE	OFFICE	(0.02)	($0.28)	0.05	0.06	0.05	160.13	160.13	$14	$14	$14
315	COURTHOUSE	HALLWAY	(0.02)	($0.61)	0.09	0.09	0.09	418.05	418.05	$31	$31	$32
322	COURTHOUSE	HALLWAY	(0.02)	($2.05)	0.29	0.30	0.29	1,393.50	1,393.50	$102	$102	$106
340	COURTHOUSE	OFFICE	(0.02)	($0.26)	0.05	0.06	0.05	134.76	134.76	$13	$13	$13
341	COURTHOUSE	VISITATION	(0.02)	($1.64)	0.23	0.24	0.23	1,114.80	1,114.80	$82	$82	$85
347	COURTHOUSE	RESTROOM WOMEN	(0.02)	($0.16)	0.03	0.03	0.03	93.51	93.51	$8	$8	$8
355	COURTHOUSE	LOBBY	(0.02)	($1.23)	0.17	0.18	0.17	836.10	836.10	$61	$61	$64
357	COURTHOUSE	OFFICE	(0.02)	($0.31)	0.06	0.06	0.06	174.69	174.69	$15	$15	$16
365	COURTHOUSE	OFFICE	(0.02)	($2.16)	0.40	0.42	0.40	1,222.85	1,222.85	$108	$108	$111
366	COURTHOUSE	OFFICE	(0.02)	($0.62)	0.11	0.12	0.11	349.39	349.39	$31	$31	$32
368	COURTHOUSE	OFFICE	(0.02)	($0.79)	0.16	0.18	0.16	404.28	404.28	$39	$39	$40
369	COURTHOUSE	OFFICE	(0.02)	($0.53)	0.11	0.12	0.11	269.52	269.52	$26	$26	$27
376	COURTHOUSE	OFFICE	(0.02)	($0.26)	0.05	0.06	0.05	134.76	134.76	$13	$13	$13
382	COURTHOUSE	RESTROOM WOMEN	(0.02)	($0.38)	0.06	0.06	0.06	187.02	230.66	$16	$19	$20
383	COURTHOUSE	RESTROOM WOMEN	(0.02)	($0.19)	0.03	0.03	0.03	93.51	115.33	$8	$9	$10
384	COURTHOUSE	RESTROOM WOMEN	(0.02)	$0.00	-	0.00	0.00	0.00	0.00	$0	$0	$0
393	COURTHOUSE	HALLWAY	(0.02)	($0.20)	0.03	0.03	0.03	139.35	139.35	$10	$10	$11
405	COURTHOUSE	RESTROOM WOMEN	(0.02)	($0.27)	0.05	0.05	0.05	155.85	155.85	$13	$13	$22
407	COURTHOUSE	RESTROOM WOMEN	(0.02)	($0.38)	0.06	0.06	0.06	187.02	230.66	$16	$19	$20
408	COURTHOUSE	RESTROOM WOMEN	(0.02)	($0.19)	0.03	0.03	0.03	93.51	115.33	$8	$9	$10
409	COURTHOUSE	RESTROOM WOMEN	(0.02)	$0.00	-	0.00	0.00	0.00	0.00	$0	$0	$0
410	COURTHOUSE	LOBBY	(0.02)	($0.61)	0.09	0.09	0.09	418.05	418.05	$31	$31	$32
412	COURTHOUSE	HALLWAY	(0.02)	($5.64)	0.78	0.83	0.78	3,832.13	3,832.13	$282	$282	$507
415	COURTHOUSE	HALLWAY	(0.02)	($1.88)	0.26	0.28	0.26	1,277.38	1,277.38	$94	$94	$169
417	COURTHOUSE	OFFICE	(0.02)	($1.23)	0.23	0.24	0.23	698.77	698.77	$62	$62	$63
421	COURTHOUSE	EXTERIOR BUILDING	0.00	$0.00	0.07	0.75	0.07	3,280.47	3,280.47	$169	$169	$227
422	COURTHOUSE	EXTERIOR BUILDING	0.00	$0.00	0.02	0.15	0.02	665.73	665.73	$34	$34	$50
423	COURTHOUSE	EXTERIOR BUILDING	0.00	$0.00	0.03	0.34	0.03	1,489.13	1,489.13	$77	$77	$103
424	COURTHOUSE	PARKING LOT	0.00	$0.00	0.09	0.93	0.09	4,081.97	4,081.97	$210	$210	$247
425	COURTHOUSE	PARKING LOT	0.00	$0.00	0.05	0.47	0.05	2,040.99	2,040.99	$105	$105	$124
426	COURTHOUSE	PARKING LOT	0.00	$0.00	0.05	0.49	0.05	2,137.34	2,137.34	$110	$110	$131
633	CITY HALL	LOBBY	(0.02)	($3.61)	0.50	0.53	0.50	2,452.56	2,452.56	$180	$180	$184
634	CITY HALL	LOBBY	(0.02)	($13.11)	1.82	1.92	1.82	8,918.40	8,918.40	$656	$656	$680
635	CITY HALL	LOBBY	(0.02)	($0.20)	0.03	0.03	0.03	139.35	139.35	$10	$10	$11
639	CITY HALL	OFFICE	(0.02)	($0.49)	0.09	0.10	0.09	279.51	279.51	$25	$25	$26
641	CITY HALL	OFFICE	(0.02)	($0.99)	0.18	0.19	0.18	559.02	559.02	$49	$49	$52
644	CITY HALL	OFFICE	(0.02)	($0.99)	0.18	0.19	0.18	559.02	559.02	$49	$49	$52
646	CITY HALL	OFFICE	(0.02)	($0.74)	0.14	0.14	0.14	419.26	419.26	$37	$37	$39
648	CITY HALL	OFFICE	(0.02)	($1.23)	0.23	0.24	0.23	698.77	698.77	$62	$62	$64
650	CITY HALL	OFFICE	(0.02)	($0.99)	0.18	0.19	0.18	559.02	559.02	$49	$49	$52
694	CITY HALL	HALLWAY	(0.02)	($0.20)	0.03	0.03	0.03	139.35	139.35	$10	$10	$11
702	CITY HALL	RESTROOM WOMEN	(0.02)	($0.26)	0.04	0.04	0.04	137.15	158.97	$12	$13	$14
704	CITY HALL	RESTROOM WOMEN	(0.02)	$0.00	-	0.00	0.00	0.00	0.00	$0	$0	$0
714	CITY HALL	OFFICE	(0.02)	($0.49)	0.09	0.10	0.09	279.51	279.51	$25	$25	$26
722	CITY HALL	OFFICE	(0.02)	($0.49)	0.09	0.10	0.09	279.51	279.51	$25	$25	$26

724	CITY HALL	OFFICE	(0.02)	($2.47)	0.46	0.48	0.46	1,397.54	1,397.54	$123	$123	$129
741	CITY HALL	OFFICE	(0.02)	($0.49)	0.09	0.10	0.09	279.51	279.51	$25	$25	$26
743	CITY HALL	OFFICE	(0.02)	($0.74)	0.14	0.14	0.14	419.26	419.26	$37	$37	$39
758	CITY HALL	EXTERIOR BUILDING	0.00	$0.00	0.03	0.31	0.03	1,366.50	1,366.50	$70	$70	$93
838	AQUATIC FACILITY	LOBBY	(0.02)	($3.50)	0.55	0.58	0.55	2,224.97	2,224.97	$175	$175	$303
839	AQUATIC FACILITY	LOBBY	(0.02)	($0.79)	0.11	0.12	0.11	538.82	538.82	$40	$40	$45
850	AQUATIC FACILITY	THERAPY POOL	(0.02)	($7.18)	1.19	1.25	1.19	4,410.43	4,410.43	$359	$359	$380
852	AQUATIC FACILITY	OLYMPIC POOL	(0.02)	($146.99)	24.29	25.56	24.29	90,343.18	90,343.18	$7,349	$7,349	$7,799
853	AQUATIC FACILITY	OLYMPIC POOL	(0.02)	($21.00)	3.47	3.65	3.47	12,906.17	12,906.17	$1,050	$1,050	$1,114
854	AQUATIC FACILITY	OLYMPIC POOL	(0.02)	($1.79)	0.30	0.31	0.30	1,102.61	1,102.61	$90	$90	$112
858	AQUATIC FACILITY	OFFICE	(0.02)	($0.46)	0.09	0.09	0.09	262.04	262.04	$23	$23	$24
863	AQUATIC FACILITY	EXTERIOR BUILDING	0.00	$0.00	0.12	1.16	0.12	5,058.67	5,058.67	$260	$260	$322

Appendix H. Lighting Logger Data

> Lighting Hours of Operation

This appendix contains the output of the Lighting Data Loggers in Table H.0 Lighting Data Logger Results. This data is the basis for the lighting baseline hours of operation.

This page left intentionally blank.

Table H.0. Lighting Data Logger Results

Lighting Data Loggers | **Retro-Tech Systems, Inc** | **Carson City, NV**

Location Info				Logger Info				Hours On Data		Hours Off Data		Totals		
ID No.	Facility Name	Room Type and Number	RTS Map ID#	Logger #	Date/Time Installed	Date/Time Removed	Date/Time Range Used	Hours On & Occupied	Hours On & Vacant	Hours Off & Occupied	Hours Off & Vacant	Total Hours Logged	% Hours On	Annualized Hours On
1	Courthouse	Restroom	Men's Restroom	RTS1677	1-12 / 11:20am	2-03 / 8:00am	1/19 @ 840PM to 2/2 @ 927PM	19.0	6.0	2.0	310.0	337.0	7.4%	649.9
2		Open Office	1019	RTS1349	1-12 / 11:25am	2-03 / 8:00am	1/19 @ 839PM to 2/2 @ 916PM	65.0	60.0	1.0	210.0	336.0	37.2%	3258.9
3		Office	1027	RTS1312	1-12 / 11:30am	2-03 / 8:00am	1/19 @ 712PM to 2/2 @ 600PM	36.0	7.0	4.0	288.0	335.0	12.8%	1124.4
4		Open office	1028	RTS1384	1-12 / 11:33am	2-03 / 8:00am	1/19 @ 913PM to 2/2 @ 852PM	76.0	30.0	3.0	226.0	335.0	31.6%	2771.8
5		Hallway	By 2019	RTS1408	1-12 / 11:35am	2-03 / 8:00am	NO DATA FOR DATE RANGE							
6		Courtroom	Justice Department #2	RTS1622	1-12 / 11:40am	2-03 / 8:00am	1/19 @ 758PM to 2/2 @ 759PM	40.0	75.0	1.0	220.0	336.0	34.2%	2998.2
7		Courtroom	Justice Department #1	RTS1617	1-12 / 11:45am	2-03 / 8:00am	1/19 @ 801PM to 2/2 @ 802PM	62.0	42.0	1.0	232.0	337.0	30.9%	2703.4
8		Office	2069	RTS1435	1-12 / 11:50am	2-03 / 8:00am	1/19 @ 722PM to 2/2 @ 732PM	74.0	146.0	0.0	116.0	336.0	65.5%	5735.7
9		Hallway	By Public Restrooms	RTS1407	1-12 / 11:53am	2-03 / 8:00am	1/19 @ 903PM to 2/2 @ 908PM	122.0	214.0	0.0	0.0	336.0	100.0%	8760.0
10		Restroom	Men's	RTS1438	1-12 / 11:56am	2-03 / 8:00am	1/19 @ 846PM to 2/2 @ 850PM	60.0	17.0	4.0	255.0	336.0	22.9%	2007.5
11		Hallway	Main By Specialty Court	RTS1343	1-12 / 12pm	2-03 / 8:00am	1/19 @ 845PM to 2/2 @ 924PM	54.0	231.0	16.0	36.0	337.0	84.6%	7408.3
12		Restroom	Women's	RTS1364	1-12 / 12:05pm	2-03 / 8:00am	1/19 @ 855PM to 2/2 @ 925PM	18.0	64.0	2.0	252.0	336.0	24.4%	2137.9
13		Stairwell	NE STAIRS	RTS1639	1-12 / 1pm	2-03 / 8:00am	1/19 @ 744PM to 2/2 @ 932PM	87.0	250.0	0.0	0.0	337.0	100.0%	8760.0
14	C o u t	Restroom	Visitor Men's	RTS1226	1-12 / 12:15pm	2-03 / 8:00am	1/19 @ 846PM to 2/2 @ 942PM	5.0	0.0	45.0	287.0	337.0	1.5%	130.0

15		Open office	Booking desk	RTS1009	1-12 / 12:20pm	2-03 / 8:00am	1/19 @ 1243PM to 2/2 @ 901AM	92.0	0.0	249.0	1.0	342.0	26.9%	2356.5
16		Hallway 24/7	Booking desk	RTS1225	1-12 / 12:25pm	2-03 / 8:00am	1/19 @ 1108PM to 2/2 @ 1148PM	285.0	51.0	0.0	0.0	336.0	100.0%	8760.0
17		Office	Facility Sergeant	RTS1058	1-12 / 12:30pm	2-03 / 8:00am	1/19 @ 1146PM to 2/2 @ 1101PM	93.0	64.0	12.0	167.0	336.0	46.7%	4093.2
18		Cell	MG 108	RTS1697	1-12 / 12:40pm	2-03 / 8:00am	1/19 @ 1139PM to 2/2 @ 1130PM	1.0	219.0	0.0	116.0	336.0	65.5%	5735.7
19	Sheriff's Administration	Hallway	Hallway by lockers	RTS1431	1-12 / 1:15pm	2-03 / 8:40am	1/19 @ 1129PM to 2/2 @ 1147PM	149.0	187.0	0.0	0.0	336.0	100.0%	8760.0
20		Restroom	Men's Restroom	RTS1387	1-12 / 1:20pm	2-03 / 8:40am	1/19 @ 1159PM to 2/2 @ 1154PM	46.0	1.0	82.0	207.0	336.0	14.0%	1225.4
21		Hallway	Hall by 164	RTS1061	1-12 / 1:25pm	2-03 / 8:40am	1/19 @ 1049PM to 2/2 @ 1124PM	145.0	192.0	0.0	0.0	337.0	100.0%	8760.0
22		Lobby	Civil 165/171	RTS1440	1-12 / 1:30pm	2-03 / 8:40am	NO DATA FOR DATE RANGE							
23		Office	170	RTS1405	1-12 / 1:30pm	2-03 / 8:40am	1/19 @ 712PM to 2/2 @ 659PM	63.0	16.0	4.0	253.0	336.0	23.5%	2059.6
24		Open office	169	RTS1390	1-12 / 1:35pm	2-03 / 8:40am	1/19 @ 718PM to 2/2 @ 719PM	102.0	22.0	1.0	211.0	336.0	36.9%	3232.9
25		Records Room	164	RTS1205	1-12 / 1:40pm	2-03 / 8:40am	1/19 @ 1134PM to 2/2 @ 913PM	56.0	116.0	5.0	157.0	334.0	51.5%	4511.1
26		Large meeting room	109	RTS1624	1-12 / 1:45pm	2-03 / 8:40am	1/19 @ 1021PM to 2/2 @ 1118PM	27.0	8.0	22.0	280.0	337.0	10.4%	909.8
27		Women's Restroom	By 107	RTS1634	1-12 / 1:49pm	2-03 / 8:40am	1/19 @ 1012PM to 2/2 @ 928PM	14.0	1.0	7.0	313.0	335.0	4.5%	392.2
28		Office	200	RTS1376	1-12 / 1:57pm	2-03 / 8:40am	1/19 @ 721PM to 2/2 @ 829PM	46.0	55.0	2.0	235.0	338.0	29.9%	2617.6
29		Hallway	By 220	RTS1357	1-12 /2pm	2-03 / 8:40am	1/19 @ 1038PM to 2/2 @ 833PM	99.0	235.0	0.0	0.0	334.0	100.0%	8760.0
30		Office	229	RTS1361	1-12 /2:13pm	2-03 / 8:40am	1/19 @ 817PM to 1/30 @ 946AM	16.0	13.0	1.0	223.0	253.0	11.5%	1004.1
31		Office	251	RTS1185	1-12 /2:08pm	2-03 / 8:40am	1/19 @ 649PM to 2/2 @ 737PM	31.0	14.0	34.0	258.0	337.0	13.4%	1169.7
32	Fire Station 51	Hall/Open Office	Reception Office	RTS1380	1-12 /2:33pm	2-03 / 9:20am	1/19 @ 859PM to 2/2 @ 716PM	84.0	41.0	3.0	206.0	334.0	37.4%	3278.4
33		Office	Office	RTS1629	1-12 /2:35pm	2-03 / 9:20am	1/19 @ 609PM to 2/2 @ 707PM	31.0	16.0	9.0	281.0	337.0	13.9%	1221.7
34		Admin Restroom	Men's Restroom	RTS1683	1-12 /2:40pm	2-03 / 9:20am	1/19 @ 831PM to 2/2 @ 801PM	6.0	1.0	15.0	314.0	336.0	2.1%	182.5
35		Office	Captains Office	RTS1377	1-12 /2:42pm	2-03 / 9:20am	1/19 @ 849PM to 2/2 @ 1108PM	55.0	187.0	5.0	91.0	338.0	71.6%	6272.0
36		Hallway	Crew Side Hall	RTS1626	1-12 /2:45pm	2-03 / 9:20am	1/19 @ 1140PM to 2/2 @ 1151PM	55.0	26.0	109.0	145.0	335.0	24.2%	2118.1

37		Weight Room	Weight Room	RTS1311	1-12 /2:48pm	2-03 / 9:20am	1/19 @ 1140PM to 2/2 @ 1128PM	49.0	102.0	26.0	159.0	336.0	44.9%	3936.8
38		Restroom	Crew Side Men's Restroom	RTS1672	1-12 /2:51pm	2-03 / 9:20am	1/19 @ 1130PM to 2/2 @ 1150PM	101.0	158.0	9.0	68.0	336.0	77.1%	6752.5
39		Apparatus Room	Apparatus Room above Electrical Panels	RTS1042	1-12 /2:55pm	2-03 / 9:20am	1/19 @ 1140PM to 2/2 @ 1125PM	113.0	139.0	12.0	72.0	336.0	75.0%	6570.0
40		Bunk Room	Bunk Room	RTS1688	1-13 /9:20am	2-03 / 9:20am	1/19 @ 1146PM to 2/2 @ 1156PM	68.0	22.0	88.0	159.0	337.0	26.7%	2339.5
41	City Hall	Office	Office	RTS1409	1-13 /8:20am	2-03 / 9:40am	1/19 @ 736PM to 2/2 @ 748PM	35.0	42.0	2.0	257.0	336.0	22.9%	2007.5
42		Office	Office	RTS1045	1-13 /8:26am	2-03 / 9:40am	1/19 @ 615PM to 2/2 @ 656PM	53.0	16.0	5.0	262.0	336.0	20.5%	1798.9
43		Hall/Common-kitchenette	Hall/Common-kitchenette	RTS1023	1-13 /8:02am	2-03 / 9:40am	1/19 @ 804PM to 2/2 @ 844PM	7.0	8.0	18.0	304.0	337.0	4.5%	389.9
44		Hall/Common	Hall/Common	RTS1030	1-13 /8:12am	2-03 / 9:40am	1/19 @ 853PM to 2/2 @ 847PM	102.0	1.0	14.0	220.0	337.0	30.6%	2677.4
45		Hall/Common	Conference Room	RTS1025	1-13 /8:28am	2-03 / 9:40am	NO DATA FOR DATE RANGE							
46		Lobby	Lobby	RTS1421	1-13 /8:33am	2-03 / 9:40am	1/19 @ 820PM to 2/2 @ 834PM	61.0	43.0	2.0	230.0	336.0	31.0%	2711.4
47		Office	Office	RTS1638	1-13 /8:45am	2-03 / 9:40am	1/19 @ 612PM to 2/2 @ 612PM	59.0	31.0	1.0	245.0	336.0	26.8%	2346.4
48		Garage	Garage	RTS1681	1-13 /8:53am	2-03 / 9:40am	1/19 @ 802PM to 2/2 @ 802PM	11.0	104.0	0.0	221.0	336.0	34.2%	2998.2
49		Garage	Garage	RTS1356	1-13 /8:55am	2-03 / 9:40am	1/19 @ 842PM to 2/2 @ 835PM	37.0	78.0	1.0	220.0	336.0	34.2%	2998.2
50		Open Office	Open Office	RTS1692	1-13 /8:40am	2-03 / 9:40am	1/19 @ 850PM to 2/2 @ 857PM	80.0	20.0	4.0	232.0	336.0	29.8%	2607.1
51		Conference Room	Conference Room	RTS1041	1-13 /8:08am	2-03 / 9:40am	1/19 @ 717PM to 2/2 @ 726PM	9.0	2.0	1.0	324.0	336.0	3.3%	286.8
52		Open Office	Open Office	RTS1411	1-13 /8:15am	2-03 / 9:40am	1/19 @ 808PM to 2/2 @ 837PM	105.0	17.0	5.0	209.0	336.0	36.3%	3180.7
53		Open Office	Open Office	RTS1428	1-13 /8:23am	2-03 / 9:40am	1/19 @ 716PM to 2/2 @ 750PM	73.0	40.0	1.0	222.0	336.0	33.6%	2946.1
54		Restroom	Restroom	RTS1034	1-13 /8:10am	2-03 / 9:40am	1/19 @ 744PM to 2/2 @ 814PM	11.0	74.0	1.0	250.0	336.0	25.3%	2216.1
55		Restroom	Restroom	RTS1193	1-13 /8:49am	2-03 / 9:40am	1/19 @ 746PM to 2/2 @ 819PM	20.0	12.0	32.0	273.0	337.0	9.5%	831.8
56	Community Center	Gym	NW Wall on unistrut	RTS1335	1-13 /10:17am	2-03 / 10:30am	1/19 @ 955PM to 2/2 @ 950PM	88.0	49.0	14.0	186.0	337.0	40.7%	3561.2
57		Gym	S Wall on Sign	RTS1382	1-13 /10:20am	2-03 / 10:30am	1/19 @ 951PM to 2/2 @ 949PM	0.0	0.0	81.0	254.0			
58		Office	Office	RTS1389	1-13 /11:16am	2-03 / 10:30am	1/19 @ 1135PM to 2/2 @ 1015PM	47.0	57.0	20.0	210.0	334.0	31.1%	2727.7

59		Office	Jays office	RTS1375	1-13 /11:22am	2-03 / 10:30am	1/19 @ 754PM to 2/2 @ 814PM	86.0	28.0	3.0	220.0	337.0	33.8%	2963.3
60		Auditorium Lobby	On Soda Machine	RTS1324	1-13 /11:08am	Logger Missing								
61		Hall	By Sierra Room	RTS1043	1-13 /10:34am	2-03 / 10:30am	1/19 @ 1156PM to 2/2 @ 1158PM	88.0	104.0	2.0	143.0	337.0	57.0%	4990.9
62		Hall/Common	By Maintenance Room	RTS1024	1-13 /10:52am	2-03 / 10:30am	1/19 @ 1159PM to 2/2 @ 1028PM	68.0	267.0	0.0	0.0	335.0	100.0 %	8760.0
63		Classroom	Kinder Room	RTS1355	1-13 /11:24am	2-03 / 10:30am	1/19 @ 800PM to 2/2 @ 923PM	74.0	263.0	0.0	0.0	337.0	100.0 %	8760.0
64		Conference Room	Sierra Room	RTS1332	1-13 /10:38am	2-03 / 10:30am	1/19 @ 819PM to 2/2 @ 1138PM	35.0	42.0	2.0	260.0	339.0	22.7%	1989.7
65		Conference Room	Bonanza Room	RTS1616	1-13 /10:58am	2-03 / 10:30am	1/19 @ 1028PM to 2/2 @ 1006PM	25.0	21.0	11.0	279.0	336.0	13.7%	1199.3
66		Men's Restroom	By Sierra Room	RTS1303	1-13 /10:29am	2-03 / 10:30am	1/19 @ 1159PM to 2/2 @ 1157PM	36.0	160.0	1.0	140.0	337.0	58.2%	5094.8
67		Restroom	Women's Restroom by Comstock room	RTS1420	1-13 /10:55am	2-03 / 10:30am	1/19 @ 1156PM to 2/2 @ 1147PM	49.0	142.0	1.0	144.0	336.0	56.8%	4979.6
68		Dressing Room	Right dressing room by Sierra Room exit	RTS1300	1-13 /10:46am	2-03 / 10:30am	1/19 @ 1156PM to 2/2 @ 1248PM	22.0	13.0	5.0	273.0	313.0	11.2%	979.6
69	Senior Center	Office	Senior Services office	RTS1316	1-13 /2:04pm	2-03 / 12:00am	1/19 @ 820PM to 2/2 @ 1139PM	71.0	60.0	2.0	205.0	338.0	38.8%	3395.1
70		Office	Admin Assistant Office	RTS1005	1-13 /2:18pm	2-03 / 12:00am	1/19 @ 855PM to 2/2 @ 852PM	35.0	54.0	2.0	245.0	336.0	26.5%	2320.4
71		Office	Directors Office	RTS1036	1-13 /2:22pm	2-03 / 12:00am	1/19 @ 851PM to 2/2 @ 853PM	30.0	43.0	1.0	261.0	335.0	21.8%	1908.9
72		Office	Accounting	RTS1347	1-13 /2:48pm	2-03 / 12:00am	1/19 @ 1155PM to 2/2 @ 1129PM	78.0	257.0	0.0	0.0	335.0	100.0 %	8760.0
73		Hall/Common	Lobby	RTS1022	1-13 /2:01pm	2-03 / 12:00am	1/19 @ 1151PM to 2/2 @ 1155PM	112.0	21.0	15.0	187.0	335.0	39.7%	3477.9
74		Hall/Common	Lunch Room	RTS1402	1-13 /2:07pm	2-03 / 12:00am	1/19 @ 1134PM to 2/2 @ 1122PM	65.0	24.0	16.0	231.0	336.0	26.5%	2320.4
75		Hall	By Case Manager Office	RTS1620	1-13 /2:13pm	2-03 / 12:00am	LOGGER NOT RESPONDING							
76		Hall/Common	Cottam Library	RTS1342	1-13 /2:40pm	2-03 / 12:00am	1/19 @ 905PM to 2/2 @ 901PM	41.0	38.0	3.0	254.0	336.0	23.5%	2059.6

77		Conference Room	Joshua Tree Room	RTS1417	1-13 /2:30pm	2-03 / 12:00am	1/19 @ 900PM to 2/2 @ 854PM	20.0	5.0	2.0	308.0	335.0	7.5%	653.7
78		Conference Room	Tahoe Room	RTS1442	1-13 /2:35pm	2-03 / 12:00am	NO DATA FOR DATE RANGE							
79		Restroom	Men's Restroom by Work Room	RTS1038	1-13 /2:25pm	2-03 / 12:00am	LOGGER NOT RESPONDING							
80		Restroom	Men's Restroom by Front Lobby	RTS1391	1-13 /2:44pm	2-03 / 12:00am	1/19 @ 840PM to 2/2 @ 1015PM	49.0	121.0	2.0	166.0	338.0	50.3%	4405.9
81	Aquatic Center	Office	Wall by refrigerator	RTS1010	1-13 /9:48am	Was taken down...found on shelf	1/19 @ 758AM to 2/2 @ 839AM	0.0	0.0	2.0	335.0			
82		Office Large Pool Area	Office Large Pool Area	RTS1439	1-13 /9:52am	2-03 / 10:05am	1/19 @ 216PM to 2/2 @ 903PM	0.0	2.0	5.0	336.0	343.0	0.6%	51.1
83		Pool lobby	Pool lobby	RTS1678	1-13 /10:03am	2-03 / 10:05am	1/19 @ 918PM to 2/2 @ 1018PM	161.0	22.0	3.0	151.0	337.0	54.3%	4756.9
84		Men's Lockers	Men's Lockers	RTS1299	1-13 /9:26am	2-03 / 10:05am	1/19 @ 917PM to 2/2 @ 1016PM	0.0	0.0	128.0	209.0			
85		Small Pool Restroom	Small Pool Restroom	RTS1304	1-13 /10:00am	2-03 / 10:05am	1/19 @ 914PM to 2/2 @ 911PM	34.0	116.0	1.0	185.0	336.0	44.6%	3910.7
86		Hall/Common	Hall/Common	RTS1651	1-13 /9:22am	2-03 / 10:05am	1/19 @ 919PM to 2/2 @ 1016PM	153.0	29.0	3.0	151.0	336.0	54.2%	4745.0
87		Large Pool	Large Pool	RTS1392	1-13 /9:33am	2-03 / 10:05am	1/19 @ 902PM to 2/2 @ 935PM	14.0	129.0	15.0	180.0	338.0	42.3%	3706.2
88		Large Pool	Large Pool	RTS1346	1-13 /9:36am	2-03 / 10:05am	1/19 @ 917PM to 2/2 @ 938PM	11.0	60.0	33.0	232.0	336.0	21.1%	1851.1
89		Small Pool	Small Pool	RTS1432	1-13 /9:40am	2-03 / 10:05am	1/19 @ 913PM to 2/2 @ 910PM	45.0	107.0	1.0	183.0	336.0	45.2%	3962.9
90		Small Pool	Small Pool	RTS1314	1-13 /9:42am	2-03 / 10:05am	1/19 @ 914PM to 2/2 @ 911PM	40.0	137.0	0.0	159.0	336.0	52.7%	4614.6
91		Multipurpose Room	Multipurpose Room	RTS1668	1-13 /9:20am	2-03 / 10:05am	1/19 @ 942PM to 2/2 @ 1005PM	130.0	56.0	4.0	146.0	336.0	55.4%	4849.3
92	Health & Human Services	Office	A118	RTS1309	1-13 /1:37pm	2-03 / 11:30am	1/19 @ 939PM to 2/2 @ 735PM	57.0	28.0	2.0	247.0	334.0	25.4%	2229.3
93		Office	Across from P114	RTS1695	1-13 /1:45pm	2-03 / 11:30am	1/19 @ 735PM to 2/2 @ 713PM	67.0	19.0	1.0	248.0	335.0	25.7%	2248.8
94		Hall	By A105	RTS1374	1-13 /1:32pm	2-03 / 11:30am	1/19 @ 818PM to 2/2 @ 939PM	54.0	25.0	3.0	256.0	338.0	23.4%	2047.5
95		Hall	By P111	RTS1206	1-13 /1:42pm	2-03 / 11:30am	1/19 @ 1156PM to 2/2 @ 817PM	88.0	29.0	10.0	206.0	333.0	35.1%	3077.8
96		Hall/Common	A120	RTS1305	1-13 /1:35pm	2-03 / 11:30am	1/19 @ 1158PM to 2/2 @ 736PM	68.0	24.0	4.0	235.0	331.0	27.8%	2434.8
97		Open Office	A105	RTS1434	1-13 /1:25pm	2-03 / 11:30am	1/19 @ 1114PM to 2/2 @ 717PM	91.0	11.0	230.0	0.0	332.0	30.7%	2691.3

98		Open Office	Clinic Lobby	RTS1396	1-13 /1:47pm	2-03 / 11:30am	1/19 @ 711PM to 2/2 @ 716PM	91.0	22.0	3.0	220.0	336.0	33.6%	2946.1
99		Conference Room	A101	RTS1397	1-13 /1:24pm	2-03 / 11:30am	1/19 @ 1157PM to 2/2 @ 657PM	22.0	24.0	3.0	283.0	332.0	13.9%	1213.7
100		Conference Room	Health Main Conference Room	RTS1663	1-13 /1:50pm	2-03 / 11:30am	1/19 @ 525PM to 2/2 @ 738PM	42.0	20.0	4.0	272.0	338.0	18.3%	1606.9
101	Library	Office	IT office	RTS1646	1-13 /11:38am	2-03 / 10:55am	1/19 @ 1156PM to 2/2 @ 1143PM	91.0	52.0	20.0	174.0	337.0	42.4%	3717.2
102		Open Office	Circulation	RTS1367	1-13 /11:40am	2-03 / 10:55am	1/19 @ 1152PM to 2/2 @ 1142PM	105.0	58.0	1.0	172.0	336.0	48.5%	4249.6
103		Office	office 3	RTS1063	1-13 /11:50am	2-03 / 10:55am	1/19 @ 1038AM to 2/2 @ 1152PM	24.0	38.0	2.0	286.0	350.0	17.7%	1551.8
104		Office	office 1	RTS1696	1-13 /11:54am	2-03 / 10:55am	1/19 @ 709PM to 2/2 @ 1151PM	26.0	22.0	5.0	287.0	340.0	14.1%	1236.7
105		Library	Children's Section	RTS1378	1-13 /11:43am	2-03 / 10:55am	1/20 @ 1201AM to 2/2 @ 1144PM	118.0	34.0	1.0	182.0	335.0	45.4%	3974.7
106		Library	Computer Section	RTS1412	1-13 /11:46am	2-03 / 10:55am	1/19 @ 255PM to 2/2 @ 1147PM	95.0	67.0	2.0	181.0	345.0	47.0%	4113.4
107		Library	Stacks	RTS1652	1-13 /11:57am	2-03 / 10:55am	1/19 @ 1154PM to 2/2 @ 1143PM	0.0	163.0	0.0	173.0	336.0	48.5%	4249.6
108		Library	Stacks	RTS1684	1-13 /11:59am	2-03 / 10:55am	1/19 @ 1155PM to 2/2 @ 1144PM	116.0	46.0	3.0	170.0	335.0	48.4%	4236.2
109		Library	Stacks	RTS1301	1-13 /12:00pm	2-03 / 10:55am	1/19 @ 1155PM to 2/2 @ 1150PM	84.0	73.0	1.0	178.0	336.0	46.7%	4093.2
110		Library	Stacks	RTS1661	1-13 /12:01pm	2-03 / 10:55am	1/19 @ 1154PM to 2/2 @ 1154PM	148.0	33.0	9.0	146.0	336.0	53.9%	4718.9
111		Restroom	Men's Restroom	RTS1381	1-13 /12:03pm	2-03 / 10:55am	1/19 @ 1237PM to 2/2 @ 1003PM	82.0	56.0	4.0	204.0	346.0	39.9%	3493.9
112		Restroom	Women's Restroom by Comstock room	RTS1676	1-13 /12:05pm	2-03 / 10:55am	1/19 @ 517PM to 2/2 @ 1003PM	78.0	57.0	2.0	204.0	341.0	39.6%	3468.0
113	Juvenile Detention	Main Lobby	Court Lobby	RTS1028	1-14 /8:30am	2-03 / 9:05am	1/19 @ 848PM to 2/2 @ 1020PM	57.0	35.0	21.0	224.0	337.0	27.3%	2391.5
114		Open Office	Outside of judges office	RTS1213	1-14 /8:38am	2-03 / 9:05am	1/19 @ 957PM to 2/2 @ 1143PM	90.0	24.0	3.0	221.0	338.0	33.7%	2954.6
115		Office	Judicial Assistant	RTS1053	1-14 /8:33am	2-03 / 9:05am	1/19 @ 1156PM to 2/2 @ 1039PM	77.0	23.0	16.0	219.0	335.0	29.9%	2614.9
116		Hall/Common	By District Attorney	RTS1394	1-14 /8:40am	2-03 / 9:05am	1/19 @ 849PM to 2/2 @ 1040PM	15.0	22.0	33.0	268.0	338.0	10.9%	958.9
117		Restroom	Men's Restroom	RTS1627	1-14 /8:46am	2-03 / 9:05am	1/19 @ 834PM to 2/2 @ 919PM	6.0	43.0	8.0	280.0	337.0	14.5%	1273.7
118		Restroom	Women's Restroom	RTS1008	1-14 /8:48am	2-03 / 9:05am	1/19 @ 847PM to 2/2 @ 931PM	10.0	26.0	17.0	284.0	337.0	10.7%	935.8
119		Cell	Cell 18	RTS1418	1-14 /8:18am	2-03 / 9:05am	1/19 @ 943PM to 2/2 @ 726PM	0.0	28.0	1.0	304.0	333.0	8.4%	736.6

120		Day room	Boys Day Room	RTS1035	1-14 /8:20am	2-03 / 9:05am	LOGGER NOT RESPONDING							
121		Courtroom	Courtroom	RTS1702	1-14 /8:28am	2-03 / 9:05am	1/19 @ 706PM to 2/2 @ 916PM	34.0	102.0	1.0	201.0	338.0	40.2%	3524.7

Appendix I. Equipment Inventory Tables

Table I.0. Pumps – Chilled Water

Facility Name	Tag	Make	Model Number	Motor Size (HP)	Nameplate Flow Rate (GPM)	Nameplate Head (ft)	Motor Efficiency (%)	RPM	Notes
Courthouse	CHWP-1	Aurora	98-03204-2	8	295	50	92	1,760	
Courthouse	CHWP-2	Aurora	98-03205	5	167	50	90	1,760	
Courthouse	CHWP-3	Aurora	98-03204-1	8	295	50	92	1,760	
Courthouse	CHWP-4	Aurora	98-03208-1	3	274	20	90	1,770	Chiller #1
Courthouse	CHWP-5	Aurora	98-03208-1	3	274	20	90	1,770	Chiller #2
Fire Station 51	P-1A	Armstrong	3X3X13 4380	15	133	135	unk	1,765	Heat Pump System
Fire Station 51	P-1B	Armstrong	3X3X13 4381	15	133	135	unk	1,765	Heat Pump System

Note - “unk” is assigned to equipment where nameplate, design drawing, and/or manufacturers information was not available.

Table I.1. Pumps – Condenser Water

Facility Name	Tag	Make	Model Number	Motor Size (HP)	Nameplate Flow Rate (GPM)	Nameplate Head (ft)	Motor Efficiency (%)	RPM	Notes
Courthouse	CP-1	Aurora	98-3206-2	7.5	480	45	92	1,760	
Courthouse	CP-2	Aurora	98-0320-3	7.5	480	45	92	1,760	
Courthouse	CP-3	Aurora	98-3206-1	7.5	480	45	92	1,760	
Fire Station 51	P-2A	Armstrong	2x2x8 4380	5	133	45	unk	1,735	
Fire Station 51	P-2B	Armstrong	2x2x8 4380	5	133	45	unk	1,735	

Note - "unk" is assigned to equipment where nameplate, design drawing, and/or manufacturers information was not available.

Table I.2. Pumps – Hot Water

Facility Name	Tag	Make	Model Number	Motor Size (HP)	Nameplate Flow Rate (GPM)	Nameplate Head (ft)	Motor Efficiency (%)	RPM	Notes
Aquatic Center	HWP-1	Paco	11UN-80155-158201	10	1,650	70	unk	1,180	
Aquatic Center	HWP-2	Paco	unk	10	350	60	86	1,725	
Aquatic Center	HWP-3	unk	unk	2	unk	unk	77	1,165	
Aquatic Center	HWP-4	unk	unk	15	unk	unk	90	3,500	
Aquatic Center	HWP-5	Goulds	unk	8	unk	unk	90	1,770	
Aquatic Center	HWP-7	Bell & Gossett	90-t 1/2A	1	40	25	unk	1,800	Hx-5
Aquatic Center	HWP-8	Bell & Gossett	90-2A	1	75	25	unk	1,800	Hx-6
City Hall	HWP-1	unk	unk	unk	unk	unk	unk	unk	Nameplate not accessible
Courthouse	HWP-1	Aurora	99-83207-1	5	170	65	90	1,760	
Courthouse	HWP-2	Aurora	99-83207-3	5	170	65	90	1,760	Courthouse Supply
Courthouse	HWP-3	Aurora	99-83207-2	5	170	65	90	1,760	
Courthouse	HWP-4	Armstrong	3X3X6 4380	2	170	20	84	1,730	Boiler #1
Courthouse	HWP-5	Armstrong	3X3X6 4380	2	170	20	87	1,740	Boiler #2
Fire Station 51	P-3A	Armstrong	2X2X8 4380	1	40	20	76	1,140	
Fire Station 51	P-3B	Armstrong	2X2X8 4380	1	40	20	76	1,140	
Health Services	HWP-1	unk	unk	0	unk	unk	unk	3,450	Boiler #1
Health Services	HWP-2	unk	unk	0	unk	unk	55	3,450	Boiler #2
Health Services	HWP-3	unk	unk	5	102	60	90	1,760	
Health Services	HWP-4	Bell & Gossett	32 2BC 9 25BF	5	102	60	83	1,740	
Health Services	HWP-5	unk	unk	0	unk	unk	55	3,450	Boiler #3
Sheriff's Admin	HWP 2A	unk	unk	8	unk	unk	89	1,725	
Sheriff's Admin	HWP 2B	unk	unk	8	unk	unk	89	1,725	

Note - "unk" is assigned to equipment where nameplate, design drawing, and/or manufacturers information was not available.

Table I.3. Heat Exchangers

Facility Name	Tag	Make	Model Number	Building Side			Cooling Tower Side		
				Design Entering Temp.	Design Leaving Temp.	Design Flow (gpm)	Design Entering Temp.	Design Leaving Temp.	Design Flow (gpm)
Aquatic Center	HX-1	Bell & Gossett	GPX-130-007	unk	unk	unk	unk	unk	unk
Aquatic Center	HX-2	Bell & Gossett	GPX-130-021	unk	unk	unk	unk	unk	unk
Aquatic Center	HX-3	Armstrong	STGMA-X13	unk	unk	unk	unk	unk	unk
Aquatic Center	HX-4	Armstrong	STGMA-X13	unk	unk	unk	unk	unk	unk
Aquatic Center	HX-5	Bell & Gossett	GPX151-MP	180	140	20	100	120	40
Aquatic Center	HX-6	Bell & Gossett	GPX151-MP	180	140	75	80	120	75
Fire Station 51	HX-1	B.A.C.	EC-B	86.5	76.5	133	unk	73	133

Note - "unk" is assigned to equipment where nameplate, design drawing, and/or manufacturers information was not available.

This page left intentionally blank.

Table I.4. Boilers

Facility Name	Tag	Make	Model Number	Input (kBtu/hr)	Output (kBtu/hr)	Min Input (kBtu/hr)
Aquatic Center	B-1	Ray Pak	H-3001A-CECRCDA	3,000	2,460	1,050
Aquatic Center	B-2	Ray Pak	H-3001A-CECRCDA	3,000	2,460	1,050
City Hall	B-1	Kewanee	3R6-KG0	990	792	unk
Courthouse	B-1	Cleaver Brooks	FLX 200	2,640	2,112	unk
Courthouse	B-2	Cleaver Brooks	FLX 200	2,640	2,112	unk
Courthouse	B-3	Teledyne Laars	PH 1010 IN 09KIACLW	1,000	818	253
Courthouse	B-4	Lochinvar	unk	399	unk	80
Courthouse	B-5	Lochinvar	unk	399	unk	80
Fire Statino 51	B-1	PVI	10 WBHE 50A-TP	400	335	unk
Fire Statino 51	B-2	PVI	10 WBHE 50A-TP	400	335	unk
Health Services	B-1	Rite	76WG	760	unk	unk
Health Services	B-2	Rite	76WG	760	unk	unk
Health Services	B-3	Rite	76WG	760	unk	unk
Sheriff's Admin	B-1	LAARS	RHHH-1200	1,092	982	unk
Sheriff's Admin	B-2	LAARS	RHHH-1201	1,092	982	unk

Note - "unk" is assigned to equipment where nameplate, design drawing, and/or manufacturers information was not available.

Table I.5. Cooling Towers

Facility Name	Tag	Make	Model Number	Fan HP
Courthouse	CT-1	B.A.C.	151462W	7.5
Fire Station 51	CT-1	B.A.C.	VTO-65-J	10

Table I.6. Water Cooled Chillers

Facility Name	Tag	Make	Model Number	Compressor Type	Refrigerant	Cooling Capacity (tons)	Full Load Efficiency (kW/ton)	Serial Number
Courthouse	CH-1	Carrier	23XL1111EC40	Screw	R-134a	160	0.597	0498J57500
Courthouse	CH-2	Carrier	23XL1111EC40	Screw	R-134a	160	0.597	0498J57499

Table I.7A. Air handling Units

Facility Name	Equipment Tag	Make	Model Number	Supply Fan		Cooling Coil	Heating Coil	Exhaust Fan (HP)
				HP	Total CFM	Capacity (MBH)	Capacity (MBH)	
Aquatic Center	MUA-1	Heat-Ex	E-Pool-1H-36/27-50000 IDF	60	50,000	-	700	unk
Aquatic Center	MUA-2	Heat-Ex	E-Pool-1H-36/27-50000 IDF	60	50,000	-	700	unk
Aquatic Center	MUA-3	Heat-Ex	5000-1B-15-4600-IDF	5	4,600	-	100	unk
Aquatic Center	MUA-4	Modine	600	10	14,445	unk	unk	unk
City Hall	MZ-1	Mammoth	EHB-502-W550-MZT	unk	unk	unk	unk	unk
Corporate Yard Fleet	MAU-1	Greenheck	DGX-120-H32-UB	8	11,025	-	881	-
Corporate Yard Fleet	MAU-2	Greenheck	DGX-120-H32-UB	8	9,025	-	721	-
Courthouse	AHU-1	Carrier	39NC21	15	8,500	unk	unk	2
Courthouse	AHU-2	Carrier	39NC17	10	7,200	unk	unk	2
Courthouse	AHU-3	Carrier	39NC11	8	4,500	unk	unk	2
Courthouse	AHU-4	Carrier	39NC17	15	7,400	unk	unk	5
Courthouse	AHU-5	Carrier	39NC07	3	2,240	unk	unk	-
Courthouse	AHU-6	Carrier	39NC32	25	15,000	unk	unk	10
Courthouse	AHU-7	Carrier	39NC11	5	3,800	unk	unk	3
Courthouse	AHU-8	Carrier	39LB06	3	2,100	unk	unk	-
Courthouse	AHU-9	Carrier	39NC07	3	2,500	unk	unk	2
Courthouse	AHU-10	Carrier	39NC61	40	27,700	unk	unk	15

Table N.7A. Continued Air handling Units

Facility Name	Equipment Tag	Make	Model Number	Supply Fan		Cooling Coil	Heating Coil	Exhaust Fan (HP)
				HP	Total CFM	Capacity (MBH)	Capacity (MBH)	
Courthouse	AHU-11	Carrier	39NC74	40	33,000	unk	unk	15
Courthouse	AHU-12	Carrier	39LC12	5	4,600	unk	unk	-
Health Services	AHU-1	Trane	SXHFC4040M47C6BD2010ADEGJKLRT68S	20	unk	unk	unk	5
Health Services	AHU-2	Trane	SXHFC4040M47C6BD2010ADEGJKLRT68S	20	unk	unk	unk	5
Juvenile Detention	MZ-1	Carrier	48MA-016-550KA	5	unk	unk	432	2
Juvenile Detention	MZ-2	Carrier	48MA-034-540KA	15	unk	unk	648	2
Library	MZ-1	Lennox	DMS24-185-350	3	6,750	180	295	1
Sheriff's Admin	AHU-1	Carrier	48AKD060 - GQ611HM	30	23,000	662	636	unk
Sheriff's Admin	AHU-2	Carrier	48AKS030 - DQ611HK	15	13,000	326	287	unk

Note - "unk" is assigned to equipment where nameplate, design drawing, and/or manufacturers information was not available.

Table I.7B. Package Dx Air Conditioning Units

Facility	Make	Model Number	Tag Number	Supply Fan	Cooling Coil	Heating Coil	
				Total CFM	Cooling Capacity (MBH)	Input Capacity (MBH)	Output Capacity (MBH)
Aquatic Center	Modine	600	MUA-4	5,830	-	400	275
Aquatic Center	SnyderGeneral	PGDB060H125IN1	AC-1	unk	unk	125	98
BRIC	Bryant	580DPV048115AAAA	AC-1	unk	unk	115	92
BRIC	Trane	YCD036A3L0AB	AC-2	unk	unk	88	63
City Hall	Carrier	48HJD005-361	RTU-2	unk	unk	72	59
City Hall	Carrier	48HJE004-351	RTU-1	unk	unk	72	59
City Hall	Carrier	48HJD006-351	RTU-3	unk	unk	72	59
Community Center	Carrier	48HJF006	AC-1	1,990	57	124	92
Community Center	Carrier	48EWO028 CVAB105	AC-2	10,000	250	262	unk
Community Center	Carrier	48HJO0095A	AC-3	3,400	101	125	86
Community Center	Carrier	48HJETBA	AC-4	6,000	139	278	181
Community Center	Carrier	48HJF00623A	AC-5	1,980	57	129	99
Community Center	Carrier	48EWO028 CVAB105	AC-6	10,000	250	262	180
Community Center	Carrier	48HJE00T5A	AC-7	2,400	642	82	55
Community Center	Carrier	48HJD0123A	AC-8	4,000	97	180	124
Community Center	Carrier	48HJE00T5A	AC-9	2,400	64	82	55
Community Center	Carrier	48HJD0055A	AC-10	1,600	35	72	47

Table N.7B. Continued Package Dx Air Conditioning Units

Facility	Make	Model Number	Tag Number	Supply Fan	Cooling Coil	Heating Coil	
				Total CFM	Cooling Capacity (MBH)	Input Capacity (MBH)	Output Capacity (MBH)
Community Center	Carrier	42DD12BD6	AC-11	995	28	7	unk
Corporate Yard Fleet	Carrier	48HCLA05A2A5A0A0A0	AC-1	unk	48	60	50
Corporate Yard #9	unk	unk	AC-1	unk	unk	unk	unk
Courthouse	Carrier	48NLX024	AC-1	900	22	40	unk
Courthouse	Carrier	50SS018	AC-2	600	16	-	unk
Fire Station 52	Carrier	48TFE006-A-541HQ	RTU-1	unk	unk	180	144
Fire Station 52	Carrier	48TFE008-A-511HQ	RTU-2	unk	unk	115	92
Fire Station 53	Carrier	48HJD006---541	RTU-1	unk	unk	72	59
Juvenile Admin	Carrier	48TJE006	RTU-1	1,990	48	94	75
Juvenile Admin	Carrier	48TJE005	RTU-2	1,575	40	94	75
Juvenile Admin	Carrier	48TJE006	RTU-3	1,875	46	94	75
Juvenile Detention	Bryant	580FPV048120NBAL	AC-1	1,560	40	94	75
Library	Trane	BYC060F3LO	AC-1	unk	58	88	70
Library	Trane	BYC060F3LO	AC-2	unk	58	88	70
Library	Trane	BYC060F3LO	AC-3	unk	58	88	70
Library	Trane	BYC060F3LO	AC-4	unk	58	88	70

Table N.7B. Continued Package Dx Air Conditioning Units

Facility	Make	Model Number	Tag Number	Supply Fan	Cooling Coil	Heating Coil	
				Total CFM	Cooling Capacity (MBH)	Input Capacity (MBH)	Output Capacity (MBH)
Library	Trane	BYC060F3LO	AC-5	unk	58	88	70
Library	Trane	BYC060F3LO	AC-6	unk	58	88	70
Library	Trane	BYC060F3LO	AC-7	unk	58	88	70
Library	Trane	BYC060F3LO	AC-8	unk	58	88	70

Library	Carrier	48TCEA06A2A5A0A0A0	AC-9	unk	unk	115	93
Public Works	BDP	581BEV120224AAEA	AC-1	unk	unk	224	183
Public Works	Bryant	583ANW024040NCAD	AC-2	unk	unk	33	27
Senior Center	Aaon	RK-10-3-EO-226	AC-1	3,850	111	270	unk
Senior Center	Rheem	RKKB-A120DL15E	AC-2	3,825	90	150	unk
Senior Center	Rheem	RKKB-A090DL15E	AC-3	2,775	68	150	unk
Senior Center	Rheem	RKMA-A072DL13	AC-4	2,325	57	180	unk
Senior Center	Aaon	RK-08-2-EO-226	AC-5	3,550	84	270	unk
Senior Center	Rheem	RKKB-A090CL15E	AC-6	3,300	68	150	unk
Senior Center	Rheem	RKKB-A090CL15E	AC-7	3,000	68	150	unk
Senior Center	Aaon	RK-15-2-E0-236	AC-8	4,800	134	390	unk
Senior Center	Rheem	RKKB-A090DL15E	AC-9	2,625	68	150	unk

Table N.7B. Continued Package Dx Air Conditioning Units

Facility	Make	Model Number	Tag Number	Supply Fan	Cooling Coil	Heating Coil	
				Total CFM	Cooling Capacity (MBH)	Input Capacity (MBH)	Output Capacity (MBH)
Sheriff's Dispatch	Bryant	581BPV072115ADVA	AC-1	2,100	64	94	76
Sheriff's Dispatch	Bryant	581BPV072115ADVA	AC-2	2,100	64	94	76
Sheriff's Dispatch	Bryant	581BPV072115ADVA	AC-3	2,100	64	94	76
Sheriff's Dispatch	Bryant	582ANW018040AAAD	AC-4	600	14	33	27

Note - "unk" is assigned to equipment where nameplate, design drawing, and/or manufacturers information was not available.

Table I.8. Energy Recovery Units and Exhaust Fans for HGx Systems

Facility Name	Tag	Make	Model Number	Quantity	Motor Size (hp)	Supply Fan Flow (CFM)	Exhaust Fan Flow (CFM)
Library	HRU-1	Des Champs Lab	EZA-2270	1	1.5	1,920	unk

Note - "unk" is assigned to equipment where nameplate, design drawing, and/or manufacturers information was not available.

Table I.9. Water-Source Heat Pumps

Facility Name	Tag	Make	Model Number	Supply Fan Flow (CFM)	Cooling Capacity (MBH)	Heating Capacity (MBH)
Fire Station 51	HP-1	Snyder General	SWPH-510	1,530	45	63
Fire Station 51	HP-2	Snyder General	SWPH-190	600	17	24
Fire Station 51	HP-3	Snyder General	SWPH-410	1,245	38	52
Fire Station 51	HP-4	Snyder General	SWPH-350	1,170	34	48
Fire Station 51	HP-5	Snyder General	SWPH-350	1,160	34	48
Fire Station 51	HP-6	Snyder General	SWPH-350	1,100	33	47
Fire Station 51	HP-7	Snyder General	SWPH-280	960	28	40
Fire Station 51	HP-8	Snyder General	SWPH-410	1,200	38	52
Fire Station 51	HP-9	Snyder General	SWPH-350	1,165	33	44
Fire Station 51	HP-10	Snyder General	SWPH-280	700	21	30
Fire Station 51	HP-11	Snyder General	SWPH-510	1,460	44	63
Fire Station 51	HP-12	Snyder General	SWPH-510	1,425	44	63

Appendix J. ECM Implementation Costs

ECM 1: Interior Lighting Retrofits and Exterior Lighting Retrofits

Table J.0. Ameresco Lighting Subcontractor - RTS Quote Summary

Contractor Quotes	Excludes Ameresco Mark-up		
Implementation Costs ECM 1	**ECM 1 Interior and Exterior Lighting Retrofits**		
	Turnkey Installation	**Contingency**	**Subtotal Direct Project Costs**
Aquatic Facility	$148,910	$2,978	$151,888
Building Department	$11,452	$229	$11,681
Cemetery	$5,869	$117	$5,987
City Hall	$53,415	$1,068	$54,484
Community Center	$84,715	$1,694	$86,410
Corporate Yard #13	$3,412	$68	$3,480
Public Works	$76,330	$1,527	77,856
Court House	$303,152	$6,063	$309,215
Fire Station 51	$67,253	$1,345	$68,598
Fire Station 52	$20,281	$406	$20,686
Fire Station 53	$8,180	$164	$8,344
Health & Human Resources	$71,564	$1,431	$72,996
Juvenile Administration	$13,027	$261	$13,287
Juvenile Annex	$8,299	$166	$8,465
Juvenile Detention	$28,665	$573	$29,239
Library	$76,933	$1,539	$78,472
Senior Center	$66,104	$1,322	$67,426
Sheriff's Administration	$74,235	$1,485	$75,720
Mills Park & Marv Pavilion	$110,627	$2,213	$112,839
Centennial Park Complex	$12,969	$259	$13,228
Pete Livermore Sports Complex	$64,170	$1,283	$65,454
Totals	**$1,309,562**	**$26,191**	**$1,335,755**

ECM 2: Boiler Replacements

Table J.1. Ameresco Subcontractor Quote Summary

ECM 2 - Boiler Replacements	Excludes Ameresco Mark up	Turnkey Installation		Sub-Total	Bonding	Sales Tax	Contingency	Total Direct Costs
Site	Item	Plumbing D&D Plumbing Material	Plumbing D&D Plumbing Labor					
Aquatic Center	**(4) Boilers**	$123,273	$64,073	$187,345	$2,842	7,116	$9,865	$207,168
City Hall	**(2) Boilers**	$70,100	$50,353	$120,453	$1,817	$3,908	$10,806	$136,984
	Total	**$193,373**	**$114,426**	**$307,798**	**$4,659**	**$11,024**	**$20,671**	**$344,152**

ECM 3: Energy Management System Upgrades and Retro-commissioning

Table J.2. Ameresco Controls Subcontractor Quote Summary

Controls Contractor Quote Summary			3 - Energy Management System Upgrades and RCx Excludes Ameresco Mark up						
Site	**Contractor**		**EMS Software**	**Global Controller**	**Upgrade IBEX**	**Front-End RCx**	**Boilers EMS**	**New DDC EMS**	**HVAC EMS**
Citywide	**BCS**	**Total**	**$29,123**						
		Matls	$15,200						
		Taxes	$1,137						
		Labor	$11,122						
		Bonding	$544						
		Contingency	$1,120						
Aquatic Center	**BCS**	**Total**		**$14,300**	**$28,964**	**$8,933**	**$36,405**		
		Matls		$6,338	$10,830		$13,290		
		Taxes		$237	$810		$993		
		Labor		$6,909	$15,672	$8,426	$20,046		
		Bonding		$266	$538	$164	$676		
		Contingency		$550	$1,114	$344	$1,400		
City Hall	**BCS**	**Total**		**$14,300**	**$11,720**	**$4,288**	**$33,129**		**$145,015**
		Matls		$6,338	$3,700		$11,625		$59,234
		Taxes		$237	$280		$869		$4,434
		Labor		$6,909	$7,073	$4,044	$18,745		$73,074
		Bonding		$266	$217	$79	$615		$2,696
		Contingency		$550	$451	$165	$1,274		$5,578
Community Center	**BCS**	**Total**		**$9,048**		**$2,859**			
		Matls		$4,802					
		Taxes		$359					
		Labor		$3,370		$2,696			
		Bonding		$169		$53			
		Contingency		$348		$110			
Courthouse Complex	**BCS**	**Total**		**$11,453**		**$6,951**			
		Matls		$6,910					
		Taxes		$517					
		Labor		$3,370		$6,556			
		Bonding		$215		$128			
		Contingency		$440		$267			
Fire Station 51	**BCS**	**Total**		**$14,300**	**$24,099**	**$3,729**			
		Matls		$6,338	$12,518				
		Taxes		$237	$936				
		Labor		$6,909	$9,268	$3,516			
		Bonding		$266	$450	$69			
		Contingency		$550	$927	$143			

Continued on the following page.

Table J.2 (Continued) Ameresco Controls Subcontractor Quote Summary

Controls Contractor Quote Summary			3 - Energy Management System Upgrades and RCx						
Site	Contractor		EMS Software	Global Controller	Upgrade IBEX	Front-End RCx	Boilers EMS	New DDC EMS	HVAC EMS
Fire Station 52	**BCS**	**Total**		**$9,048**		**$2,859**			
		Matls		$4,802					
		Taxes		$359					
		Labor		$3,370		$2,696			
		Bonding		$169		$53			
		Contingency		$348		$110			
Fire Station 53	**BCS**	**Total**		**$9,048**		**$2,859**			
		Matls		$4,802					
		Taxes		$359					
		Labor		$3,370		$2,696			
		Bonding		$169		$53			
		Contingency		$348		$110			
Health & Human Resources	**BCS**	**Total**				**$4,288**			
		Matls							
		Taxes							
		Labor				$4,044			
		Bonding				$79			
		Contingency				$165			
Juvenile Administration	**BCS**	**Total**		**$9,048**		**$1,430**			
		Matls		$4,802					
		Taxes		$359					
		Labor		$3,370		$1,348			
		Bonding		$169		$27			
		Contingency		$348		$55			
Library	**BCS**	**Total**		**$9,048**		**$2,859**			
		Matls		$4,802					
		Taxes		$359					
		Labor		$3,370		$2,696			
		Bonding		$169		$53			
		Contingency		$348		$110			
Senior Center	**BCS**	**Total**				**$2,145**			
		Matls							
		Taxes							
		Labor				$2,022			
		Bonding				$40			
		Contingency				$82			

Continued on the following page.

Table J.2 (Continued) Ameresco Controls Subcontractor Quote Summary

Controls Contractor Quote Summary			3 - Energy Management System Upgrades and RCx						
Site	**Contractor**		**EMS Software**	**Global Controller**	**Upgrade IBEX**	**Front-End RCx**	**Boilers EMS**	**New DDC EMS**	**HVAC EMS**
Sheriff's Administration	**BCS**	**Total**				**$2,859**			
		Matls							
		Taxes							
		Labor				$2,696			
		Bonding				$53			
		Contingency				$110			
Sheriff's Dispatch	**BCS**	**Total**		**$9,048**		**$2,859**			
		Matls		$4,802					
		Taxes		$359					
		Labor		$3,370		$2,696			
		Bonding		$169		$53			
		Contingency		$348		$110			
MAC	**BCS**	**Total**						**$34,772**	
		Matls						$12,690	
		Taxes						$949	
		Labor						$19,149	
		Bonding						$646	
		Contingency						$1,337	
Totals	**Total**	**$500,786**	**$29,123**	**$108,643**	**$64,784**	**$48,920**	**$69,534**	**$34,772**	**$145,015**
	Matls	**$193,823**	$15,200	$54,736	$27,048		$24,915	$12,690	$59,234
	Taxes	**$13,790**	$1,137	$3,382	$2,026		$1,862	$949	$4,434
	Labor	**$264,604**	$11,122	$44,320	$32,013	$46,134	$38,792	$19,149	$73,074
	Bonding	**$9,313**	$544	$2,027	$1,205	$904	$1,291	$646	$2,696
	Contingency	**$19,261**	$1,120	$4,179	$2,492	$1,882	$2,674	$1,337	$5,578

ECM 4: Building Envelope

Table J.3. Ameresco Building Envelope Subcontractor - RTS Quote Summary

Contractor Quotes	Excludes Ameresco Mark up		
Implementation Costs ECM 4	**ECM 4 Building Envelope**		
	Turnkey Installation	**Contingency**	**Subtotal Direct Project Costs**
Aquatic Facility	$76,298	$1,526	$77,824
City Hall	$10,748	$215	$10,963
Community Center	$12,879	$258	$13,137
Fire Station 52	$8,191	$164	$8,355
Juvenile Detention	$4,325	$86	$4,411
Sheriff's Dispatch	$5,974	$119	$6,094
Totals	**$118,415**	**$370**	**$120,784**

ECM 5: City Hall HVAC Retrofit

Table J.4. Ameresco Subcontractor Quote Summary

ECM 5 – City Hall HVAC Retrofit	Excludes Ameresco Mark up	Turnkey Installation					Sub-Total	Bonding	Sales Tax	Contingency	Total Direct Costs
		Plumbing		Mechanical							
		D&D Plumbing		AMI Mechanical							
Site	Item	Material	Labor	Material	Labor	Subcontractor Labor					
City Hall	New VAV AC supply unit w/ HW reheat	$45,815	$82,208	$92,793	$96,149	$50,608	$367,573	$5,565	$8,150	$26,290	$407,978
	Total	**$45,815**	**$82,208**	**$92,793**	**$96,149**	**$50,608**	**$367,573**	**$5,565**	**$8,150**	**$26,290**	**$407,978**

This Page is intentionally left blank.

ECM 7: Building Dynamics

Table J.5. Ameresco Building Dynamics - Ameresco Quote Summary

Ameresco Quote	Excludes Ameresco Mark up	
Implementation Costs ECM 7	**ECM 7 Building Dynamics**	
	Initial Setup & Programming	**Subtotal Direct Project Costs**
City Wide – Includes 5 years	**$8,500**	**$8,500**

Appendix K. Carson City Standards of Comfort

Table K.0. Mechanical Systems for Carson City Modeled Buildings

Modeled Buildings		Existing						Proposed					
		Occupied		Unoccupied		Fan Schedule		Occupied		Unoccupied		Fan Schedule	
Name	Mechanical Systems/Zones	Cooling (F)	Heating (F)	Cooling (F)	Heating (F)	Schedule	Annual Hours	Cooling (F)	Heating (F)	Heating (F)	Cooling (F)	Schedule	Annual Hours
Library	AC - 1-5,7,8	74	68	85	45	Daily: 6:00 AM to 10:00 PM	5,840	74	68	95	55	M: 9:00 AM to 8:00 PM, T-TH: 9:00 AM to 9:00 PM, F: 9:00 AM to 8:00 PM, SS: 8:00 AM to 6:00 PM	4,056
Library	HRU - 6,9	74	68	74	68	24/7	8,760	74	68	95	55	M: 9:00 AM to 8:00 PM, T-TH: 9:00 AM to 9:00 PM, F: 9:00 AM to 8:00 PM, SS: 8:00 AM to 6:00 PM	4,056
Library	MZ-1	74	68	85	45	Daily: 6:00 AM to 10:00 PM	5,840	74	68	95	55	M: 9:00 AM to 8:00 PM, T-TH: 9:00 AM to 9:00 PM, F: 9:00 AM to 8:00 PM, SS: 8:00 AM to 6:00 PM	4,056
Public Safety	Jail AHU's - 1-5,7-9,12	72	70	72	70	24/7	8,760	72	70	72	70	24/7	8,760
Public Safety	Courthouse AHU's - 6,10,11	72	70	72	70	24/7	8,760	74	68	90	55	M-F: 6:00 AM to 6:00 PM SS: Off	3,120
Senior Center	AC - 1,2,4-9	72	68	72	68	24/7	8,760	74	68	90	55	M-F: 7:00 AM to 5:00 PM SS: Off	3,640
Senior Center	AC - 3	69	66	72	55	Daily: 8:00 AM to 6:00 PM	3,640	74	68	90	55	M-F: 7:00 AM to 5:00 PM SS: Off	3,640
Aquatic Center	AC-1 Exercise Rm	72	68	80	60	Daily: 5:00 AM to 10:00 PM	6,188	72	68	80	60	M-F: 4:00 AM to 8:00 PM SS: 8:00 to 6:00 PM	5,200
Aquatic Center	MUA - 1,2	N/A	78	N/A	60	Daily: 5:00 AM to 10:00 PM	6,188	N/A	78	N/A	60	M-F: 4:00 AM to 8:00 PM SS: 8:00 to 6:00 PM	5,200
Aquatic Center	MUA-3 Therapy	N/A	80	N/A	70	Daily: 5:00 AM to 10:00 PM	6,188	N/A	80	N/A	70	M-F: 4:00 AM to 8:00 PM SS: 8:00 to 6:00 PM	5,200
Aquatic Center	MUA-4 Locker Rooms	N/A	75	N/A	55	Daily: 5:00 AM to 10:00 PM	6,188	N/A	75	N/A	55	M-F: 4:00 AM to 8:00 PM SS: 8:00 to 6:00 PM	5,200
Fire Station #1	HP - 1,3,4,5	70	68	70	68	24/7	8,760	74	68	74	68	24/7	8,760
Fire Station #1	HP - 6,7	70	68	90	60	Daily: 6:00 AM to 8:00 PM	5,096	74	68	90	55	Daily: 6:00 AM to 8:00 PM	5,096

Table K.0. Continued. Mechanical Systems for Carson City Modeled Buildings

Modeled Buildings		Existing						Proposed					
		Occupied		Unoccupied		Fan Schedule		Occupied		Unoccupied		Fan Schedule	
Name	Mechanical Systems/Zones	Cooling (F)	Heating (F)	Cooling (F)	Heating (F)	Schedule	Annual Hours	Cooling (F)	Heating (F)	Heating (F)	Cooling (F)	Schedule	Annual Hours
Fire Station #1	HP - 2,8,9,10,11,12,13	70	68	90	60	M-F: 6:00 AM to 8:00 PM SS: Off	3,640	74	68	90	55	M-F: 6:00 AM to 8:00 PM SS: Off	3,640
City Hall	MZ-1	72	70	72	68	M-F: 5:00 AM to 10:00 PM SS: Off	4,420	74	68	90	55	M-F: 6:00 AM to 6:00 PM SS: Off	3,120
City Hall	AC - 1,2,3	74	68	90	55	M-F: 5:00 AM to 10:00 PM SS: Off	4,420	74	68	90	55	M-F: 6:00 AM to 6:00 PM SS: Off	3,120
Modeled Building System/Zone Average		**72**	**70**	**79**	**61**		**6,341**	**74**	**70**	**88**	**58**		**4,742**

Table K.1. Mechanical Systems for Carson City Non-Modeled Buildings

Non-Modeled Buildings		Existing						Proposed					
		Occupied		Unoccupied		Fan Schedule		Occupied		Unoccupied		Fan Schedule	
Name	Mechanical Systems/Zones	Cooling (F)	Heating (F)	Cooling (F)	Heating (F)	Schedule	Annual Hours	Cooling (F)	Heating (F)	Heating (F)	Cooling (F)	Schedule	Annual Hours
Community Center	AC - 1-12	75	66	83	58	M-F: 8:00 AM to 6:00 PM	2,600	74	68	90	55	M-F: 8:00 AM to 6:00 PM	2,600
Fire Station 52	AC - 1-2	76	65	86	50	24/7	8,760	74	68	90	55	24/7	8,760
Juvenile Detention	MZ - 1, AC-1	72	69	N/A	N/A	N/A	N/A	74	68	90	55	M-F: 7:00 AM to 6:00 PM	2,860
Juvenile Detention	MZ - 2	72	70	N/A	N/A	N/A	N/A	74	68	90	55	24/7	8,760
Sheriff's Dispatch	AC - 1-4	73	66	79	62	24/7	8760	74	68	90	55	24/7	8,760
Non-Modeled Building System/Zone Average		**74**	**67**	**83**	**57**		**6,707**	**74**	**68**	**90**	**55**		**6,348**