9/29/2023

Winter Park City Operations

ASHRAE Level II Energy Audit

15 lightyears
Energy Testing | Solar Power | Green Certification

TLC ENGINEERING SOLUTIONS

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Executive Summary

TLC Engineering Solutions (TLC) and 15 Lightyears performed an ASHRAE Level 2 facility energy audit of the Winter Park Central Complex as a part of a contract with the City of Winter Park.

This report is related to the energy-consuming systems only and is intended to fulfill the requirements of an ASHRAE Level 2 Energy Audit, per the guidelines set forth by the ASHRAE document "Procedures for Commercial Building Energy Audits." The purpose was to observe existing conditions and gather information that would enable TLC to render an opinion concerning conditions or deficiencies that could affect efficient use of this facility, and to identify potential areas for improvement. Neither the field visits nor this report is intended to uncover hidden defects or the presence of hazardous materials.

TLC reviewed renovation/expansion bid drawings created in 2001, current utility bills from January 2021 through December 2022, subsequent project documentation, and visited the site in January 2023 to review the mechanical and electrical equipment, the HVAC and lighting controls systems, and observe each space type and its general energy use intensity. In the course of its work, TLC obtained extensive photo documentation of the conditions of the facility. Several of the photographs are included in Appendix B of this report, and the reader is encouraged to thoroughly review the photographs and descriptions, as they are intended to support and supplement the observations described herein.

After the time on site, TLC developed energy saving spreadsheets to assist with the analysis of recommended Energy Conservation Measures (ECMs) and Facility Improvement Measures (FIMs). The combination of all the walkthrough and post-walkthrough activities led to the development of the ECM and FIM list. A complete description and analysis of each ECM, as well as a table summarizing estimated cost and savings of each measure, can be found later in this report in the Energy Saving Opportunities section.

Project Information & Contacts

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General Facility Description

The Central Complex is a multi-building complex of approximately 67,000 total square feet. An aerial view of the Central Complex is shown below.

Figure 1: Aerial View of the Central Complex

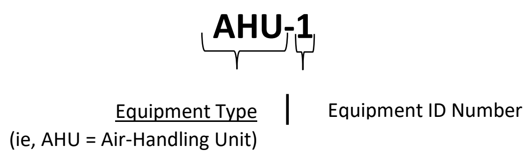
The Central Complex consists of several separate buildings that act as support operations for the City of Winter Park. The buildings included in the report are the following: PWC Facilities Maintenance, PWC Garage, PWC Generator Storage, PWC EU Admin & WPEU Breakroom, PWC Lakes Boat Storage, PWC Streets, PWC Tire Storage, PWC Trailer Storage, PWC CDL, PWC Utilities, PWC Human Resources, PWC Utility Maintenance, PWC Winter Park Warehouse, Covered Storage, Trailer Storage, Pipe Storage, and an existing support office located South of the PWC Utility Maintenance building.

Mechanical Systems

The Central Complex features a range of mechanical systems installed over the course of the facility's lifetime, with the oldest installed in 1999 and the newest installed in 2022. Air conditioning and ventilation for the majority of the complex is provided via split DX air handling units, window air conditioners, and exhaust fans. Mechanical system information was obtained via a combination of resources, including information gathered during TLC's audit walk-through of the buildings, as well as drawings provided by the City of Winter Park (dated 2000). The below breakdown of the mechanical systems and areas they serve is TLC's best attempt to consolidate all avenues of information into one master list.

Equipment Naming Convention

The general naming convention used on the mechanical drawings is shown below. Please note, this convention applies to most of the equipment, but not all equipment.



Air Handling Units

The Central Complex, as mentioned before, utilizes a variety of system types. The details of the systems are listed below by the buildings that include air conditioning.

- Building 1 (PWC Human Resources) & Building 2 (PWC Facilities Maintenance):
  - These buildings consist of one (1) fan coil unit and two (2) split DX air handling units. The FCU has a capacity of 2 tons and each air handling unit has a capacity of 5 tons.
- Building 3 (PWC CDL):
  - The special collections building utilizes one (1) window air conditioner. There was limited information available for this unit.
- Building 4 (PWC EU Admin):
  - The lake office operates with one (1) split DX air conditioning unit, with a capacity of 1.5 tons.
- Building 10 (PWC Utilities) & Building 20 (PWC Utility Maintenance)
  - These utility buildings utilize four (4) DX air conditioners. The tonnage on these units ranges between 1 ton to 5 tons. One unit is larger than the others and is manufactured by Aaon.
- Building 11 (PWC Garage):
  - The garage employs three (3) split DX air handling units. These units range in capacity from 2 tons to 5 tons.
- Building 12 (PWC Streets):
  - The Streets building is equipped with three (3) split DX air handling units. One unit operates at 4 tons, and two of the units operate at 5 tons.
- Building 19 (Pipe Storage):
  - This storage building utilizes one (1) split DX air handling units, with a capacity of 5 tons.
- Existing Building (located South of Building 20, Utilities Maintenance):
  - This office utilizes one (1) split DX air handling unit, with a 2 ton capacity.

Exhaust Fans

Exhaust fans were observed in all Central Complex buildings, providing general exhaust for restrooms located within the building. Additionally, specialized spaces such as garages and chemical storage, are provided with exhaust via dedicated fans. These specialized spaces include a garage fan for PWC EU Admin (Building 4), a garage fan for PWC Garage (Building 11), and ventilation exhaust fans for PWC Generator Storage (Building 16) and PWC Tire Storage (Building 23).

Building Controls

The building is not currently controlled by a centralized Building Automation System (BAS). All mechanical, electrical, and plumbing systems operate in a standalone fashion. However, many of the DX units have been outfitted with Ecobee smart thermostats. The Ecobee system allows for some monitoring, as well as remote scheduling and setpoint adjustment of the different HVAC systems.

Lighting Systems

Interior lighting throughout the complex is predominantly fluorescent fixtures with some LED fixtures. The restroom lighting is controlled via a mixture of manual wall switches and occupancy sensors.

Domestic Water Fixture (Plumbing) Systems

There are several Electric Water Heaters utilized at the Central Complex. Buildings 1 and 2 (PWC Human Resources and PWC Facilities Maintenance) are served by one water heater each with capacity of 50-gallons and 4500 watts. Building 4 (PWC EU Admin) contains a 30-Gallon, 4500-watt electric water heater. Building 10 and 20 (PWC Utilities and PWC Utilities Maintenance) utilize two separate 82-gallon, 4500-watt water heaters. Building 12 (PWC Streets) has a water heater with a 50-gallon, 4500-watt capacity. Building 15 (Covered Storage) utilizes a 40-gallon water heater that consumes 4936 kWh/yr. Lastly, Building 19 (Pipe Storage) is equipped with a 40-gallon, 4500-watt water heater.

Electrical Systems

There are two (2) known generators onsite. These generators are manufactured by Cummins and are located at Building 12 (PWC Streets) and Building 19 (Pipe Storage).

Key Operating Parameters

The building is currently operated 24/7 due to the nature of the building mission. There are some areas that will experience typical office hours. Of the spaces equipped with smart thermostats, a limited number have been provided with HVAC setbacks to 75F. However, many conditioned spaces throughout the complex are set to 72F at all times.

Site Visit

The site was audited by TLC engineers and 15 Lightyears personnel in January 2023. A full evaluation of existing energy consuming systems, compliant with ASHRAE Standard 211-2019 was performed. During the audit, TLC personnel were escorted by the City of Winter Park facilities manager, Leif Bouffard. He, as well as any facility staff that were available for comment, were questioned on system operation, condition, and maintenance of the building systems.

Utility Analysis

Historical Utility Data

The building is currently provided with electricity and water utilities. Electrical utility consumption and demand values were provided for the months of January 2021 through June 2023. The monthly consumption profile is as expected, where values increase in the warmer months due to cooling needs.

No billing statements were provided, but a blended rate for kWh savings was determined based on published rates. Calculation of the blended utility rate takes into account the non-fixed costs associated with electrical utilities use by the facility, including fuel charges, per-kWh cost, demand charges, etc. Table 3 details the components of the blended rate calculation.

Table 1: Annual Baseline Energy Consumption

Utility	Total
Annual Electrical Consumption (kWh)	726,427
Annual Electrical Cost	-

The following graph and table show the total consumption and demand per monthly billing period for electricity.

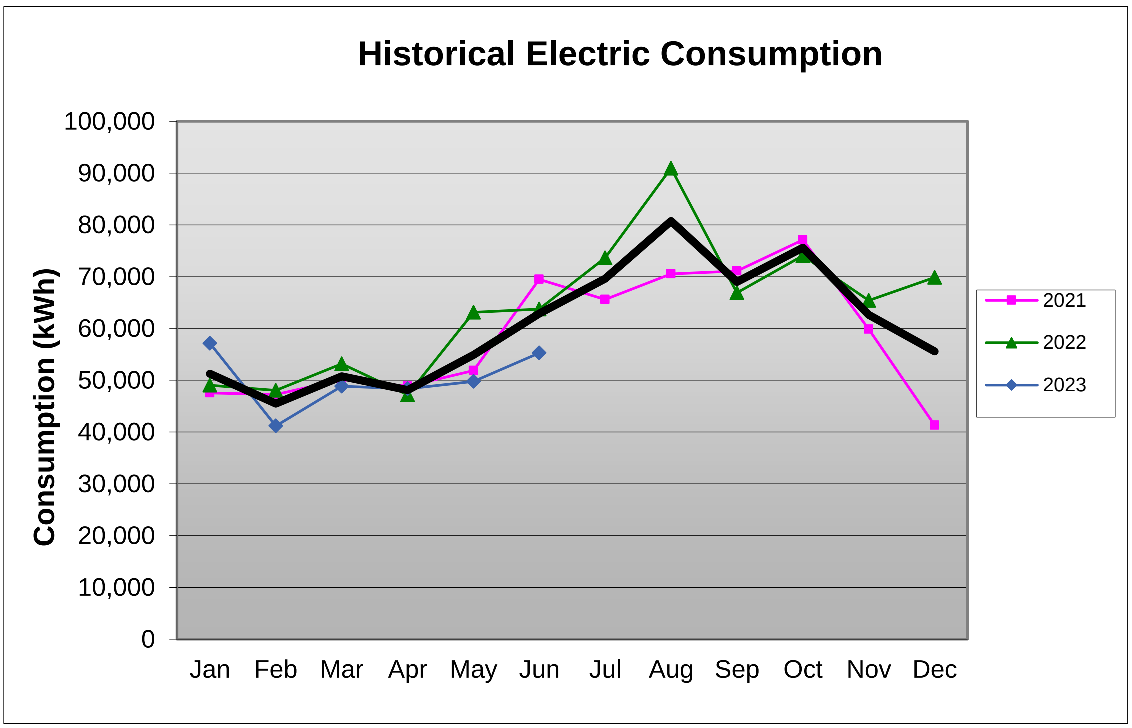


Figure 2: Central Complex Electric Consumption

Table 2: Central Complex Electricity Consumption Data

Date	Consumption (kWh)	Demand (kW)
Jan-21	47,515	321.06
Feb-21	47,234	345.1
Mar-21	50,130	355.78
Apr-21	48,820	320.54
May-21	51,888	333.09
Jun-21	69,488	371.76
Jul-21	65,566	382.07
Aug-21	70,524	187.66
Sep-21	71,117	190.53
Oct-21	77,101	193.72
Nov-21	59,824	178.95
Dec-21	41,325	140.94
Jan-22	49,046	157.16
Feb-22	48,049	184.68
Mar-22	53,194	175.09
Apr-22	47,182	151.74
May-22	63,121	173.72
Jun-22	63,760	189.96
Jul-22	73,612	196.36
Aug-22	78,851	254.342
Sep-22	66,874	192.528
Oct-22	74,054	258.088
Nov-22	57,869	258.402
Dec-22	64,174	194.884
Jan-23	57,127	196.402
Feb-23	41,170	171.008
Mar-23	48,862	201.788
Apr-23	48,336	171.008
May-23	49,742	171.898
Jun-23	55,270	171.898

Benchmarking

TLC compared energy consumption for the site using common benchmarks to gauge how the site compares to similar ones both regionally and nationally, principally through the use of Energy Star Portfolio Manager. The complex's Energy Use Intensity (EUI), which is used by energy engineers to determine overall energy consumption to a common unit of measure, was compared to other similar buildings throughout the United States. The Energy Use Intensity measures annual consumption of electricity per square foot, in kBTU/sf/year.

These benchmarks were developed by the Department of Energy and are based on feedback from building operators all over the country. Using the utility billing information and observing the system operation allows the energy profiles to be broken down to greater detail. The Central Complex was modeled as a mixed-use complex in Portfolio Manager.

The historical energy consumption from the previous 24 months was entered into Portfolio Manager. The chart below compares the Central Complex to the average energy use intensity (EUI) of similar buildings in Energy Star's database.

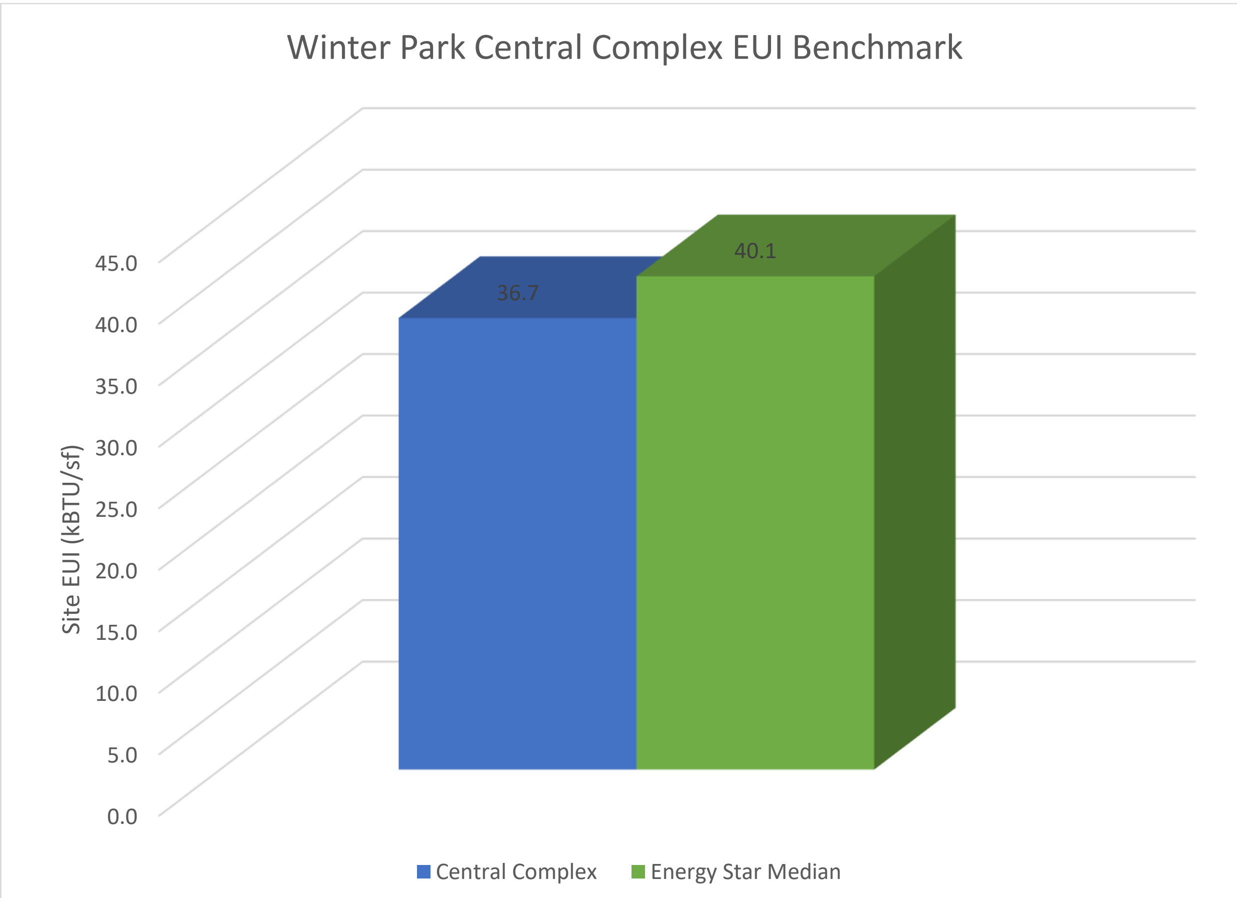


Figure 3: Central Complex Energy Performance Comparison

The site's calculated site energy use intensity – the amount of electricity consumed onsite per square foot of building area – of the Central Complex of 36.7 kBTU per square foot is approximately 8.5 percent lower than the baseline Energy Star comparison value of 40.1 kBTU per square foot.

This measure is based upon the feedback of building owners and operators for the previous year. It is worth noting that the median value reported by Energy Star is dependent on the annual responses from building surveys, and that the occupant load and climate conditions of buildings of the same type can vary significantly, as well as the equipment in use within similar clinics. The energy conservation measures detailed in this report will serve to decrease the EUI of the Central Complex facility through efficiency increases.

Utility Rate Analysis

The building is provided with electricity by the City of Winter Park (CoWP), following their Rate Schedule GSD-1, General Service – Demand. The utility rate charges shown below were used to calculate the costs associated with the provided consumption and demand. Energy savings calculated for this building have been assigned a blended rate of $0.1076/kWh, which is the calculated blended rate not including fixed customer charges.

Table 3: Utility Rate Schedule

Description	Charge
Demand Charge	$5.05 per kW of billing demand
Energy Charge	$0.04216 per kWh
Fuel Cost Recovery Factor	$0.02281 per kWh
Gross Receipts Tax	2.5641%
Franchise Fee	6.00%
Electric Utility Tax	10.00%
EL State Sales Tax (Commercial Only)	7.45% (First $5,000)
EL State Sales Tax (Commercial Only)	6.95% (Over $5,000)

Average Rates

As noted above, a blended cost per kWh has been calculated from the rate schedule. Savings for this building have been calculated using the blended rate. Water rates are based off the utility rate tables from the City of Winter Park under the assumption of a 2” water meter for combined water and sewer under Block 3 pricing. This table outlining the water rates is attached as Appendix D. The following table details the average rate over the period of analysis.

Table 4: Average Utility Rate

Utility	Average
Electricity	$0.1076/kWh
Water	$10.08/kgal

Energy Saving Opportunities

The operation and condition of equipment at the Central Complex was observed to offer a few different avenues for improvement. This is to be expected given the age of the equipment itself and how long it has been in service. Improvements can be made by replacing the aging equipment as well as optimizing the control sequences and settings. The following table summarizes the recommended ECMs for this facility that should be considered for future projects. In addition, the table distinguishes between measures specifically intended to save energy (ECMs) and facility improvement measures (FIM) that benefit the overall operation of the facility but may not provide significant energy savings.

Table 5: ECM/FIM Summary

Energy Savings Measure	FIM/ECM	ECM Category	Annual kGal Savings	Annual kWh Savings	Annual $ Savings	Cost $	Payback (years)
HVAC Controls	ECM	Low Cost	--	4,454	$479	$2,400	5.0
Plumbing Retrofits	ECM	Low Cost	7.7	--	$77	$36	0.5
Exterior Lighting Improvements	ECM	Moderate Cost	--	9,566	$1,029	$7,496	7.3
Interior Lighting Improvements	ECM	Low Cost	--	28,918	$3,112	$2,500	0.8
DX Unit Retrofits	FIM	Capital Improvement	--	--		$52,638	
Envelope Improvements	FIM	Capital Improvement	--	--		$766	
Totals			**7.7**	**42,938**	**$4,620**	**$12,432**	**2.7**

*ROI calculations exclude capital improvement items, as they are intended more for facility improvement than for energy savings.

The cost and paybacks shown in the table above are estimates based on the information gathered during the auditing process. TLC utilized RSMeans 2023, as well as engineering best practices, to estimate the cost of these suggested measures. Final pricing will vary based on contractors' estimation and final equipment selections. Final payback periods are also dependent on contractor pricing and the facility's negotiated utility price.

HVAC Controls Optimization

General Description

The scope for this ECM involves optimizing building HVAC controls through one or multiple controls strategies. For this project, the controls strategy recommended would be occupancy scheduling with setback temperatures.

Consistent occupied and unoccupied temperature settings will be implemented based on the building type and their needs. Occupied schedules for the HVAC controls will be set up to dictate the hours when the buildings are considered occupied versus unoccupied. Whenever a building enters unoccupied mode, the building HVAC controls will utilize the unoccupied settings in lieu of the occupied settings.

Site Specifics

While the complex overall is occupied during business hours Monday to Friday, there are areas that are not occupied fully during regular office hours. These noncritical areas would be optimized with controls schedules based on the hours these areas are typically occupied. HVAC controls will be given setback temperature settings to use during unoccupied conditions. Operating portions of the complex at setback temperatures will result in energy savings due to the HVAC systems not having to work as hard to condition these areas when unoccupied.

Interior Lighting Improvements

General Description

This measure involves converting older style lighting fixtures, such as fluorescent and incandescent, to modern LED lighting fixtures and lamps. Unless a building has been built or renovated in the past few years, it is common to find extensive use of fluorescent and incandescent fixtures throughout the building. Fluorescent and incandescent lighting technologies are a product of their time and often remain without intentional replacement. Older lighting technologies require more wattage to produce the same amount of light as LED fixtures. This also results in a higher heat output from the lamps which raises HVAC cooling costs.

Existing fluorescent and incandescent lighting fixtures will be replaced/retrofitted with new LED lighting fixtures. This will greatly reduce the energy required to illuminate the building. Additionally, cooling systems will have to run less often to offset the heat generated by the lighting. There are several additional benefits to LED lighting technology. LED lighting has longer burn hour life, faster on/off response time, and easier dimming capabilities compared to fluorescent and incandescent technologies. Because LED light fixtures have longer burn hour life, this will reduce the material and time cost of replacing burned out lamps.

Site Specifics

The facility was observed to have predominantly linear fluorescent fixtures with T8 lamps. Existing non-LED lighting will be replaced with new LED lighting on a one-for-one basis. Existing lighting material waste will be disposed of according to local regulations.

Exterior Lighting Improvements

General Description

This measure involves converting older style exterior lighting fixtures, such as metal halides, and CFLs to modern LED lighting fixtures and lamps. Unless a building has been built or renovated in the past few years, metal halides are common to find for exterior fixtures and highbay fixtures in large assembly spaces. Metal Halide lighting fixtures are a product of their time and often remain without intentional replacement. Older lighting technologies require more wattage to produce the same amount of light as LED fixtures.

Existing metal halide lighting fixtures will be replaced/retrofitted with new LED lighting fixtures. This will greatly reduce the energy required to illuminate the exterior of the building. There are several additional benefits to LED lighting technology. LED lighting has longer burn hour life, faster on/off response time, and easier dimming capabilities compared to metal halides. Because LED light fixtures have longer burn hour life, this will reduce the material and time cost of replacing burned out lamps.

Site Specifics

The facility was observed to have metal halide fixtures for its exterior lights. Existing non-LED lighting will be replaced with new LED lighting on a one-for-one basis. Existing lighting material waste will be disposed of according to local regulations.

Plumbing Retrofit

This measure involves replacing older style plumbing fixtures that consume a large amount of water in comparison to modern low-flow fixtures. Unless a building has been built or renovated with low water consumption in mind, it is not uncommon to see standard plumbing fixtures with a higher water consumption than necessary.

Existing high-usage plumbing fixtures will be replaced or retrofitted with low-flow, low water consumption fixtures. This will greatly reduce the water required to operate these fixtures without impacting the usefulness they provide to the building occupants as well as slightly reduce the amount of hot water used in the building.

Site Specifics

The sink faucets in the facility are standard flow rated fixtures. Adding low flow aerators on sink faucets will reduce the gallons per minute flow rate in order to save water. Additionally, energy savings should also be produced in addition to these savings by using less hot water for the sinks.

Facility Improvement Measures

TLC identified additional Facility Improvement Measures (FIM) that do not provide energy savings but should be addressed. By implementing the recommended FIM, the facility will experience improved equipment reliability, increased thermal comfort for occupants, and be able to operate as originally designed. While it is possible that these measures may decrease energy consumption, this has not been quantified as their purpose is focused on performance and reliability.

DX Unit Retrofit

General Description

This measure proposes replacing existing DX split system equipment, which is at or nearing the end of its predicted useful life. Direct expansion (DX) air conditioning equipment consists of a refrigerant loop, in which the refrigerant is compressed and expanded at different points of the loop to transfer thermal energy. Typically, a refrigerant coil is placed directly in the supply air stream, where the refrigerant absorbs thermal energy as it evaporates and expands. Thermal energy is rejected at a compressor, where the refrigerant is compressed and condenses, rejecting the heat that was removed from the supply air steam.

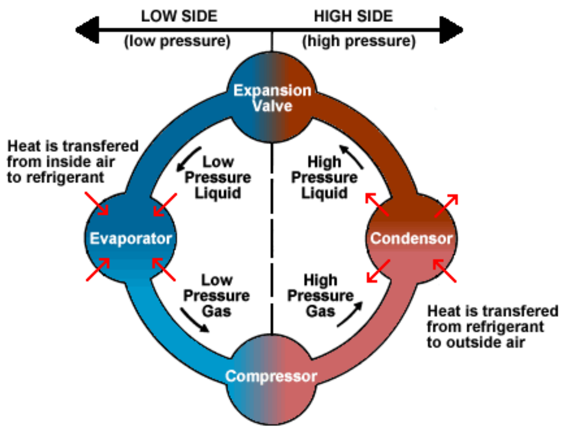


Figure 4: The Refrigeration Cycle

Over time, HVAC units degrade in operational efficiency as coil surfaces oxidize on the exterior and sometimes scale on the interior which reduces heat transfer efficiency. The moving mechanical components also wear, which further reduces the operational efficiency of the equipment. The new equipment will be installed in place of the existing equipment, including providing new refrigerant line sets for all split systems.

Advances in technology and improvements necessitated by energy code updates have led to DX equipment available today with far higher efficiencies than what was used in the past. Replacing the existing systems with new higher efficiency systems will reduce energy consumption and provide improved occupant comfort.

Site Specifics

There were several carrier split system units observed to be nearing the end of their expected useful life and in need of replacement. These systems also use a type of refrigerant that is no longer in production, which may make the cost of repair very high. This measure proposes to replace the existing split systems with like-for-like replacements. As stated above, the newer systems will be more efficient than the existing systems and will result in slight energy savings.

Envelope Improvements

General Description

This measure involves removing instances of building envelope penetrations that can lead to unwanted infiltration of outdoor air into conditioned spaces. During the Summer month, infiltration can introduce humid or warm outdoor air as well as leak conditioned air to the outdoors, which can increase cooling loads and decrease the efficiency of air conditioning equipment.

Site Specifics

During the site walkthrough of the utilities maintenance building, it was observed that one or more wall-mounted exhaust fans were no longer in operation. The dampers associated with these exhaust fans appeared to have noticeable gaps when fully closed. This measure proposes to remove the exhaust fans that are no longer in use and close the walls were they were installed in order to prevent the infiltration of unwanted outdoor air.

Calculation Methodology – Spreadsheet System Models

Savings for this report were evaluated using spreadsheet building models for the lighting and HVAC systems. The methodologies used for each measure are described separately in this section. Industry Standard methods of evaluation were used and are detailed in this section. Additionally, assumptions made to calculate the energy savings are detailed.

HVAC Controls Optimization

Savings for this measure have been based on a reduction in cooling energy due to setting back non-critical portions of the complex that are not always occupied. The following table shows the major inputs used in the calculation of savings for this measure.

Table 6: Controls Optimization Major Inputs

Input Name	Bldg./Area Affected	Input Value	Basis of Input
% Cooling Energy Reduction	Utilities Maintenance	1%	Engineering judgment
% Cooling Energy Reduction	Garage Building	1%	Engineering judgment
% Cooling Energy Reduction	Streets Building	1%	Engineering judgment

Calculations:

Savings for this measure were based on calculating the annual cooling energy and saving a percentage of it. The existing annual cooling energy was calculated from the electric utility baseline as the sum of all the electrical consumption for each month exceeding the lowest month's consumption. The following formula was used to calculate existing annual cooling energy.

$$Existing\ Cooling\ kWh = Annual\ Total\ kWh - (12 \times Baseload\ Month\ kWh)$$

Plumbing Retrofits

Savings for this measure are based on a reduction in the water consumption by the replacement of sinks with more efficient fixtures with lower gallons per minute flow rate. The following table shows the major inputs used in the calculation of savings for this measure.

Table 7: Plumbing Retrofits Major Inputs

Input Name	Bldg./Area Affected	Input Value	Basis of Input
Number of people	Entire building	10	Engineering judgement
Minutes of sink use/person/day	Entire building	1.5	Engineering judgement
Existing Sink Flow Rate	Entire building	2.0 GPM	Engineering judgement
Proposed Sink Flow Rate	Entire building	0.5 GPM	Engineering judgement

Calculations:

Savings for this measure were comprised of water savings. The water savings were the difference in the existing and proposed annual water consumption based on assumed annual usage and flow rate of the fixture in GPM (gallons per minute). The water usage for existing and proposed fixtures were calculated using the following formulas for sinks.

$$Water\ Usage = Number\ of\ people \times GPM \times Minutes\ of\ use\ per\ day \times 365\ days/year$$

Interior Lighting Improvements

Savings for this measure have been based on a reduction in the lighting energy based on a reduction in lighting installed wattage. The following table shows the major inputs used in the calculation of savings for this measure.

Table 8: Lighting Improvements Major Inputs

Input Name	Bldg./Area Affected	Input Value	Basis of Input
Building Area	Building 1	2,961 sf	Provided value
Existing Lighting Power Density	Building 1	1.0 W/sf	Typical value for T8 lamps throughout
Proposed Lighting Power Density	Building 1	0.6 W/sf	Typical value for LED lamps throughout
Annual Burn Hours	Building 1	2,340	Building schedule
Building Area	Building 3	253 sf	Provided value
Existing Lighting Power Density	Building 3	1.0 W/sf	Typical value for T8 lamps throughout
Proposed Lighting Power Density	Building 3	0.6 W/sf	Typical value for LED lamps throughout
Annual Burn Hours	Building 3	730	Building schedule
Building Area	Building 4	1,550 sf	Provided value
Existing Lighting Power Density	Building 4	1.0 W/sf	Typical value for T8 lamps throughout
Proposed Lighting Power Density	Building 4	0.6 W/sf	Typical value for LED lamps throughout
Annual Burn Hours	Building 4	2,340	Building schedule
Building Area	Building 10	16,400 sf	Provided value
Existing Lighting Power Density	Building 10	0.76 W/sf	Typical value for T8 lamps throughout
Proposed Lighting Power Density	Building 10	0.6 W/sf	Typical value for LED lamps throughout
Annual Burn Hours	Building 10	2,340	Building schedule
Building Area	Building 11	9,000 sf	Provided value
Existing Lighting Power Density	Building 11	0.8 W/sf	Typical value for T8 lamps throughout
Proposed Lighting Power Density	Building 11	0.6 W/sf	Typical value for LED lamps throughout
Annual Burn Hours	Building 11	6,205	Building schedule
Building Area	Building 12	4,100 sf	Provided value
Existing Lighting Power Density	Building 12	1.0 W/sf	Typical value for T8 lamps throughout

Input Name	Bldg./Area Affected	Input Value	Basis of Input
Proposed Lighting Power Density	Building 12	0.6 W/sf	Typical value for LED lamps throughout
Annual Burn Hours	Building 12	3,640	Building schedule
Building Area	Building 16	4,000 sf	Provided value
Existing Lighting Power Density	Building 16	1.0 W/sf	Typical value for T8 lamps throughout
Proposed Lighting Power Density	Building 16	0.6 W/sf	Typical value for LED lamps throughout
Annual Burn Hours	Building 16	2,920	Building schedule
Building Area	Building 23	600 sf	Provided value
Existing Lighting Power Density	Building 23	1.0 W/sf	Typical value for T8 lamps throughout
Proposed Lighting Power Density	Building 23	0.6 W/sf	Typical value for LED lamps throughout
Annual Burn Hours	Building 23	730	Building schedule

Calculations:

Savings for this measure were comprised of energy savings. The energy savings were the difference in the existing and proposed kWh for all the lighting fixtures in the building. The energy usage in kWh for the building was calculated using the following formula.

$$Energy\ Usage = \frac{Building\ Area \times LPD \times Hours}{1{,}000}$$

Exterior Lighting Improvements

Savings for this measure have been based on a reduction in the lighting energy based on a reduction in lighting installed wattage. The following table shows the major inputs used in the calculation of savings for this measure.

Table 9: Exterior Lighting Improvements Major Inputs

Input Name	Bldg./Area Affected	Input Value	Basis of Input
Quantity of Fixtures	Building 4	4	Existing quantity of fixtures
Existing Fixture Wattage	Building 4	100 W	Typical value for existing fixtures
Proposed Fixture Wattage	Building 4	27 W	Typical value for exterior LED fixtures
Existing Annual Burn Hours	Building 4	8,760	Building schedule
Proposed Annual Burn Hours	Building 4	4,380	Estimated Value
Quantity of Fixtures	Building 10	12	Existing quantity of fixtures
Existing Fixture Wattage	Building 10	100 W	Typical value for Metal Halide fixtures
Proposed Fixture Wattage	Building 10	27 W	Typical value for exterior LED fixtures

Input Name	Bldg./Area Affected	Input Value	Basis of Input
Annual Burn Hours	Building 10	4,380	Building schedule
Quantity of Fixtures	Building 22	32	Existing quantity of fixtures
Fixture Wattage	Building 22	18 W	Typical value for existing fixtures
Existing Annual Burn Hours	Building 22	8,760	Building schedule
Proposed Annual Burn Hours	Building 22	4,380	Estimated Value
Quantity of Fixtures	Pump Control	4	Existing quantity of fixtures
Existing Fixture Wattage	Pump Control	23 W	Typical value for Metal Halide fixtures
Proposed Fixture Wattage	Pump Control	13 W	Typical value for exterior LED fixtures
Annual Burn Hours	Pump Control	4,380	Building schedule

Calculations:

Savings for this measure were comprised of energy savings. The energy savings were the difference in the existing and proposed kWh for all the lighting fixtures in the building. The energy usage in kWh for the building was calculated using the following formula.

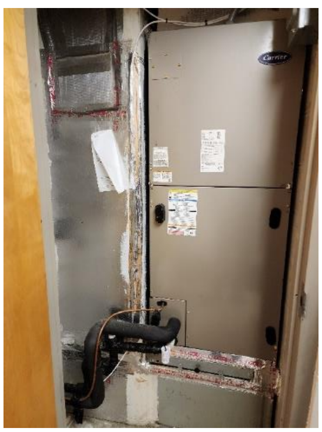
$$Energy\ Usage = \frac{Quantity\ of\ Fixtures \times Fixture\ Wattage \times Hours}{1{,}000}$$

Appendix A – Mechanical Equipment

The following table shows a listing of all recorded major equipment in the building.

Building - Central Complex	Type	Equip	Location Served	Tag	Qty	Capacity	Units	Make	Model	Serial Number	Year
B1/B2	AHU	Air Handling Unit			1	3/4	HP	Carrier	FE4ANB006	1021F06928	2021
B1/B2	AHU	Air Handling Unit			1	3/4	HP	Goodman	ARUF60D14AC	1501045102	2015
B1/B2	CU	Condensing Unit			1	5.0	Ton	Carrier	25VNA860A300	1221E10284	2021
B1/B2	CU	Condensing Unit			1	2.0	Ton	Daikin	RKB24AXVJU	K002135	2019
B1/B2	CU	Condensing Unit			1	5.1	Ton	Goodman	GSX130611AB	1409353423	2014
B1/B2	EWH	Electric Water Heater - 50 Gallon			1	4500.0	Watt	Rheem	PROPE50 T2 RH92 CS	Q052122174	2021
B1/B2	FCU	Fan Coil Unit			1		HP	Daikin	FTKB24AXVJU	K003037	2019
B3	AHU/CU	Window Air Conditioner			1			Midea			
B4	CU	Condensing Unit			1	1.5	Ton	Goodman	GSX140181LC	1812108133	2018
B4	EF	Garage Exhaust Fan			1		HP				
B4	EWH	Electric Water Heater - 30 Gallon			1	4500.0	Watt	Rheem	81MV30DT A	1199B19852	1999
B4	AHU	Air Handling Unit			1	1/3	HP	Goodman	ARUF25B14AC	1901279780	2019
B10/B20/B22	CU	Condensing Unit			1	2.5	Ton	Carrier	38YCC030-3	2001E34867	2001
B10/B20/B22	CU	Condensing Unit			1		Ton	Goodman			
B10/B20/B22	CU	Condensing Unit		#3	1	2.0	Ton	Carrier	38YCC024300	1301E24344	2001
B10/B20/B22	CU	Condensing Unit		#4	1	3.0	Ton	Carrier	PA10JA036-C	3904E30592	2004
B10/B20/B22	CU	Condensing Unit		#5	1	3.0	Ton	Carrier	38YCC036300	1501E20028	2001
B10/B20/B22	CU	Condensing Unit			1	2.0	Ton	Goodman	GSZ140241KH	1910279165	2019
B10/B20/B22	CU	Condensing Unit			1	1.0	Ton	Mitsubishi Electric	MUY-GL12NA	69C06555	
B10/B20/B22	CU	Condensing Unit			1	3.5	Ton	Nordyne	JT5BD 042K	JTF101000077	2010
B10/B20/B22	CU	Condensing Unit			1	3.0	Ton	Goodman	GSX130361EB	1407194105	2014
B10/B20/B22	CU	Condensing Unit			1	4.0	Ton	Goodman	GSZ140481KF	1908708907	2019
B10/B20/B22	CH	Air-Cooled Chiller			1	30.0	Ton	AAON	CFA-030-C-A-8-DC00K	02101-CNCS089(	2021
B10/B20/B22	CU	Condensing Unit			1	4.0	Ton	Daikin	DZ14SN0481AE	2011696701	2020
B10/B20/B22	CU	Condensing Unit			1	5.0	Ton	Goodman	GSX140601KE	2202083630	2022
B10/B20/B22	CU	Condensing Unit			1	5.0	Ton	Goodman	GSZ140801KE		
B10/B20/B22	AHU	Air Handling Unit			1	1/2	HP	Carrier	FB4ANF042	2001A62527	2001
B10/B20/B22	AHU	Air Handling Unit			1	1/3	HP	Goodman	ARUF36C14BC	1406402693	2014
B10/B20/B22	AHU	Air Handling Unit			1	1/2	HP	Goodman	ARUF46D14AG	1908009471	2019
B10/B20/B22	CH	Indoor Air Handling Unit			1	7.6	HP	AAON	V3-DLB-8-0-162C-3ES	02101-CJED0636	2021
B10/B20/B22	AHU	Air Handling Unit			1	1.0	HP	Goodman	ASPT		
B10/B20/B22	AHU	Air Handling Unit		A/C #3	1	1/4	HP	Carrier	FB4ANF024	1801A74404	2001
B10/B20/B22	EWH	Electric Water Heater - 82 Gallon		#1	1	4500.0	Watt	State	S868227SFEX	X01307416	
B10/B20/B22	EWH	Electric Water Heater		#2	1	4500.0	Watt	State	S868227SFEX		
B10/B20/B22	AHU	Air Handling Unit			1	1/2	HP	Goodman	ARUF49D14AD	2106689149	2021
B10/B20/B22	AHU	Air Handling Unit		A/C #4	1	1/3	HP	Carrier	FB4ANF036	2001A63159	2001
B10/B20/B22	AHU	Air Handling Unit			1	1.0	HP	Goodman	ASPT61D14AC	1907253709	2019
B11	UH	Unit Heater			2			Dayton			
B11	AHU	Air Handling Unit		#2	1	1/4	HP	Carrier	FB4ANF024	1901A74376	2001
B11	AHU	Air Handling Unit		#3	1	1/3	HP	Carrier	FB4ANF030	2001A58096	2001
B11	AHU	Air Handling Unit			1		HP	Addison			
B11	AHU	Air Handling Unit			1	1.0	HP	Goodman	ASPT59C14AC	1908676665	2019
B11	AHU	Air Handling Unit		AHU-5	1	3/4	HP	Carrier	FB4ANK060	1501A66973	2001
B11	GEF	Garage Exhaust Fan			1		HP				
B11	CU	Condensing Unit			1	5.0	Ton	Carrier	38YCC060300	4101E01422	2001
B11	CU	Condensing Unit			1		Ton	Carrier			
B11	CU	Condensing Unit			1	2.5	Ton	Goodman	GSC130301EB	1208657089	2012
B11	CU	Condensing Unit			1	2.0	Ton	Carrier	38YCC024300	4101E13888	2001
B11	CU	Condensing Unit			1	4.0	Ton	Goodman	GSX140481KD	1901070286	2019
B12	EWH	Electric Water Heater - 50 Gallon			1	4500.0	Watt	Rheem	XE50M06ST45U1	Q051707573	2017
B12	AHU	Air Handling Unit		AHU #1	1	1.0	HP	Goodman	ASPT60D14AC	1504245229	2015
B12	AHU	Air Handling Unit			1	1/2	HP	Goodman	ARUF48D14AB	1311397080	2013
B12	AHU	Air Handling Unit			1	1/2	HP	Addison	VCA071C03E	10401904001	2001
B12	CU	Condensing Unit			1	4.0	Ton	Goodman	GSX130481BC	1307287907	2013
B12	CU	Condensing Unit			1	5.0	Ton	Goodman	GSX140601KD	1910101180	2019
B12	CU	Condensing Unit			1	5.0	Ton	Addison	RCA071003E		2001
B12	G	Generator			1			Cummins			
B15	EWH	Electric Water Heater - 40 Gallon			1	4936.0	kWh/yr	Ruud	PES40-2T	0401C06094	2001
B16/B18	EF	Exhaust Fan					HP				
B19	G	Generator			1			Cummins			
B19	CU	Condensing Unit			1	5.0	Ton	Goodman	GSX140601KD	2001062973	2020
B19	EWH	Electric Water Heater - 40 Gallon			1	4500.0	Watt	Rheem	PROE40 T2 RH95	Q041621742	2016
B19	AHU	Air Handling Unit			1	1	HP	Goodman	AVPTC60D14AD	1510097813	2015
B23	EF	Exhaust Fan					HP				
Existing BLDG	CU	Condensing Unit			1	2.0	Ton	Daikin	RKB24AXVJU	K003257	2019
Existing BLDG	FCU	Fan Coil Unit			1		HP	Daikin	FTKB24AXVJU		2020

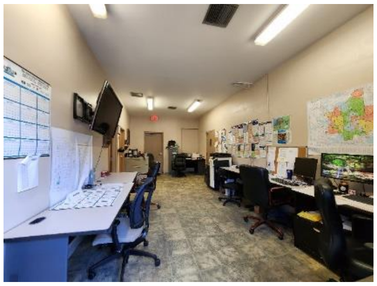
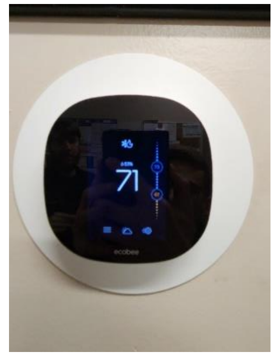
Appendix B – Site Walkthrough Photos

<table>
<tr><td colspan="2">Building 1 & Building 2 (PWC Human Resources & PWC Facilities Maintenance)</td></tr>
<tr><td>
C1: Condensing Unit</td><td>
C2: Interior Lighting</td></tr>
<tr><td>
C3: Air Handling Unit</td><td>
C4: Fan Coil Unit</td></tr>
</table>

 C5: Electric Water Heater	 C6: Air Handling Unit
Building 3 (PWC CDL)	
 C7: Window Unit	 C8: Exterior of Building

<table>
<tr><td>
C9: Exterior Lighting</td><td>
C10: Interior Lighting</td></tr>
<tr><td colspan="2">Building 4 (PWC EU Admin)</td></tr>
<tr><td>
C11: Exterior of Building</td><td>

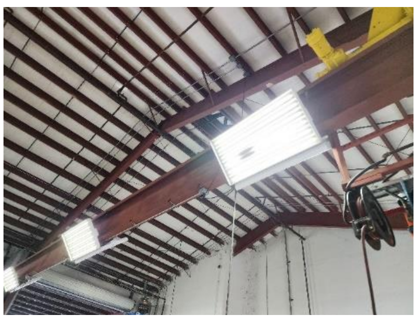
C12: Condensing Unit</td></tr>
</table>

 C13: Office Space	 C14: Smart Thermostat
 C15: Electric Water Heater	 C16: Air Handling Unit
Building 10 (PWC Utilities), Building 20 (PWC Utilities Maintenance), & Building 22 (PWC Utilities Storage)	
 C17: Condensing Units	 C18: Air Cooled Chiller

C19: Air Handling Units

C20: Electric Water Heaters

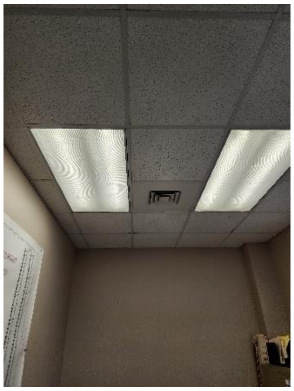
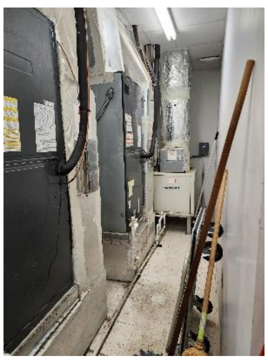
Building 11 (PWC Garage)



C21: Interior Lighting

C22: Unit Heater

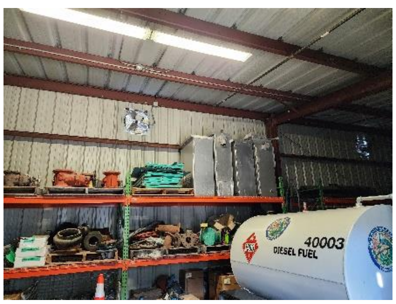
 C23: Air Handling Unit	 C24: Air Handling Unit
 C25: Condensing Units	
Building 12 (PWC Streets)	

 C26: Interior Lighting	 C27: Electric Water Heater and Air Handling Unit
 C28: Air Handling Units	 C29: Condensing Units
Building 15 (PWC Covered Storage)	

C30: Covered Storage Building

C31: Electric Water Heater

Building 16 (PWC Trailer Storage) & Building 18 (PWC Generator Storage)



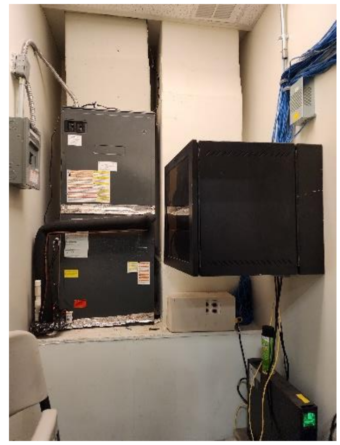
C32: Interior Lighting and Ventilation Exhaust Fan

Building 19 (Pipe Storage)

C33: Condensing Unit

C34: Electric Water Heater

C35: Interior Lighting



C36: Air Handling Unit

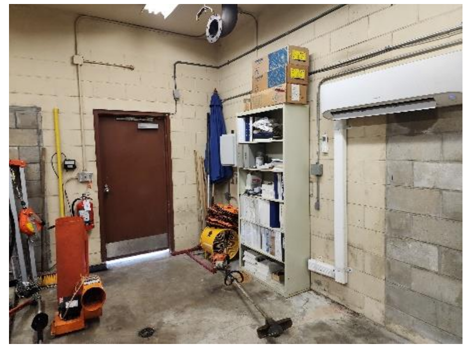
Building 23 (PWC Tire Storage)

C37: Interior Lighting

C38: Storage Exhaust Fan

Existing Building (located South of Building 20; PWC Utilities Maintenance)

C39: Condensing Unit



C40: Fan Coil Unit

Appendix C – Water Rates for City of Winter Park

COUNTY
WATER & SEWER (COMMERCIAL & PUBLIC AUTHORITY)

Effective 10/01/2022

DEPOSIT REQUIREMENTS

	3/4" Mtr	1" Mtr	1 1/2" Mtr	2" Mtr	3" Mtr	4" Mtr	6" Mtr	8" Mtr	10" Mtr
Water Service	75.00	100.00	130.00	165.00	270.00	375.00	690.00	Avg x 3	Avg x 3
Water & Sewer Service	145.00	165.00	195.00	570.00	675.00	780.00	1,140.00	Avg x 3	Avg x 3

WATER RATES

Meter Size	Availability (Base)	Block 1 (1,000 gallons)	Block 1 ($$ per 1,000)	Block 2 (1,000 gallons)	Block 2 ($$ per 1,000)	Block 3 (1,000 gallons)	Block 3 ($$ per 1,000)	Block 4 (1,000 gallons)	Block 4 ($$ per 1,000)	Block 5 (1,000 gallons)	Block 5 ($$ per 1,000)
3/4"	11.87	(4) 1 to 4	1.68	(4) 5 to 8	2.48	(4) 9 to 12	3.55	(8) 13 to 20	4.72	21 & Greater	6.07
1"	29.70	(10) 1 to 10	1.68	(10) 11 to 20	2.48	(10) 21 o 30	3.55	(20) 31 to 50	4.72	51 & Greater	6.07
1 1/2"	59.39	(20) 1 to 20	1.68	(20) 21 to 40	2.48	(20) 41 to 60	3.55	(40) 61 to 100	4.72	101 & Greater	6.07
2"	95.03	(32) 1 to 32	1.68	(32) 33 to 64	2.48	(32) 65 to 96	3.55	(64) 97 to 160	4.72	161 & Greater	6.07
3"	190.05	(64) 1 to 64	1.68	(64) 65 to 128	2.48	(64) 129 to 192	3.55	(128) 193 to 320	4.72	321 & Greater	6.07
4"	296.96	(100) 1 to 100	1.68	(100) 101 to 200	2.48	(100) 201 to 300	3.55	(200) 301 to 500	4.72	501 & Greater	6.07
6"	593.91	(200) 1 to 200	1.68	(200) 201 to 400	2.48	(200) 401 to 600	3.55	(400) 601 to 1,000	4.72	1,001 & Greater	6.07
8"	950.24	(320) 1 to 320	1.68	(320) 321 to 640	2.48	(320) 641 to 960	3.55	(640) 961 to 1,600	4.72	1,601 & Greater	6.07
10"	1,365.98	(460) 1 to 460	1.68	(460) 461 to 920	2.48	(460) 921 to 1,380	3.55	(920) 1,381 to 2,300	4.72	2,301 & Greater	6.07

SEWER RATES

	Availability Charge (Base)		3/4" Mtr	1" Mtr	1 1/2" Mtr	2" Mtr	3" Mtr	4" Mtr	6" Mtr	8" Mtr	10" Mtr
			14.03	35.07	70.14	112.21	224.43	350.67	701.33	1,122.13	1,613.08
	(1,000 gallons)	($$ per 1,000)	(Base + Cons)	(Base + Cons)	(Base + Cons)	(Base + Cons)	(Base + Cons)	(Base + Cons)	(Base + Cons)	(Base + Cons)	(Base + Cons)
6.53	1	6.53	20.56	41.60	76.67	118.74	230.96	357.20	707.86	1,128.66	1,619.61
	2	13.06	27.09	48.13	83.20	125.27	237.49	363.73	714.39	1,135.19	1,626.14
	3	19.59	33.62	54.66	89.73	131.80	244.02	370.26	720.92	1,141.72	1,632.67
	4	26.12	40.15	61.19	96.26	138.33	250.55	376.79	727.45	1,148.25	1,639.20
	5	32.65	46.68	67.72	102.79	144.86	257.08	383.32	733.98	1,154.78	1,645.73
	6	39.18	53.21	74.25	109.32	151.39	263.61	389.85	740.51	1,161.31	1,652.26
	7	45.71	59.74	80.78	115.85	157.92	270.14	396.38	747.04	1,167.84	1,658.79
	8	52.24	66.27	87.31	122.38	164.45	276.67	402.91	753.57	1,174.37	1,665.32
	9	58.77	72.80	93.84	128.91	170.98	283.20	409.44	760.10	1,180.90	1,671.85
	10	65.30	79.33	100.37	135.44	177.51	289.73	415.97	766.63	1,187.43	1,678.38
	11	71.83	85.86	106.90	141.97	184.04	296.26	422.50	773.16	1,193.96	1,684.91
	12	78.36	92.39	113.43	148.50	190.57	302.79	429.03	779.69	1,200.49	1,691.44