Executive Summary

The current electrical system is functional but requires some understanding in order to avoid overloading circuits. Certain outlets can be used for space heaters while others cannot and only a given number of space heaters can be used in each room depending on the outlets they are plugged into. Additions of outlets and light fixtures over the years has resulted in a creative and complex wiring system as circuitry has been derived from whichever panels had available breakers for the given items. The resulting system is difficult to understand for anyone who is not involved in the daily use or maintenance of it.

Currently, all electrical upgrades would be voluntary, but there are situations in which upgrades would be required.

- The addition of larger electrical loads such as electric baseboard heat, an electric convection oven, or an elevator could exceed the capacity of the system thereby requiring a service upgrade.
- Major architectural revisions could trigger code-required upgrades to systems such as updates to panels or the addition of a fire alarm system.

There are items that are safety concerns. It is recommended the Church address these items.

There are opportunities for changing or adding light fixtures and controls to improve energy efficiency and make operations of the church more environmentally sustainable.

16.1 Site Systems Analysis

A. Power Service

1. Utility power is delivered overhead to a weatherhead on the east side of the building from a utility pole on the east side of 10th Ave East. Service is 240/120V, 1 phase, 3 wire, 400 amps.

2. There is an old weatherhead on the north side of the building that is no longer in service. It appears to have accommodated a three phase service at one point possibly serving the 3 phase blower for the pipe organ.

3. Service size is marginal for the loads of the building. It accommodates current loads but is likely nearing capacity. The current service potentially will become overloaded if any projects occur that add

substantial electrical loads to the building such as a mechanical upgrade. The mechanical options currently proposed all include electric baseboard heating in selected areas. Currently, there are space heaters used in many areas. From experience, the current electrical system has capacity for the space heaters though it takes some knowledge in where to plug them in to avoid tripping branch circuits. In terms of electrical load calculations, the space heaters do not necessarily need to be specifically accounted for as they are temporary plugged in items that get covered in the general allowances for receptacle loads. Baseboard heaters would be permanently connected items though and their full load would need to be included in the electrical load calculation. Depending on how many baseboard heaters there are and the KW rating of each, the baseboard heaters could trigger a requirement for a service upgrade based on the load calculation results.

4. Additionally, the building would be better served with a 3 phase service rather than single phase. 3 phase would provide more overall capacity and also could accommodate larger motor loads should that become necessary. Potential upgrades that could result in adding larger motor loads include mechanical system upgrades and adding an elevator.

5. It is recommended to consider upgrading the existing service. The upgraded service would be 208Y/120V, 3 phase, 4 wire. Amperage of the service would be determined by analysis of loads but it is anticipated a 600 amp service would be suitable. COST ESTIMATE: $50,000.

B. Emergency Power

1. The building does not currently have a generator and there does not appear to be a need for one.

2. The only Code required emergency loads in the building are emergency egress lighting. This can be accomplished using battery units so does not require a generator. Refer to Lighting under Building Analysis for discussion of emergency egress lighting.

3. Currently there are two Uninterruptible Power Supply (UPS) units in the building. One serves the network devices and the other serves the door controller. The UPS units will keep the network and the door access system operational during a power outage for the length of time allowed by the batteries in each UPS.

C. Telephone

1. Telephone service to building appears to be adequate for the needs of the Church.

2. No changes are required for the existing telephone service.

D. Cable Television

1. It does not appear that the building currently has television service.

2. Nothing is required unless the Owner desires to add television service.

16.2 Building Analysis

A. Power Distribution

1. The Main Distribution Panel (MDP) is located in the basement corridor of the 1928 addition. It is 240/120V, 1 phase, 3 wire, 400 amps. Note that the amperage is an educated guess as the panel itself does not have a nameplate and there are no record drawings to refer to. The panel directly serves three branch panels. One is Panel A located adjacent to the MDP and served directly from bussing in the MDP. The other two are newer panels one located across the hall from the MDP and the other in the large storage room just north of Stuart Hall. The two newer panels are fed via 100/2 breakers wall mounted next to the MDP.

2. The MDP is functional but very old. It possibly was installed as part of the 1928 addition. The MDP has exposed live bussing. This is a code violation and a safety issue. Any person opening the panel door has access to energized bussing which, if touched, will deliver an electrical shock.

3. It is strongly recommended to replace the existing MDP. New MDP could either be 240/120V, 1 phase, 3 wire or 208Y/120V, 3 phase, 4 wire depending on whether a service upgrade also occurs. The new MDP would have a deadfront cover so that when the panel door is opened live bussing is not exposed. New MDF would be equipped with bolt in breakers as required to serve the branch panels. COST ESTIMATE: $17,500

4. Branch panels in the building are a mix of very old panels and newer panels. The very old panels have fuses rather than breakers. Old fused panels are located in the basement hall of the 1928 addition (Panel A), in the corridor near the central stair on the main level, in the Chapel, and in the corridor on the upper level. Newer panels are located in the basement corridor of the 1928 addition, in the storage

room north of Stuart Hall, in the Chapel (adjacent to fused panel), in the upper level corridor, and in the upper balcony at the south end of Stuart Hall.

5. As receptacles, lights and other devices have been added over the years, they have typically been circuited to the newer panels. The older fused panels are still active though and continue to serve various receptacles, lights and other devices. The newer devices are in satisfactory condition and can remain in service. The fused panels are functional but old and in marginal condition. The fused panels can remain in service but it is recommended to consider replacement. COST ESTIMATE: $2500 per panel. (There are four total fused panels.)

6. Branch circuitry is a mix of various vintages of wires. The wiring to the newer panels generally has insulation types that are acceptable under current code. The wiring to the fused panels generally has insulation types that do not meet current codes. Included is some knob and tube style wiring that likely is 60+ years old. It is not imperative to replace the older wiring as it is functional and can remain as an existing condition. But, it is recommended to consider replacement of the older wiring particularly in any areas where architectural renovations occur. Knob and tube wiring can become a safety issue if it has been disturbed over time or if the insulation has become brittle. A qualified electrician could inspect the wiring and provide a recommendation on the condition it is in. COST ESTIMATE: $15,000 to replace all wiring that does not meet current code.

7. Generally the building has adequate receptacles. The Chapel area needs additional receptacles as do a few other areas. Receptacles have been added to serve heaters as the central boiler system is only operated on Sundays. If mechanical upgrades occur with capability to heat selected areas as needed, the receptacles installed for heaters can then serve general needs. Many of the receptacles are older and not grounded. It is recommended to add receptacles in the Chapel and at other areas as needed. Added receptacles would be served from the newer panels. If circuitry upgrades occur to replace older wiring it is recommended to replace the older ungrounded receptacles at that time. COST ESTIMATE: $5000 for receptacle adds and replacements.

8. There is consideration to add a convection oven in the kitchen. Depending on the oven used, this is potentially a substantial electrical load. Once the oven to be used is determined, analysis will be

required to determine how to serve it from the electrical system. COST ESTIMATE: $1000 for electrical feeder to convection oven.

B. Mechanical Connections

1. Power circuitry, starters and disconnects will be required for mechanical units that are added. Details will depend on the mechanical upgrades that occur.

2. See the Mechanical Report for proposed mechanical upgrades.

3. Estimated electrical costs associated with proposed mechanical upgrades are as follows. Note that costs do not cover a service upgrade as this is covered elsewhere but the HVAC Options potentially will require a service upgrade as well.

   a. Fire Sprinkler System - $6000
   b. Second Floor Restroom - $1500
   c. Water Heater Replacement - $1250
   d. HVAC Option #1 - $25,000
   e. HVAC Option #2 - $30,000
   f. HVAC Option #3 - $40,000

C. Lighting

1. Existing light fixtures are a mix of different styles and types. Corridors and offices generally have surface wraparounds with T8 fluorescent lamps. These are efficient fixtures but not particularly aesthetic. Incandescent fixtures are still present in many areas. Several were equipped with screw in type compact fluorescent lamps for energy savings. HID type lamps are used in Stuart Hall.

2. Lighting upgrades can be considered for all areas but are not necessary. Upgrades could improve energy efficiency, controllability, lighting performance and aesthetics. Lighting upgrades can be done for selected individual rooms, selected areas, or for the entire building.

3. The building does not currently have automatic controls for lighting as required by Seattle Energy Code. It is not required to put them in place as conditions are existing. But, if lighting upgrades are done, the areas involved will need to have code compliant controls installed.

4. Switching for corridor lights is limited and generally consists of keyed switches at minimal locations. Consequently, corridor lighting is usually on all the time. It is recommended to consider adding standard switches at all normally used access points to corridors. This would facilitate turning the lights off during non-occupied hours.

5. Emergency egress lighting currently in place does not comply with code requirements. Exit signs are generally located where they need to be but are old and do not have required battery backup. To comply with code, exit signs need to be replaced with units that include battery backup. Also, a few additional signs are likely needed at selected lighting. There is no egress lighting currently in place. In a power outage the building goes dark. Egress lighting is required to achieve a minimum level of illumination along egress paths in a power outage. This can be accomplished using either "buy eye" style battery units or battery ballasts in fixtures.

6. It is recommended to add emergency egress lighting for the building but not necessarily required. If the overall scope of upgrades for the building ends up primarily as systems upgrades and minor and/or primarily cosmetic architectural upgrades then it will not be required to bring emergency egress lighting up to code. But, if significant architectural renovations are done it will likely become necessary to install code compliant emergency egress lighting for the entire building. COST ESTIMATE: $7500

7. Exterior lighting is limited as some exterior lighting circuits no longer are operational. It is recommended to provide new circuitry for exterior lighting and to add photonsensor and/or timeclock controls to turn the exterior lights on and off as needed. COST ESTIMATE: $2500

D. Fire Alarm

1. The building does not currently have a fire alarm system. By current code, the building is required to have a fire alarm system. The system would include smoke detection for paths of egress, audible notification by horns throughout, visible notification by strobes in common areas, and manual pull stations at exterior doors.

2. It is recommended to add a fire alarm system for the building but not necessarily required. If the overall scope of upgrades for the building ends up primarily as systems upgrades and minor and/or primarily cosmetic architectural upgrades then it will not be required to install a fire alarm system. But, if significant architectural renovations are done it will likely become necessary to add a fire alarm system for the entire building. COST ESTIMATE: $30,000