Sunnyvale Civic Center

MEP Facilities Assessment Report

June 26, 2017

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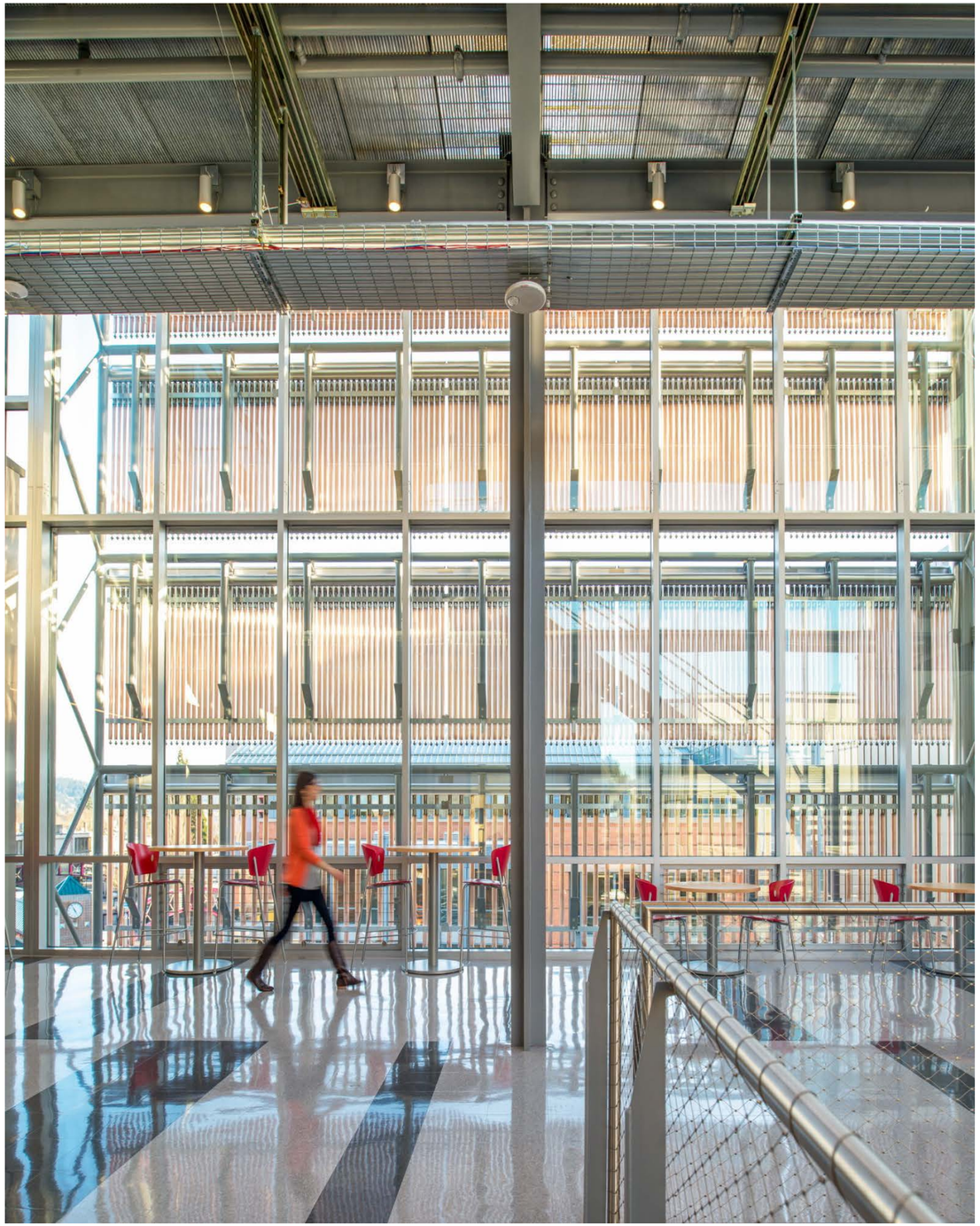

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Executive Summary

This document is a Facility conditions assessment report of MEP systems conducted by PAE Consulting Engineers for the Sunnyvale Civic Center as part of the ongoing masterplan effort to modernize it. This report covers the Civic Center buildings outlined on the table below. Note that PAE has not visited all buildings within the Sunnyvale Civic Center. The only buildings visited and assessed by PAE within this report are the Annex Building and the Public Safety buildings, other buildings are included here for completeness and because there will eventually be work within them as projected in the masterplan.

Table 1: Sunnyvale Civic Center Buildings, occupied area, and Masterplan Phasing

Sunnyvale Civic Center	Existing Area (SF)	New Masterplan Area (SF)
City Hall	Not in scope	N/A
South Annex	Not in scope	N/A
City Hall Annex (NOVA)	15,000	19,000
Public Safety	45,000	57,000
Library	Not in scope	N/A
Office Center	Not in scope	N/A

Each building's assessment is provided and summarized in a one to two page section that provides the pertinent information about MEP system conditions, and includes re-usability ratings for Fire Protection, Plumbing, Mechanical, and Electrical systems for each building. The intention of this facilities condition assessment is to assist the project team and Cost Estimating Consultant in deciding which buildings should be replaced or repaired, and to provide a relative indication of what the replacement cost of MEP systems is. The relative replacement cost assessment is provided in a 1 through 4 rating for each of the MEP systems with each number rating representing a range in cost replacement relative to a brand new system being provided. The actual cost of replacement will be provided by the project cost estimating consultant.

Section 1.0 of this report provide a high level MEP one-page assessment summary as described above and intended to be used by the project Cost Estimating Consultant. Sections 2.0 and 3.0 provide a more detailed description of the conditions of existing MEP equipment for the buildings evaluated. Section 4.0 provides descriptions of the MEP upgrade recommendations required in each building to support the architectural and program revisions.

In general, the areas being renovated will require new MEP systems to support the renovation work. In general the existing MEP systems at a building level can support the renovation work as a "Tenant Improvement" project limited to the areas being renovated given the temporary nature of these upgrades.

Figure 1: Sunnyvale Civic Center

Sample One Page Facility Assessments

How to Read the Assessment Tables

This page shows a sample or example building assessment page that has not been filled out. The information on this page contains assessment information provided for each building. The assessment lists general building information and a variety of building elements that fall under different engineering disciplines (Fire Protection, Plumbing, HVAC, and Electrical). Each building element condition is rated on a scale from 1 to 4, with a score legend provided below. The table titled Overall Summary shows an average of these scores, and is meant to assist the assessment team, including Cost Consultant and Owner, in using this information to decide what to do with each of the existing buildings.

The following sections and pages provide this summarized assessment information for buildings in all the campuses.

General	
Building Name	Building name
Building Area (Sq. Ft.)	Building area
Year Built	Year bldg was built
Last Year Modified (MEP equipment replaced)	Year of latest renovation
Number of Floors	bldg number of floors
Building Program	Classroom, Office, Lab

Overall Summary	
Fire Protection Score	(1-4)
Plumbing Score	(1-4)
Mechanical Score	(1-4)
Electrical Score	(1-4)

Score Legend
1 = Unacceptable condition. Assume 100% replacement/cost needed.
2 = Poor condition. Assume 50% to 60% replacement/cost needed.
3 = Fair condition. Assume 20% to 30% replacement/cost needed.
4 = Good condition. Assume 0% to 10% replacement/cost needed.

Fire Protection	**Score (1-4)**	**Notes (Items Reviewed)**
Fire Pump		Fire pump and fire pump control panel
Sprinkler System		Fire protection pipe, valves, and sprinkler heads
Specialized Sprinkler System		Pre-action, dry-pipe, and gaseous systems
Testing Recommended		Flow testing

Plumbing System	**Score (1-4)**	**Notes (Items Reviewed)**
Gas system		Utility meter, valves, and piping
Cold/Potable Water		Reduced pressure backflow preventer, other valves, booster pumps, Piping
Hot Water		Hot water generation, mixing valves, recirculation pumps, and piping
Fixtures		Water closets, urinals, lavs, kitchen sinks, low flow?
Sewer, Waste, and Vent Systems		Piping, grease separators, oil interceptors
Storm system		Roof receptors, gutters, and downspouts
Insulation		Pipe insulation
Lab systems		Natural gas, CDA, VAC, and other gases
Miscellaneous		Solar thermal arrays, rainwater harvesting, and water recycling systems
Testing Recommended		Pipe video, pipe cleaning, pressure testing, water balancing

HVAC	**Score (1-4)**	**Notes (Items Reviewed)**
Chilled Water Systems		Cooling towers, chillers, pumps, piping, and valves
Heating Hot water systems		Boilers, pumps, piping, and valves
Air handling equipment		Rooftop AHU's, Rooftop DX systems, supply fans
Filtration Level		MERV 8, 13 Air Filters
Exhaust Systems		Exhaust systems for restroom, general, kitchen, labs
Decentralized systems		Split DX Ac's, VRF systems, unit heaters, furnaces
Ductwork		Ductwork, silencers, VAV terminals
Insulation		Pipe insulation
Controls		HVAC controls, %OA, CO2, lighting, sub-metering, dashboards
Miscellaneous		Geothermal heat exchange, heat recovery, fume hoods
Testing Recommended		TAB, pipe pressure testing, refrigerant charge

Electrical	**Score (1-4)**	**Notes (Items Reviewed)**
Site Electrical		12kV, underground, aboveground/pad-mounted transformers
Power Systems		Switchboard, panelboards, metering
Distribution		Conduit, wiring, supports and seismic bracing
Devices		Receptacles
Demand Response Capable?		Y/N
Lighting		Lighting Fixtures Types (T8, T12,LED)
Lighting Controls		Lighting control system, sensors, daylighting and switches
Fire Alarm		FACP – type and manufacturer, devices
Emergency and Backup Systems		Generator, ATS, emergency switchboard UPS, batteries
Miscellaneous		PV, EV chargers, lightning protection
Testing Recommended		Infra-red testing, arc flash ratings/study, grounding testing

1.0 MEP Assessment Summary

1.1 City Hall Annex (NOVA) Assessment Summary

The existing HVAC systems at level 1 were mostly re-used in the 2003 renovation and are therefore too old for this upgrade project. While the central chiller, boiler and associated pumps, and most distribution piping can be re-used; level 1 Air Handling Units (AHU's), fans, zone terminals, coils, ductwork, and controls are all to be replaced.

The existing plumbing fixtures and valves in restrooms on level 1 (within scope of renovation) are to be replaced to meet new code water efficiency requirements.

The existing electrical systems…

General	
Building Name	City Hall Annex
Building Area (Sq. Ft.)	15,500 (Level 1 renovations)
Year Built	Circa 1984
Last Year Modified (MEP equipment replaced)	2003
Number of Floors	2
Building Program	NOVA – Career transition center

Overall Summary	
Fire Protection Score	2
Plumbing Score	2
Mechanical Score	2
Electrical Score	2

Score Legend
1 = Unacceptable condition. Assume 100% replacement/cost needed.
2 = Poor condition. Assume 50% to 60% replacement/cost needed.
3 = Fair condition. Assume 20% to 30% replacement/cost needed.
4 = Good condition. Assume 0% to 10% replacement/cost needed.

Fire Protection	**Score (1-4)**	**Notes (Items Reviewed)**
Fire Pump	1	None.
Sprinkler System	2	Existing, heads to be replaced and re-piped.
Specialized Sprinkler System	1	None.
Testing Recommended	1	Sprinkler system testing recommended prior to reuse.

Plumbing System	**Score (1-4)**	**Notes (Items Reviewed)**
Gas system	4	Gas supply to building to be reused.
Cold/Potable Water	4	Water supply to building to be reused.
Hot Water	3	Hot water heater to be reused.
Fixtures	1	Bathroom fixtures to be replaced.
Sewer, Waste, and Vent systems	3	Sewer service to building to be reused.
Storm system	3	Storm service to building to be reused.
Insulation	1	New insulation to be provided.
Lab systems	N/A	None.
Miscellaneous	N/A	None.
Testing Recommended	1	Test all plumbing infrastructure before reuse.

HVAC	**Score (1-4)**	**Notes (Items Reviewed)**
Chilled Water Systems	4	Chilled water system to be reused.
Heating Hot water systems	4	Heating hot water system to be reused.
Air handling equipment	1	AHU's to be replaced in area of work.
Filtration Level	1	Filters to be replaced with AHU's/Fan Coil Units.
Exhaust Systems	1	Restroom exhaust systems to be replaced in area or work.
Decentralized systems	N/A	None. Data center systems not being renovated.
Ductwork	1	Ductwork to be replaced in areas of work.
Insulation	1	Insulation to be replaced in areas of work.
Controls	1	Local thermostats and controls to be replaced in areas of work. Reuse existing central building controls.
Miscellaneous	N/A	None.
Testing Recommended	1	Pre-TAB report to ensure proper ventilation.

Electrical	**Score (1-4)**	**Notes (Items Reviewed)**
Site Electrical	3	Service is adequate.
Power Systems	1	Majority of panels are aged and recommended for replacement.
Distribution	2	Conduits and Supports to be evaluated based on latest applicable codes. From visual inspection, conduits and supports looked acceptable.
Devices	1	Outlets and switches are aged, but operable. Replace based on age.
Demand Response Capable?	1	No.
Lighting	1	T8 Fluorescent 2x4 louvered fixtures. Appear to be original. Exterior lighting via wallpacks, need maintenance or replacement.
Lighting Controls	1	Timer control for outdoor site lighting. Switched indoor lighting.
Fire Alarm	3	Fire alarm system suitable for building application. Tied into FACP located in Public Safety Building.
Emergency and Backup Systems	1	Existing emergency distribution system is not code compliant.
Miscellaneous	3	Existing 75kVA UPS installed in 2005. Existing Halon clean agent fire suppression for Computer Room.
Testing Recommended	Yes	Fire Alarm, infrared, generator, and arc flash as required.

1.2 Public Safety Building Assessment Summary

The existing HVAC systems were mostly renovated/replaced in 2009-2011 with a large portion of old ductwork being reused. While the central chiller, boiler and associated pumps, distribution piping, AHU's

are all relatively new and can be re-used; all equipment in areas to be renovated is to be replaced with new VAV terminal units, ductwork, diffusers, and local controls/thermostats.

The existing plumbing fixtures and valves in restrooms on level 1 (within scope of renovation) are to be replaced to meet new code water efficiency requirements.

The existing electrical systems…

General	
Building Name	Public Safety Building
Building Area (Sq. Ft.)	9,400 (Level 1 renovations) 7,500 (Dedicated new EOC, 2 new levels)
Year Built	1983
Last Year Modified (MEP equipment replaced)	2009-2011
Number of Floors	2
Building Program	Public safety, police, EOC, crime lab

Overall Summary	
Fire Protection Score	2
Plumbing Score	2
Mechanical Score	2
Electrical Score	2

Score Legend
1 = Unacceptable condition. Assume 100% replacement/cost needed.
2 = Poor condition. Assume 50% to 60% replacement/cost needed.
3 = Fair condition. Assume 20% to 30% replacement/cost needed.
4 = Good condition. Assume 0% to 10% replacement/cost needed.

Fire Protection	**Score (1-4)**	**Notes (Items Reviewed)**
Fire Pump	1	None
Sprinkler System	2	Existing, heads to be replaced and re-piped
Specialized Sprinkler System	1	None
Testing Recommended	1	Sprinkler system testing recommended prior to reuse.

Plumbing System	**Score (1-4)**	**Notes (Items Reviewed)**
Gas system	4	Gas supply to building to be reused.
Cold/Potable Water	4	Water supply to building to be reused.
Hot Water	3	Hot water heater to be reused.
Fixtures	1	Bathroom fixtures to be replaced.
Sewer, Waste, and Vent systems	3	Sewer service to building to be reused.
Storm system	3	Storm service to building to be reused.
Insulation	1	New insulation to be provided.
Lab systems	N/A	None.
Miscellaneous	N/A	None.
Testing Recommended	1	Test all plumbing infrastructure before reuse.

HVAC	**Score (1-4)**	**Notes (Items Reviewed)**
Chilled Water Systems	4	Chilled water system to be reused.
Heating Hot water systems	4	Heating hot water system to be reused.
Air handling equipment	1	AHU's to be reused.
Filtration Level	1	Filters to be reused, replaced only for normal maintenance.
Exhaust Systems	1	Restroom exhaust systems to be replaced in area or work.
Decentralized systems	N/A	Replace as required to provide N+1 or 2N redundancy to critical areas, connect to emergency power.
Ductwork	1	Ductwork to be replaced in areas of work.
Insulation	1	Insulation to be replaced in areas of work.
Controls	1	Local thermostats and controls to be replaced in areas of work. Reuse existing central building controls.
Miscellaneous	N/A	None.
Testing Recommended	1	Pre-TAB report to ensure proper ventilation.

Electrical	**Score (1-4)**	**Notes (Items Reviewed)**
Site Electrical	3	Service appears adequate for this building type.
Power Systems	3	Switchboards, panels (High and Low) appear to be in good condition.
Distribution	2	Conduits and supports to be reused if possible. Replace where seismic restraint/supports are required.
Devices	1	Outlets and switches are aged, but operable. Replace based on age.
Demand Response Capable?	1	No.
Lighting	1	T8 Fluorescent 2x4 louvered and linear fixtures. Appear to be original. Exterior lighting via poletop fixtures.
1Lighting Controls	1	Indoor lighting is all manually controlled. Outdoor lighting control not observed.
F1ire Alarm	2	FACP is locating in second floor room, and controls multiple buildings.
Emergency and Backup Systems	2	2N redundant emergency system with 6-pole ATS.
Miscellaneous	3	Existing 45kVA UPS powers 911 system. Existing Halon clean agent fire suppression for Computer Room.
Testing Recommended	Yes	Fire Alarm, infrared, generator, and arc flash as required.

2.0 City Hall Annex (NOVA) MEP Detailed Assessment

2.1 General Project Description

This section of this document provides a more in-depth conditions assessment of the mechanical (HVAC, Pluming, and Fire-Protection), electrical systems of the City Hall Annex Building. This report also covers existing conditions related to the thermal building envelope components. The information gathered on this report is based on existing as-built drawings and a site walk to the property conducted on June 5, 2017.

The Annex Building was built circa 1984 and has a major HVAC system renovation in 2003. The building is a two-story structure totaling approximately 25,000 SF of area. The existing building envelope elements are original as is most of the mechanical, plumbing, electrical, and fire-protection (MEP/FP) infrastructure and utility services.

The building and MEP/FP equipment have been well kept despite being their age. Based on the site walk, visual observation of the equipment, and information provided by the civic center Facilities and Engineering team, the equipment is in fair condition.

Figure 2: Annex Building

Detailed descriptions of the MEP/FP systems' existing conditions and recommendations for upgrades are provided in the sections below.

2.2 Existing Building Envelope

The existing building envelope has not been renovated the since original building construction and appears to be in fair condition based on visual observation. See the architectural assessment report for additional building envelope information on the existing envelope condition. This section focuses only on the thermal and energy code performance of the envelope.

The performance of the thermal envelope for the Annex building is documented on the table below. The building was designed and built around 1980's and presumably met the energy code requirements of the time. The table below shows information gathered from the as-built plans and from the CA energy code, Title 24 (Part 6)-1980 for the existing envelope, and from the CA energy Code, Title 24 (Part 6)-2016 for current requirements. The existing fenestration is double-pane with aluminum frame which is unusual for most buildings of that era.

Table 2: Existing Building Envelope Performance

Envelope Element	California Energy Code Title 24 - 2016 Climate Zone 3	Existing Building California Energy Code Title 24 - 1980	Recommended Performance
Slab on Grade	No requirements	U-Value = ~0.18	No alterations expected, recommended
Exterior Wall	U-Value = 0.650 (Mass Heavy)	U-Value = ~0.4	No alterations expected, recommended
Roof	U-Value = 0.082 Continuous insulation R-8 (alteration)	U-Value = ~0.11	No alterations expected, recommended
Fenestration (Fixed Window)	Fenestration window area less than 40% Assembly U-Value = 0.47 Relative Solar Heat Gain Coefficient (RSHGC) = 0.31 VT = 0.42 (Fixed)	Fenestration area is unchanged Assembly U-Value = unknown Solar Heat Gain Coefficient (SHGC, per T24) = unknown VT = unknown	Fenestration area and performance is unchanged, no alterations expected or recommended.
Fenestration (Fixed Skylight)	Fenestration skylight area less than 5% Assembly U-Value = 0.58 Relative Solar Heat Gain Coefficient (RSHGC) = 0.25 VT = 0.49 (Fixed)	Skylight area is unchanged Assembly U-Value = unknown Solar Heat Gain Coefficient (SHGC) = unknown VT = unknown	Skylight area and performance is unchanged, no alterations expected or recommended.

Figure 3: Existing Building Entrance

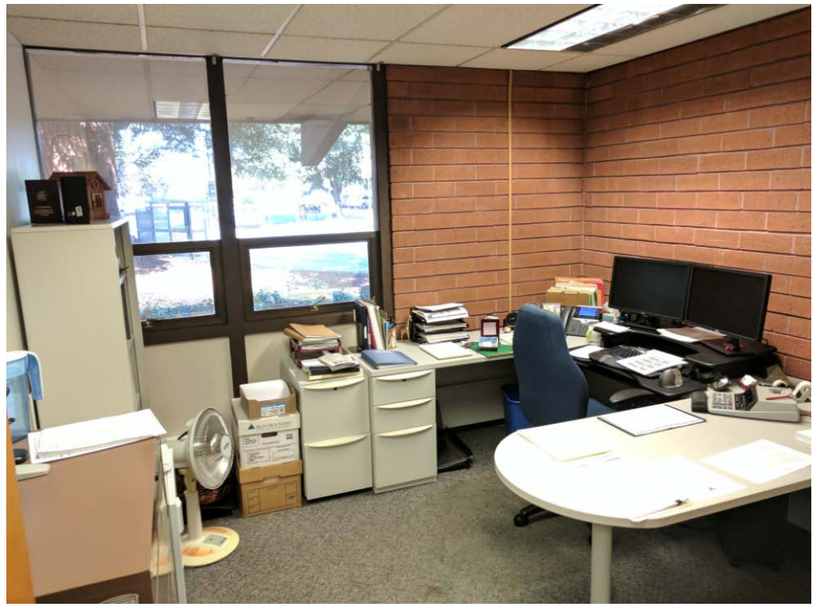

Figure 4: Office with Exterior Window

Figure 5: Office with Operable Window

Figure 6: Single-Pane Glazing

2.3 HVAC Systems

The existing HVAC system was installed in the original building build out from 1980's. The building HVAC went through a major upgrade in 2003. The renovation work included new cooling tower, chiller, Boiler, pumps for chilled and hot water, central multi-zone air handling unit (AHU), reheat zone coils, and new controls. Much of the original existing ductwork was reused.

This places the existing HVAC equipment at 14 years of operation and the existing ductwork at about 33 years of operation. Per table 7 below this places all existing equipment at the end of their lifetime except for the cooling tower, chiller, boiler, and pumps.

Comparison of Service Life Estimates

Equipment Item	Median Service Life, Years: Abramson et al. (2005)	Median Service Life, Years: Akalin (1978)
Air Conditioners		
Window unit	N/A*	10
Residential single or split package	N/A*	15
Commercial through-the-wall	N/A*	15
Water-cooled package	>24	15
Heat pumps		
Residential air-to-air	N/A*	15[b]
Commercial air-to-air	N/A*	15
Commercial water-to-air	>24	19
Roof-top air conditioners		
Single-zone	N/A*	15
Multizone	N/A*	15
Boilers, Hot-Water (Steam)		
Steel water-tube	>22	24 (30)
Steel fire-tube		25 (25)
Cast iron	N/A*	35 (30)
Electric	N/A*	15
Burners	N/A*	21
Furnaces		
Gas- or oil-fired	N/A*	18
Unit heaters		
Gas or electric	N/A*	13
Hot-water or steam	N/A*	20
Radiant heaters		
Electric	N/A*	10
Hot-water or steam	N/A*	25
Air Terminals		
Diffusers, grilles, and registers	N/A*	27
Induction and fan-coil units	N/A*	20
VAV and double-duct boxes	N/A*	20
Air washers	N/A*	17
Ductwork	N/A*	30
Dampers	N/A*	20
Fans	N/A*	
Centrifugal	N/A*	25
Axial	N/A*	20
Propeller	N/A*	15
Ventilating roof-mounted	N/A*	20
Coils		
DX, water, or steam	N/A*	20
Electric	N/A*	15
Heat Exchangers		
Shell-and-tube	N/A*	24
Reciprocating compressors	N/A*	20
Packaged Chillers		
Reciprocating	N/A*	20
Centrifugal	>25	23
Absorption	N/A*	23
Cooling Towers		
Galvanized metal	>22	20
Wood	N/A*	20
Ceramic	N/A*	34
Condensers		
Air-cooled	N/A	20
Evaporative	N/A*	20
Insulation		
Molded	N/A*	20
Blanket	N/A*	24
Pumps		
Base-mounted	N/A*	20
Pipe-mounted	N/A*	10
Sump and well	N/A*	10
Condensate	N/A*	15
Reciprocating engines	N/A*	20
Steam turbines	N/A*	30
Electric motors	N/A*	18
Motor starters	N/A*	17
Electric transformers	N/A*	30
Controls		
Pneumatic	N/A*	20
Electric	N/A*	16
Electronic	N/A*	15
Valve actuators		
Hydraulic	N/A*	15
Pneumatic	N/A*	20
Self-contained		10

*N/A: Not enough data yet in Abramson et al. (2005). Note that data from Akalin (1978) for these categories may be outdated and not statistically relevant. Use these data with caution until enough updated data are accumulated in Abramson et al.

Figure 7: Typical Life Spans for Common Equipment – ASHRAE Fundamentals 2011

The existing HVAC system design is outdated and could not be used in a modern buidling due to current energy use restrictions. This means that any building renovation that is not a repair or maintenance to the existing system requires that a new HVAC system be designed and installed.

The existing HVAC is also outdated in terms of thermal comfort and zoning and cannot provide comfort comparable to what is expected in a modern building.

Figure 8: Annex Building Cooling Tower within enclosure

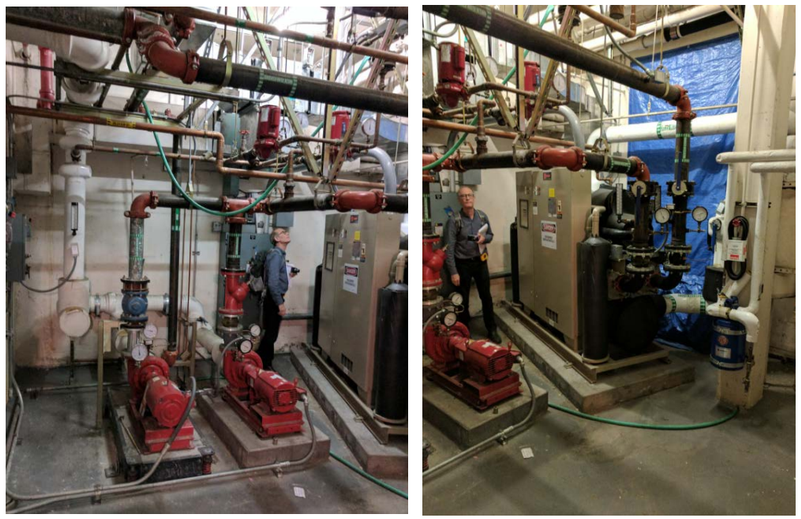

Figure 9: Annex Building Chiller and Chilled Water Pumps

Figure 10: Annex Building Boiler and Multi-Zone AHU

Figure 11: Annex Building HVAC Controls Panel

The chiller, boiler, and associated pumps are all located on the basement level. The building multi-zone AHU is also located on the basement level. Duct distribution from the main AHU is routed from the basement level up to level 1 to serve the office and administration spaces on that level.

Aside from equipment rooms, the basement level program includes a data center, a print shop, and a small administration area associated with the print shop.

The areas on the basement level are also served by the building multi-zone AHU. The data center is also served by a floor-mounted Liebert unit via a underfloor air delivery plenum. The Liebert air-cooled condenser is located in an area way behind an external louver, which is not recommended.

Figure 12: Liebert AC Unit Serving the Data Center

Figure 13: Liebert Air-Cooled Condenser in Areaway

2.4 Plumbing Systems

The existing plumbing system was installed in the original building build out from 1980's. The building domestic water heater, thermostatic control valve, and plumbing fixtures were replaced in the 2003 renovation project and are therefore approximately 14 years old.

The existing plumbing utilities and piping infrastructure is from the original building construction and approximately 33 years old. The existing plumbing piping infrastructure (domestic cold water, sanitary sewer, storm, and gas) should be tested prior to being reused.

Figure 14: Domestic Hot Water Gas Fired Heater and sewer/storm ejector Pumps

The building has two ejector pumps, one for sewer and another for storm, both located in the basement level of the building.

The building plumbing fixtures are outdated in terms of water performance and would not meet current CALGreen code requirements, requiring that they be replaced in a renovation scenario.

2.5 Fire Protection Systems

The building is fully sprinklered. The wet sprinkler system service comes into the building from the site utility system and distribution. The actual location for the fire protection water entry point is by the cooling tower area as indicated by the outdoor PIV, although the fire riser and test valves were not observed.

Figure 15: Fire Protection Post Indicator Valve (PIV)

2.6 Electrical Service and Distribution

This section describes the overall power system at the City Hall Annex Building. Existing conditions described below are based on drawings provided to the design team, interviews with City personnel, and a project walk through.

Service

The normal utility power is provided by Pacific Gas & Electric (PG&E). A 1600A, 208/120V, 3-phase 4-wire service is delivered to the main switchgear located in the basement Print Shop. It is presumed that a dedicated PG&E, exterior pad-mount transformer provides this service. Power is then distributed from this main switchboard to panels located throughout the facility.

The majority of the main distribution and secondary distribution panels is in fair condition, of original vintage, and manufactured by Federal Pacific. Some equipment was replaced during a 1984 renovations.

Based upon the main panel's rating of 1600A, 208Y/120V, 3-phase, 4-wire, the existing service could serve a load density of approximately 32W/sf. The building's current estimated demand load is 11W/sf. This includes 4W/sf for plug load and lighting and 5W/sf for mechanical systems. The electric service appears to be appropriate for the building type.

Figure 16: Main Distribution Panel

Distribution

The 1600A main switchboard serves all the branch panels and mechanical loads for the building. The main switchboard is located in the Print Shop which also contains the main automatic transfer switch and a 208/120V-208/120V 75kVA isolation transformer. Branch power panels are distributed throughout the facility to feed power, lighting, mechanical, and computer room loads and are rated at 100A-to-225A. Existing panels appear to be in fair condition.

The main distribution panel also contains a 400 circuit breaker labeled 'Council Chamber Dist. Panel.' Further investigation is required.

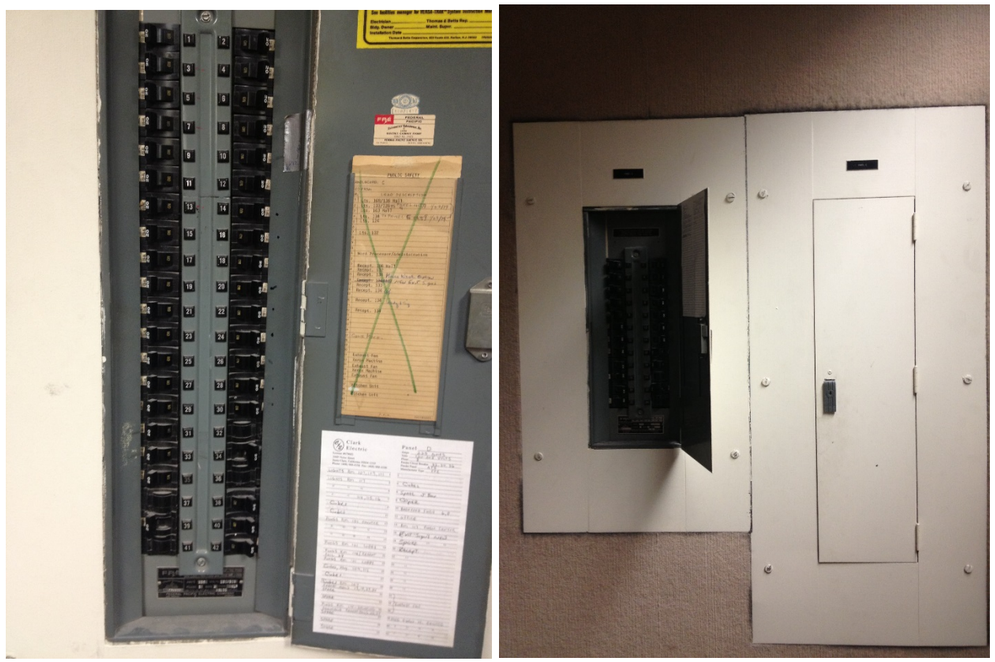

Figure 17: Branch Panels

Figure 18: Council Chamber Distribution Panel Subfeed from Annex Building

2.7 On-Site Power Systems

In addition to the 1600A distribution board, there is a 150kW, diesel, 208/120V, 3-phase, 4-wire generator that provides emergency standby power to the building. The generator is located in an exterior pit and via the ATS provides power to the computer room, emergency lighting, and various mechanical and plumbing equipment loads. The emergency distribution system is not currently segregated into NEC article 700, 701, and 702 branches.

Figure 199: 150kW Generator Pit

It could not be determined if the existing lighting infrastructure in the building meets the CBC, section 1006.2, requirement of having emergency lighting fixture provide an average of 1 foot-candle, along the path of egress.

An additional 75kVA Uninterruptable Power Supply (UPS) located in the first floor UPS room provides backup power to certain loads in the Computer Room. The UPS is equipped with an integral input bypass which allows for manual transfer between utility and battery power. The UPS panel powers the Computer Room panels located in the basement.

Figure 20: UPS Bypass Panel and Battery Cabinets

2.8 Signal Systems

Fire Alarm

A fire alarm control panel was not observed during the site visit. Existing fire alarm devices appear to be made by Honeywell (Notifier). According to as-built drawings, the fire alarm system is tied into a main Fire Alarm Control Panel (FACP) located in the Public Safety Building via an existing underground ductbank connecting the facilities.

PROVIDE FIRE ALARM WIRING IN ¾"C TO HONEYWELL FIRE ALARM CONTROL PANEL (FACP) IN COMMUNICATIONS ROOM #2014, SECOND FLOOR, PUBLIC SAFETY BUILDING LOCATED ACROSS ALL AMERICA WAY. (N) FIRE ALARM WIRING SHALL BE ROUTED VIA (E) UNDERGROUND COMMUNICATIONS DUCT BANK. PROVIDE ALL ACCESSORIES REQUIRED FOR THE FACP TO COMMUNICATE TO THE AHU-1 AS A SEPARATE ZONE. ACTIVATION OF THE DUCT SMOKE DETECTORS IN AHU-1 SHALL TRIGGER AN ALARM IN THE FACP AND SHUTDOWN AHU-1.

Figure 21: Fire Alarm Note on 2003 HVAC Upgrade Drawings (Sheet E-1.1)

The Fire Alarm System appears to be in working condition but aged. Depending upon the extent of the renovations, the fire alarm system may need to be expanded or modified to support the new program. Further investigation is recommended to determine the extent of the required upgrades to the fire alarm system.

The Computer Room is provided with a Halon clean agent fire suppression system. The Mail Room, Computer Room, and Computer Operator Room are located on raised floors with underfloor smoke detectors.

Figure 22: Computer Room Clean Agent Fire Suppression and Raised Floor

2.9 Lighting Equipment

The building makes use of a combination of fixtures throughout, primarily 2'x4' recessed troffers and incandescent monopoints. Existing fixture lamp types appear to be primarily linear fluorescent. The amount of lighting provided appears to be sufficient.

Figure 23: Typical Interior Light Fixtures

Exterior fixtures consist of wallpacks mounted to the building façade. Many of these fixtures have not been maintained.

Figure 24: Typical Exterior Light Fixtures

Figure 25: Exterior Lighting Timeclock

2.10 Lighting Controls

The existing lighting controls provide manual switch and occupancy sensing control to the fixtures in the building. Lighting control panels were not observed.

A timeclock is used for controlling exterior lighting.

It is unlikely that the lighting controls meet the latest California Title 24 requirements. For example, daylighting and dimming controls are not provided, as required per T24.

It is expected that all new control equipment will be required.

3.0 Public Safety Building MEP Detailed Assessment

3.1 General Project Description

This section of this document provides a more in-depth conditions assessment of the mechanical (HVAC, Pluming, and Fire-Protection), electrical systems of the Public Safety Building. This report also covers existing conditions related to the thermal building envelope components. The information gathered on this report is based on existing as-built drawings and a site walk to the property conducted on June 5, 2017.

The Public Safety Building was built circa 1983 and has a major HVAC system renovation in 2009. The building is a two-story structure totaling approximately 45,000 SF of area. The existing building envelope elements are original as is most of the mechanical, plumbing, electrical, and fire-protection (MEP/FP) infrastructure and utility services.

The building and MEP/FP equipment have been well kept despite being their age. Based on the site walk, visual observation of the equipment, and information provided by the civic center Facilities and Engineering team, the equipment is in fair condition.

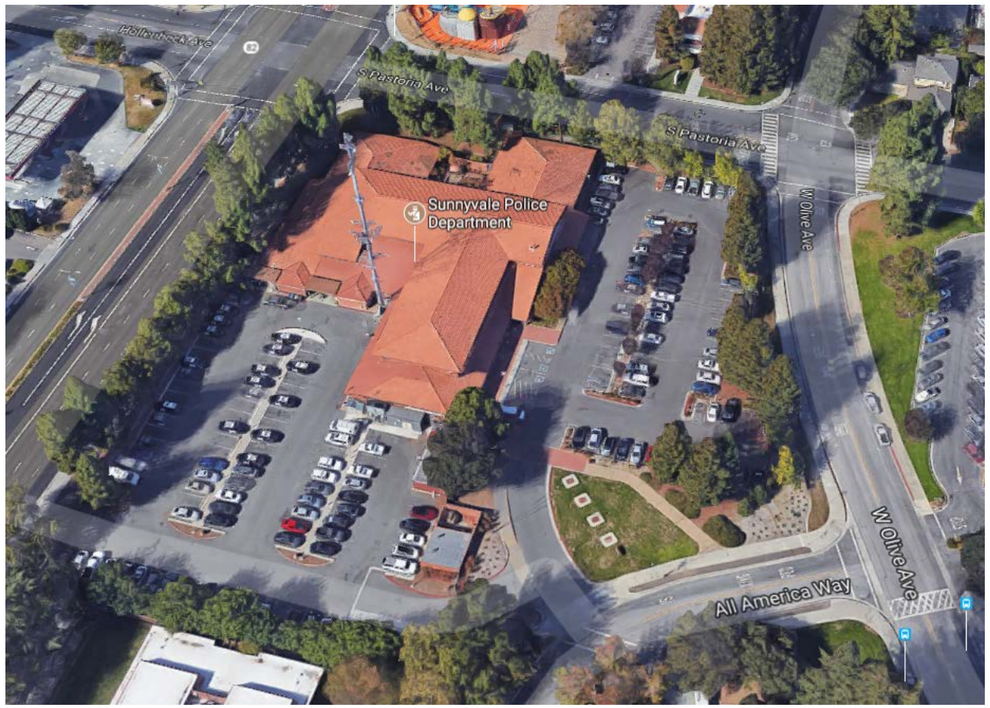

Figure 26: Public Safety Building

Detailed descriptions of the MEP/FP systems' existing conditions and recommendations for upgrades are provided in the sections below.

3.2 Existing Building Envelope

The existing building envelope has not been renovated the since original building construction and appears to be in fair condition based on visual observation. See the architectural assessment report for additional building envelope information on the existing envelope condition. This section focuses only on the thermal and energy code performance of the envelope.

The performance of the thermal envelope for the Public Safety Building is documented on the table below. The building was designed and built around 1980's and presumably met the energy code requirements of the time. The table below shows information gathered from the as-built plans and from the CA energy code, Title 24 (Part 6)-1980 for the existing envelope, and from the CA energy Code, Title 24 (Part 6)-2016 for current requirements. The existing fenestration is double-pane with aluminum frame which is unusual for most buildings of that era.

Table 3: Existing Building Envelope Performance

Envelope Element	California Energy Code Title 24 - 2016 Climate Zone 3	Existing Building California Energy Code Title 24 - 1980	Recommended Performance
Slab on Grade	No requirements	U-Value = ~0.18	No alterations expected, recommended
Exterior Wall	U-Value = 0.650 (Mass Heavy)	U-Value = ~0.4	No alterations expected, recommended
Roof	U-Value = 0.082 Continuous insulation R-8 (alteration)	U-Value = ~0.11	No alterations expected, recommended
Fenestration (Fixed Window)	Fenestration window area less than 40% Assembly U-Value = 0.47 Relative Solar Heat Gain Coefficient (RSHGC) = 0.31 VT = 0.42 (Fixed)	Fenestration area is unchanged Assembly U-Value = unknown Solar Heat Gain Coefficient (SHGC, per T24) = unknown VT = unknown	Fenestration area and performance is unchanged, no alterations expected or recommended.
Fenestration (Fixed Skylight)	Fenestration skylight area less than 5% Assembly U-Value = 0.58 Relative Solar Heat Gain Coefficient (RSHGC) = 0.25 VT = 0.49 (Fixed)	Skylight area is unchanged Assembly U-Value = unknown Solar Heat Gain Coefficient (SHGC) = unknown VT = unknown	Skylight area and performance is unchanged, no alterations expected or recommended.

3.3 HVAC Systems

The existing HVAC system was installed in the original building build out from 1980's. The building HVAC went through a major upgrade in 2009. The renovation work included new cooling tower, chiller, Boiler, pumps for chilled and hot water, two central VAV air handling unit (AHU's), VAV terminal units with reheat, fan coil Units, and new controls. Much of the original existing ductwork was reused.

This places the existing HVAC equipment at 8 years of operation and the existing ductwork at about 33 years of operation. Per table 7 below this places the existing equipment is about mid-way through their lifetime.

Comparison of Service Life Estimates

Equipment Item	Median Service Life, Years: Abramson et al. (2005)	Akalin (1978)
Air Conditioners		
Window unit	N/A*	10
Residential single or split package	N/A*	15
Commercial through-the-wall	N/A*	15
Water-cooled package	>24	15
Heat pumps		
Residential air-to-air	N/A*	15[b]
Commercial air-to-air	N/A*	15
Commercial water-to-air	>24	19
Roof-top air conditioners		
Single-zone	N/A*	15
Multizone	N/A*	15
Boilers, Hot-Water (Steam)		
Steel water-tube	>22	24 (30)
Steel fire-tube		25 (25)
Cast iron	N/A*	35 (30)
Electric	N/A*	15
Burners	N/A*	21
Furnaces		
Gas- or oil-fired	N/A*	18
Unit heaters		
Gas or electric	N/A*	13
Hot-water or steam	N/A*	20
Radiant heaters		
Electric	N/A*	10
Hot-water or steam	N/A*	25
Air Terminals		
Diffusers, grilles, and registers	N/A*	27
Induction and fan-coil units	N/A*	20
VAV and double-duct boxes	N/A*	20
Air washers	N/A*	17
Ductwork	N/A*	30
Dampers	N/A*	20
Fans	N/A*	
Centrifugal	N/A*	25
Axial	N/A*	20
Propeller	N/A*	15
Ventilating roof-mounted	N/A*	20
Coils		
DX, water, or steam	N/A*	20
Electric	N/A*	15
Heat Exchangers		
Shell-and-tube	N/A*	24
Reciprocating compressors	N/A*	20
Packaged Chillers		
Reciprocating	N/A*	20
Centrifugal	>25	23
Absorption	N/A*	23
Cooling Towers		
Galvanized metal	>22	20
Wood	N/A*	20
Ceramic	N/A*	34
Condensers		
Air-cooled	N/A	20
Evaporative	N/A*	20
Insulation		
Molded	N/A*	20
Blanket	N/A*	24
Pumps		
Base-mounted	N/A*	20
Pipe-mounted	N/A*	10
Sump and well	N/A*	10
Condensate	N/A*	15
Reciprocating engines	N/A*	20
Steam turbines	N/A*	30
Electric motors	N/A*	18
Motor starters	N/A*	17
Electric transformers	N/A*	30
Controls		
Pneumatic	N/A*	20
Electric	N/A*	16
Electronic	N/A*	15
Valve actuators		
Hydraulic	N/A*	15
Pneumatic	N/A*	20
Self-contained		10

*N/A: Not enough data yet in Abramson et al. (2005). Note that data from Akalin (1978) for these categories may be outdated and not statistically relevant. Use these data with caution until enough updated data are accumulated in Abramson et al.

Figure 27: Typical Life Spans for Common Equipment – ASHRAE Fundamentals 2011

The existing HVAC system design is comparable to a modern HVAC system and can be reused in future renovations since it still has many years of operation left.

Figure 28: Public Safety Building Cooling Tower and Chiller

Figure 29: Public Safety Building Boiler and Hot Water Pumps

Figure 30: Public Safety Building Air Handling Unit (AHU)

Figure 31: Annex Building HVAC Controls Panel

The boiler and associated pumps are all located on level two. The building two AHU's is also located on the level two. Duct distribution from the main AHU's is routed to levels two and level one.

The public safety building also includes a data center, Emergency Operations Center, Crime Lab, transit monitoring room, and other PSC related program areas.

Figure 32: Liebert AC Unit Serving the Data Center

3.4 Plumbing Systems

The existing plumbing system was installed in the original building build out from 1980's. The building domestic water heater, thermostatic control valve, and plumbing fixtures were replaced in the 2009 renovation project and are therefore approximately 8 years old.

The existing plumbing utilities and piping infrastructure is from the original building construction and approximately 33 years old. The existing plumbing piping infrastructure (domestic cold water, sanitary sewer, storm, and gas) should be tested prior to being reused.

Figure 33: Domestic Hot Water Gas Fired Heater and sewer/storm ejector Pumps

The building plumbing fixtures are outdated in terms of water performance and would not meet current CALGreen code requirements, requiring that they be replaced in a renovation scenario.

3.5 Fire Protection Systems

The building is fully sprinklered. The wet sprinkler system service comes into the building from the site utility system and distribution. The actual location for the fire protection water entry point was not observed.

3.6 Electrical Service and Distribution

This section describes the overall power system at the Public Safety Building. Existing conditions described below are based on drawings provided to the design team, interviews with City personnel, and a project walk through.

Service

The normal utility power is provided by Pacific Gas & Electric (PG&E) via an exterior pad-mounted transformer. An 800A, 480/277V, 3-phase, 4-wire electrical service is delivered to the main switchgear (MSB) located in the Main Electrical Room. The main electrical room also contains secondary distribution equipment, an automatic transfer switch (ATS), uninterruptible power supply (UPS), and an outdoor lighting control panel. Power is then distributed from this main switchboard to distribution panels located throughout the facility.

The majority of the main distribution and secondary distribution panels is in good condition, of original vintage, and manufactured by Square D.

Based upon the main panel's rating of 800A, 480Y/277V, 3-phase, 4-wire, the existing service could serve a load density of approximately 11W/sf. The electric service appears to be appropriate for the building type.

Figure 34: Main Distribution Panel

Distribution

The 800A main switchboard serves secondary distribution panels, motor control centers, and branch panels. Branch power panels are distributed throughout the facility to feed power, lighting, mechanical, elevator, and computer room loads and are rated at 100A-to-225A. Existing panels appear to be in good condition.

Figure 35: Branch Panels

3.7 On-Site Power Systems

The building is also provided with two 230kW diesel, 480/277V, 3-phase, 4-wire generators. The generators are located together in an exterior enclosure and do not appear to be paralleled. Instead, the emergency power system consists of a 6-pole changeover switch accompanied by a pair of 3-pole transfer switches.

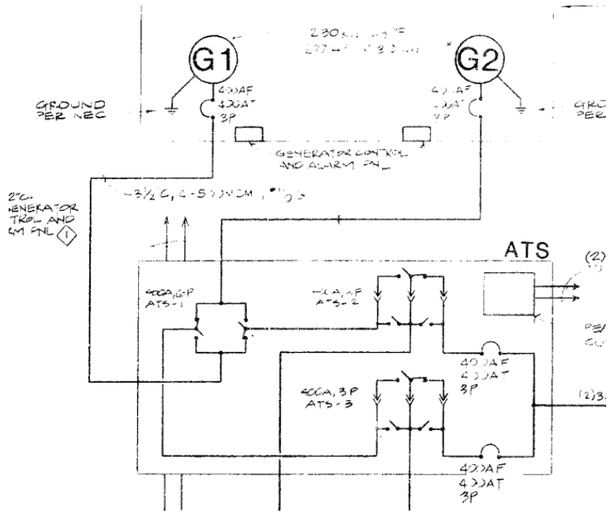

Figure 369: Automatic Transfer Scheme (1983 Sheet E-7)

The emergency power system provides a 2N level of redundant emergency standby power to the building's computer room, emergency lighting, Emergency Operations Center (EOC), and various mechanical and plumbing equipment loads.

It is unclear whether this building requires a Critical Operations Power System. The emergency distribution system is not currently segregated into NEC article 700, 701, and 702 branches.

Figure 379: Automatic Transfer Switches

It could not be determined if the existing lighting infrastructure in the building meets the CBC, section 1006.2, requirement of having emergency lighting fixture provide an average of 1 foot-candle, along the path of egress.

An additional 45kVA Uninterruptable Power Supply (UPS) located in the main electrical room provides backup power to Computer Room panels located in the room adjacent to the second floor computer room. The UPS is equipped with an integral input bypass which allows for manual transfer between utility and battery power.

Figure 38: UPS Bypass Panel and Battery Cabinets

3.8 Signal Systems

Fire Alarm

A fire alarm control panel was not observed during the site visit. Existing fire alarm devices appear to be made by Honeywell (Notifier). According to as-built drawings, the Fire Alarm Control Panel (FACP) is located in Communications Room [2014] and ties into neighboring buildings, such as the Annex, via underground ductbanks.

Fire Alarm devices were observed throughout the building. Smoke detectors and strobes were observed. Manual pull stations and notification devices were located near exits.

The Fire Alarm System appears to be in working condition but aged. Depending upon the extent of the renovations, the fire alarm system may need to be expanded or modified to support the new program. Further investigation is recommended to determine the extent of the required upgrades to the fire alarm system.

The Computer Room is provided with a Halon clean agent fire suppression system. The Computer Room is located on a raised floors with underfloor smoke detectors.

Figure 39: Computer Room Clean Agent Fire Suppression and Raised Floor

3.9 Lighting Equipment

The building makes use of a combination of fixtures throughout, primarily 2'x4' recessed troffers and linear fluorescents. Existing fixture lamp types appear to be primarily linear fluorescent. The amount of lighting provided appears to be sufficient.

Figure 40: Typical Interior Light Fixtures

Exterior lighting appears to consist of decorative pole fixtures located around the building perimeter.

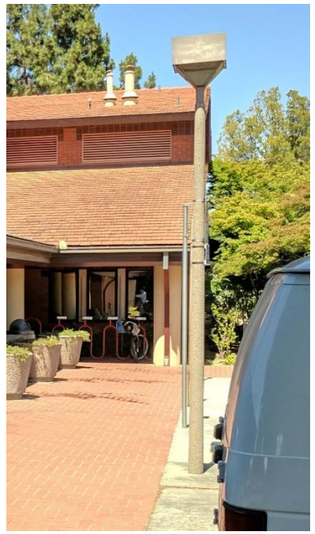

Figure 41: Typical Exterior Light Fixtures

3.10 Lighting Controls

The existing lighting controls provide manual switch and occupancy sensing control to the fixtures in the building. Lighting control panels were not observed.

Perimeter spaces on the second floor are equipped with an infrared lighting control system.

A timeclock is used for controlling exterior lighting.

It is unlikely that the lighting controls meet the latest California Title 24 requirements. For example, daylighting and dimming controls are not provided, as required per T24.

It is expected that all new control equipment will be required.

3.11 911 System

The building houses and Emergency Operations Center, a Traffic Control Center, as well as a communication tower. It is inferred from the redundant generator configuration that these functions are critical, and associated with the 911 system.

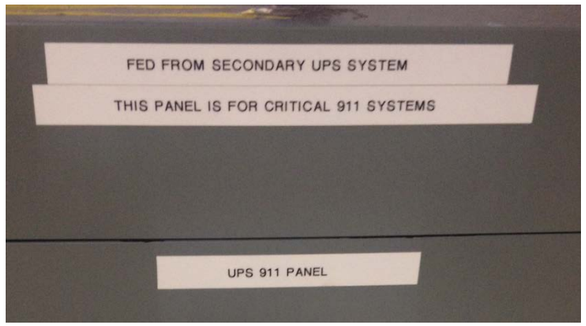

Figure 42: Panel Label Indicating 911 System

Figure 43: Communications Tower

4.0 Recommendations For Building Renovations

4.1 Annex Recommendations:

The following is a list of upgrades to MEP systems to support the proposal architectural renovations to the NOVA Annex Test Fit:

- HVAC: Reuse existing cooling tower, chiller, boiler and associated pumps.
- HVAC: Provide new AHU (20,000 CFM) unit, indoor, location TBD.
- HVAC: Provide 15 VAV terminal units with reheat coils, assume each VAV terminal is 1,000 CFM in size.
- HVAC: One new toilet exhaust fan, mushroom type, 2,000 CFM
- HVAC: Two new VRV/VRF units sized at 3 tons for IDF/MPOE rooms
- HVAC: New building controls system to match existing.
- Plumbing: New plumbing fixtures throughout
- Plumbing: Reuse CW pipe service, new pipe otherwise
- Plumbing: Reuse DHW heater
- Plumbing: New DHW pipe throughout
- Plumbing: Reuse sewer pipe entry service, new pipe otherwise
- Plumbing: Reuse storm pipe, roof drains throughout
- Fire Protection: Reuse fire water pipe entry valves, riser, new lateral pipe and sprinklers
- Electrical Power: Reuse existing service, provide new panels, distribution, and devices throughout scope.
- Electrical Lighting: Provide new LED lighting throughout with code compliant lighting controls throughout scope.
- Fire Alarm: Reuse existing fire alarm front end. Expand/modify as required. Provide matching new devices throughout scope.
- Emergency Power: Do not relocate/add additional emergency loads. Do not trigger upgrade to existing emergency distribution system.
-

4.2 Recommendations for new Building

The following is a list of upgrades to MEP systems to support the proposal architectural renovations to the NOVA Annex Test Fit:

- HVAC (renovation): Reuse existing cooling tower, chiller, boiler and associated pumps.
- HVAC (renovation): Provide new AHU (10,000 CFM) unit, indoor, location TBD.
- HVAC (renovation): Provide 8 VAV terminal units with reheat coils, assume each VAV terminal is 1,000 CFM in size.
- HVAC (renovation): One new toilet exhaust fan, mushroom type, 1,500 CFM
- HVAC (renovation): Two new VRV/VRF units sized at 3 tons for IDF/MPOE rooms
- HVAC (renovation): New building controls system to match existing.
- HVAC (new building): Provide new rooftop AC unit, 4,000 CFM, ductwork, diffusers, 5 VAV Terminals with reheat coils, and controls.
- Plumbing (renovation and new building): New plumbing fixtures throughout
- Plumbing (renovation): Reuse CW pipe service, new pipe otherwise
- Plumbing (renovation): Reuse DHW heater
- Plumbing (renovation): New DHW pipe throughout
- Plumbing (renovation): Reuse sewer pipe entry service, new pipe otherwise
- Plumbing (renovation): Reuse storm pipe, roof drains throughout
- Plumbing (new building): Provide new utility service for gas, new domestic water piping, hot water piping, sewer piping, storm piping, domestic water heater.
- Fire Protection (renovation): Reuse fire water pipe entry valves, riser, new lateral pipe and sprinklers
- Fire Protection (new building): Provide new fire riser zone with all valves and testing station, provide coverage of sprinklers throughout per NFPA13.
- Electrical Power (renovation): Reuse existing service, provide new panels, distribution, and devices throughout scope.
- Electrical Power (new building): Provide new electrical utility service, new panels, distribution, and devices for new building.
- Electrical Lighting: Provide new LED lighting throughout with code compliant lighting controls
- Fire Alarm: Reuse existing fire alarm front end. Expand/modify as required. Provide matching new devices throughout scope.
- Emergency Power: Do not relocate/modify EOC spaces, or relocate/add additional emergency loads. Do not trigger upgrade to existing emergency distribution system.
-