UNITARIAN UNIVERSALIST FELLOWSHIP OF CORVALLIS
M A S T E R P L A N N I N G R E P O R T

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INTRODUCTION

This report summarizes the work of STUDIO-E Architecture, its consultants, and the staff and leadership of the Unitarian Universalist Fellowship of Corvallis (UUFC) in developing a Masterplan for the UUFC campus, buildings and infrastructure.

Project:

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UNITARIAN UNIVERSALIST FELLOWSHIP OF CORVALLIS

Established in Corvallis in 1948, the Unitarian Universalist Fellowship of Corvallis (UUFC) is a caring and welcoming spiritual community. Paraphrased below, its website describes a fellowship with a liberal religious orientation that seeks after truth, justice, and meaning in their lives. The UUFC affirms and promotes the seven Unitarian Universalist (UU) principles, which include the inherent worth and dignity of every person; justice, equity and compassion in human relations; acceptance of one another and encouragement to spiritual growth in their congregations; a free and responsible search for truth and meaning; the right of conscience and the use of the democratic process within their congregations and in society at large; the goal of world community with peace, liberty, and justice for all; and respect for the interdependent web of all existence of which we are a part.

Drawing from these Principles, UUs seek to foster respect for all people, to manifest their reverence for the natural world, and to model their ideals through individual and collective contributions to the larger community. Their spiritual and personal dedication to best stewardship of the Earth is expressed in the following commitments:

- Promoting the sustainability of the Earth's resources
- Promote public awareness of threats to environmental health and stability
- The protection of biodiversity and ecological services
- Nurture the connection of spirituality and environmental action
- Promoting environmental justice around the world

PURPOSE OF THIS REPORT

In 2007 the UUFC decided to take a comprehensive look at its facilities and undertake a study of its long-term improvements to its infrastructure and expansion to accommodate the current and future growth of membership and activities. The UUFC engaged STUDIO-E Architecture (SEA) to develop a Masterplan for the improvement and further development of its campus and facilities. UUFC requested that the design team consider the following needs, ideas, concepts, and parameters in the Masterplanning process:

- Addition of a large new social hall
- Improve the functionality of the kitchen
- Addition of a comfortable library/informal social room
- Expand second story of Religious Exploration wing
- Continued and improved accessibility for alter-abled persons throughout the facility
- Improved functionality of, improved alter-abled access, better exiting safety, more storage, and improved lighting for the Religious Exploration (RE) wing
- Improved functionality of the administration and office spaces
- Improvement of the ministers' offices
- Additional efficient storage capacity
- Consider good indoor environmental quality, including air quality and thermal comfort
- High sustainability goals, including high energy efficiency and on-site renewable energy production
- Aesthetic integration of existing buildings and proposed renovations, expansions and additions
- Addition of parking spaces and exits to street
- Continued improvement of ground and sensitive relationship with the neighborhood and community

PROCESS

Since planning for the future is a complex task, SEA's approach was to keep the process simple and spend UUFC's planning resources wisely. In order to help UUFC establish priorities and decide how to move forward, the design team needed to know more about the organization. The UUFC had on its own led several internal assessments of its current facilities and future needs, and had also commissioned analyses by outside consultants. These reports and summaries are attached for reference at the end of this document.

Over a period of about a half-year the building expansion committee and the architect reviewed previous documents, discussed options, and developed design concepts. Part of this review process was to separate the overall design concept into smaller project phases. This would have several benefits, including facilitating capital fundraising targeted to specific smaller projects, and permitting minimal disruption to UUFC operations and day-to-day activities.

From the information assembled by the various UUFC committees, a list of design concepts was distilled to form a menu of affordable changes, improvements, transformations, and strong design strategies that would be cost effective, could be implemented in an incremental manner, and would best fit the needs of UUFC.

It would establish goals and strategies for an incremental transformation from an older building to a facility that operates efficiently and reflects the ideals of the UUFC. The goals of this initial phase included:

- establish guiding design and concept principles for future, phased, projects
- set energy efficiency, healthy environments, and other sustainability goals
- improve the operations functionality of the site and building
- reinforce a strong and positive identity
- establish construction budgets, including phased construction

We commissioned a construction cost estimate, including budgets for specific projects or phases. As the project progressed -besides contributing to the process through their participation in developing programmatic content- UUFC staff and members of the leadership reviewed, critiqued and commented on the documents and drawings that the design team provided to them.

This process led to a final schematic design that was approved by the committee and was capped with a joint PowerPoint presentation by the Committee and the architect, describing to the assembled Fellowship the process, and summarizing the design solution that they had developed together.

On August 26, 2007, the UUFC leadership and the architect made a presentation to the Fellowship, during which they described the work accomplished, presented the final Masterplan design boards (see Appendix) to the assembled congregation, the leadership, and the board of directors.

From the warm compliments and positive feedback received at the conclusion of our presentation, it appeared that the creative collaboration resulted in an exciting and inspirational – yet feasible and realistic Masterplan.

SUSTAINABLE DESIGN

Sustainable "green" building embodies a design intent on balancing environmental responsiveness, resource efficiency, and cultural and community sensitivity. The goal of this process is to create buildings that meet the needs of current building occupants while being mindful of the needs of future generations.

Why Design Green?

The building sector has a tremendous impact on the environment. The statistics are compelling. Buildings in the U.S. consume more than:

- 30% of our total energy
- 60% of our electricity
- 5 billion gallons of potable water per day just to flush toilets

Worldwide, buildings consume or are responsible for:

- 40% of the world's total energy use
- 35% of all carbon dioxide (CO_2) emissions
- 25% of the world's timber harvest
- 16% of fresh water withdrawal

A typical North American commercial construction project generates up to 2.5 pounds of solid waste per square foot of floor space. More than 210 million tons of solid waste are generated and disposed of annually, a substantial portion of which is attributed to construction site and building use waste. The industry appropriates land from other uses such as natural habitats and agriculture.

These are just a few examples of the environmental impacts associated with the construction and operation of buildings.

What are the benefits of sustainable building?

Green building practices can substantially reduce these negative environmental impacts and reverse the trend of unsustainable construction activities. In addition to increasing resource efficiency and reducing environmental impacts, sustainable building strategies can yield cost savings through long term reduced operating costs. Specifically these benefits include improved energy performance and comfort, a healthier indoor environment, increased durability of building components, and simplified maintenance requirements that can lead to a better bottom line for property managers and owners. Sustainable building works as a set of strategies to improve the economics of managing buildings while also improving their overall quality.

We, as a community, have an opportunity to develop new and existing buildings using green building strategies to reduce the impacts contributing to depletion of natural resources, water quality, air pollution, and global warming, while also lowering operating costs and maintenance needs.

Enhanced Design

Sustainable building strategies should be considered from the moment that the developer/owner initiates the project. The professional development team should include the developer/owner, the architect, all the engineering consultants, the landscape architect, the general contractor, and asset- and property-management staff that are committed to applying environmentally sensitive building principles and practices. The following comprise the general strategies recommended for incorporation into a sustainable design process:

Site and Water

Sustainable design and site planning integrates design and construction strategies to minimize environmental site impacts, reduce construction costs, maximize energy, water, and natural resource conservation, improve operational efficiencies, and promote alternative transportation. Water management practices help to protect salmon and other wildlife.

Energy Efficiency

Energy conservation helps maximize tenant comfort and reduce utility bills. Conservation measures slow the accumulative impacts of energy production and delivery, extraction of non-renewable natural resources, degradation of regional air quality, global warming, and increasing concentration of pollutants in our water, food and environment.

It may be of interest to note that many in Oregon believe that most of our electricity is produced by Hydro-electric dams –a less environmentally damaging power source than, say, the coal- or oil-burning power plants of the East or South of the US. It is important to point out that this perception is erroneous, as the actual mix of power sources for the State of Oregon is as follows:

Hydro	44%
Coal	42%
Natural Gas	7%
Nuclear	3%
Wind & Biomass	3%
Other	1%

Since most of the power generated via natural gas and coal comes from Oregon's neighboring states Oregon exports nearly half of its energy dollars out of state, depriving our economy as a result. Secondly, Oregon's power usage also exports to our neighbors nearly all of the air pollution generated by Oregon's power usage. The latter, of course, benefits our state but burdens our neighbors with serious social and environmental consequences.

Health and Indoor Air Quality

Minimize exposure of residents and workers to toxic materials. Use safe, biodegradable materials and alternatives to hazardous materials.

Materials Efficiency

There are many building products on the market and techniques that contribute to more durable and less resource-intensive buildings. Reducing, reusing, and recycling building materials conserves local and regional natural resources. Sourcing regionally harvested and processed materials promotes local businesses, nurtures the local economy, and strengthens the regional tax base.

Operations and Maintenance

O&M practices impact the building owners' costs and occupants' health, comfort, and safety. Thus, sustainable building O&M practices enhance occupant health and operational savings. The key to successful building performance results from O&M plans, education, and design that is cost-effective and convenient to implement.

SURVEY OF EXISTING FACILITIES

In 1958 the UUFC purchased two surplus government buildings located at Camp Adair and installed them on permanent foundations on a two-and-one-fourth acre property on Circle Boulevard. One building, arranged in T-formation, became the meeting hall. The other, arranged in L-formation, became the religious exploration building. In the early 80's the kitchen was expanded, and the Fellowship Hall (sanctuary), offices, bathrooms, and foyer were added. A few years later the Religious Exploration wing was constructed, which was expanded with a large addition in 1988. A longtime member, architect Edith Yang, designed the plans for many of these additions and renovations.

The site is rectangular in shape, 233' x 406', with an average slope of approximately 3%, or 13 feet difference, descending from north to south. Its northern and western edges are bounded by NW Elmwood Street and NW Firwood Street, respectively, quiet residential street, while NW Circle Blvd to the south is a relatively busy street. To the east, the Fellowship owns a residence that is, at this point, not considered for inclusion in the project.

The existing building is located near the southern third of the property, angles at an approximate 30% off the N-S axis. While an entrance, probably originally intended as the "main" entrance, faces to NW Circle Blvd, the entry most commonly used, due to its location closest to the parking lot, is found on the west side of the building, tucked between the sanctuary and the RE wing. The L-shaped parking lot holds 57 vehicles. The pastoral campus is further beautified by extensive mature landscaping, including dozens of very large evergreen and deciduous trees, large shrubs and bushes, and dense groundcover.

SITE UTILITIES

General Utilities

The construction plans indicate all the existing utilities, including gas, water, sewer and storm drain extending from NW Circle Blvd. Gas and electric meters are located on the west wall of the RE wing.

Water System

The construction plans indicate that a 2" diameter water plan extends from NW Circle Blvd. It is likely that the supply line will be sufficiently sized to serve the planned improvements. When the additions are implemented, the water supply load and line size requirements for the expansions will need to be determined by the mechanical engineer.

Sanitary Sewer

The plans indicate a sanitary sewer line, extending from NW Circle. If 6" diameter, as is common for this type of facility, then this line should be adequate to serve the future improvements.

Storm Sewer

The plans show a 10" dia. storm water pipe on the southwest edge as well as a 6" dia. pipe on the south border of the site. Based on this existing infrastructure, therefore, there should be adequate capacity for any planned expansion.

However, as with other major cities in Oregon, the City of Corvallis will likely require that future commercial developments treat stormwater prior to discharge from the site. With final design and construction likely to be a year to several years away, we recommend that the schematic planning of the stormwater system incorporate future Stormwater Management Methods. Generally, conveying stormwater from roof and paved surfaces to a bio-swale located along the south edge of the site should satisfy the majority of the additional treatment requirements.

Paving

The existing asphalt paving on driveways and parking areas appears to be in good shape. All new paving related to the improvements will need to be constructed with proper subgrade and pavement sections, designed to carry the functional loads imposed on the various different parking and driveway areas.

The south entrance to the UUFC is characterized by generous pedestrian paved areas constructed of exposed aggregate concrete. This paving is generally in good shape, although several sections exhibit large cracks and my need to be replaced. As with other paving, these improvements must be made upon a proper subgrade and must include control joints to ensure future stress fractures.

Public Improvements

Both NW Fir and Street and NW Circle Blvd are fully improved with curb, gutter, paving and sidewalk. Also all utilities have been extended to the site and it does not appear that any upsizing of these utilities will be required. Off-site work in the public right-of-way is not anticipated.

BUILDING STRUCTURE

Our observations are based on our review of the available historical plan sets as well as our walk-through of the building.

Note that prior to the definition of a comprehensive work scope such as would be delineated in schematic design documents, our observations will by force be limited to a summary of general structural systems and observation of any obvious structural deficiencies. Details and descriptions of specific structural requirements are not included in this summary and would naturally require additional review of historical and proposed plans, in-depth investigation of foundations, floor structures, and wall and ceiling cavities.

Building Type and Age

Our review of the plans indicates that the existing buildings were constructed in various phases from 1958 to 1988 (of course the original Adair Village barracks buildings were most likely built in the 1940's, then moved to the UUFC site in 1958). These structures include classrooms, offices, sanctuary, kitchen, social spaces, and accessory areas. The buildings are constructed principally of conventional light framed wood construction, various exposed heavy timber construction, and prefabricated roof trusses. According to the building code the structures are classified as non-fire-rated light wood frame (see Code Analysis).

Site

Prior to development, the original site topography was characterized by a natural slope of approximately 3% toward the south. The existing buildings appear to have been constructed on a partially excavated and flat-graded building pad. As such, much of the construction is likely to be built on original native soils. While the nature of this native base material is unknown at this time, our limited site investigation and observation of existing foundations and interior finishes revealed no significant settlement problems. It should be noted that anecdotal evidence indicates some standing water was observed in two places in the crawl space -under the east side of RE wing (possibly spill-over from a clogged downspout) and under the white storm water pipe under the kitchen (from a leak at one of the pipe fittings). These problems require prompt resolution to ensure that no other causes of higher concern (such as natural groundwater) need to be considered.

Planned Building Modifications

As discussed during our meeting at the site, we understand that proposed changes to the buildings involve the shuffling of existing social spaces, administrative offices, circulation, and kitchen, as well as the construction of significant building additions, new bathrooms and associated social and storage spaces, as well as new window and door openings in various interior and exterior walls. As the floors of the existing buildings are constructed of wood framing, there are some structural implications to the proposed shuffling of rooms and spaces, relating to design live loads. This may include a variety of new support beams, posts, short stud walls and strip foundations in the crawl spaces to support new, and shore up existing, framing structure.

Additionally, the proposed construction of new window and door openings poses the probability of significant design and construction work relating to the lateral force resisting system of the building, which is likely to be outdated relative to today's building codes. Where new openings are proposed in existing wood framed walls, similar requirements might take the form of adding plywood and/or additional nailing to some portion of the remaining walls of the building. Additional items such as tie-down hardware may also be required, in order to reinforce existing - or provide necessary connections between walls and foundations.

New areas of roof construction would, of course, need to meet the current snow load design requirements. Furthermore, where new framing would bear on existing framing or otherwise impose additional loads (such as new snow drifts), supplemental or entirely new framing could be required to bring the existing areas up to current design requirements. One such area would be the roof of the existing social hall, at its juncture with the new Social Hall, where the installation of a higher roof to the north would possibly result in the requirement for upgrading the existing roof framing to accommodate the potential snow drifts created on the lower roof.

Additional structural improvements not noted herein may also be required. Obviously, specific details of all the above-mentioned general requirements can only be provided after plans for all proposed changes are finalized.

Geo-Technical Investigation

The existing condition of the building shows no indication of major subsurface instability. However, as noted above, the addition of loads on existing building components and areas, as well as any large new building additions will need to be reviewed by a civil engineering firm. At the conclusion of the schematic design phase, prior to initiation of the design development phase, the owner will need to engage the services of a reputable geo-technical engineering firm familiar with the local conditions, to initiate test bores on the site, including specifically in the area of new construction. Besides the soils analysis, the engineer's work should include, at a minimum, erosion control measures; recommendations for subsurface preparation of foundations, site paving, and driveways; surface and subsurface drainage strategies and construction details; strategies and details for onsite treatment and mitigation of stormwater, including bio-swales and flow-through planters; stormwater system operations and maintenance documents; paving and curb construction details; and retaining wall construction and drainage recommendations (if relevant).

ELECTRICAL SYSTEMS

General

This report is the result of our visit to the UUFC campus in the Summer of 2007. Our observations and comments are based strictly on visual observation. Any further engineering effort would require in-depth review of existing documents associated with electrical systems and actual surveying of existing equipment.

In general, the building interior lighting system utilizes too few and very outdated fixtures, resulting in poor lighting quality throughout most of the building spaces. There is no emergency lighting along egress paths. The fire alarm system operates only partially and covers only some areas of the building. The electrical power system appears to be in fair condition.

Electrical Power System

The present electrical service is 208/120V, three-phase, with a 600A main breaker. There are several lighting and power panelboards in various locations to serve the area loads. The system has no back-up power.

<u>Recommendation:</u> The existing utility service appears to have sufficient power for the anticipated remodeling of the building. However, due to equipment aging and limited space for connecting new equipment, an electrical upgrade should be programmed. Under this upgrade, most panelboards should be considered for replacement with new and larger panels. The kitchen panel should be relocated to a different location in conjunction with the remodel and addition.

A small stand-by emergency generator system could be considered to support the facility's Life-Safety systems that would include egress lights, fire alarm and communication system.

Electrical Lighting System

The building interior has an assortment of outdated conventional T12 fluorescent prismatic lens (including square and corridor wraparounds, and recessed), old "classroom" fixtures, and residential-style wood framed ceiling fluorescent fixtures. Due to the age and insufficient number of fixtures, interior lighting levels are poor.

The present building exterior lighting is very minimal, consisting of a few sporadically placed utility flood lights or linear fluorescents. The entire parking lot is illuminated by only two pole-mounted lights.

Recommendation: Any improvement in lighting efficiency would reduce power consumption and release the system, making available spare capacity for the needed interior remodel and the addition. New lighting fixtures, with efficient T8 and T5 lamps, should be equipped with parabolic louvers, or should be direct/indirect type fixtures, to produce appropriate lighting quality and levels for the area where personal computers are used. Classroom fixtures should be controlled with automatic daylight sensors to conform to the state of Oregon Energy Code. To take full advantage of these automatic controls, the fixtures should be equipped with dimming ballasts. For further discussion on this subject, see below.

New poles with suitable lights should be located throughout the parking and driving paths, to provide adequate lighting level. Any exterior building-mounted incandescent lights should be replaced with high efficiency metal halide, LED, or fluorescent fixtures, depending on use and location.

Life Safety System

Egress Lighting: The existing lighting system along egress paths likely does not meet today's NFPA-101 (Life Safety Code) stringent requirements for minimum emergency illumination and City of Corvallis Fire Department's inspection procedure.

Recommendations: Maintaining a battery-back emergency lighting system would become expensive when the quantity of fixtures increases. Battery technology has improved considerably during the last 10 years, but battery life still remains short, whether it is actually used or not. To ensure that the battery is ready for emergency situation, it is required to be periodically tested. Therefore, a stand-by emergency generator could be considered for this size campus. The maintenance task would be reduced considerably by running and checking a single unit instead of individual batteries. A self-contained generator can be in the form of a rectangular locked box in the yard, or as close as 4 feet from the building wall. The generator should be sized for other critical systems or equipment, and especially for future expansion.

Fire Alarm System: The existing fire alarm system likely does not meet today's safety standard, particularly NFPA-72 and ADA.

Recommendations: An effective fire alarm system must be carefully planned so that when the alarm goes off, everyone in every corner of the building can be alerted both audibly and visually. Alarm strobes must be placed along the hallways, restrooms, and conference rooms.

LIGHTING SYSTEMS

Planning documents suggest that a significant remodel is likely to occur, but a final budget has not yet been determined. Consequently, our recommendations for a lighting system upgrade for this building are based on a few general construction principles.

In spaces where major architectural remodeling will occur, we generally recommend new energy efficient light fixtures to complement space functions and other architectural features. New fixtures selected for the space would also result in significantly improved lighting quality.

If space functions change, new fixtures may be recommended to accommodate the new uses. In some spaces, the cost of installing new fixtures will not be significantly greater than relocating and retrofitting existing fixtures. For example, larger conference rooms and classrooms may be marketable spaces where multiple functions can occur if new lighting systems are installed to accommodate different illuminance needs.

If an area is not scheduled for major architectural remodeling, we may recommend retrofitting existing fixtures with energy efficient lamps and electronic ballasts, as long as the existing fixtures have a significant service life remaining. Some salvaging from other removed fixtures may be cost effective.

Our recommendations are based on a plan with an average budget for upgrading lighting systems. We further assume that an energy efficient lighting design may qualify for incentives from the local utility to help offset the cost of installing high performance lighting components.

Existing Conditions

A number of the lighting systems at UUFC are nearing the end of their useful service life. There is a wide variety of fixtures, including industrial, utility, and residential grade, and some incandescent fixtures equipped with screw-base compact fluorescent lamps. There are numerous locations throughout the facility with incandescent and halogen, lighting including the social hall, foyer, sanctuary, and sanctuary gallery. Some luminaires have been replaced by more efficient T-8 fixtures. However, most of the luminaire types used in and around the facility are ineffective as efficient lighting sources, compared to current cost-effective technology. New energy- and light-efficient products are available that can greatly improve the efficiency of the lighting systems from 50 to 300 percent, depending on the existing equipment that is replaced. For example, an incandescent fixture producing 20 lumens per watt can be replaced by a compact fluorescent fixture producing 70 lumens or more per watt.

Recommendations:

Fluorescent Fixtures. Remove and replace all of the fluorescent fixtures that are powered by magnetic ballasts. Depending on the age of the lighting equipment, some of the ballasts may contain potentially-harmful PCB compounds. During a facility upgrade, recycling and disposing of these ballasts requires a modest additional cost, but the environmental benefits of removing PCB compounds outweigh this cost.

Incandescent Fixtures. Replace incandescent and halogen lamps located throughout the facility with compact fluorescent lamps (CFLs) or high-quality (we recommend only CREE Lighting, at this point) light emitting diode (LED) lamps.

Lighting System Operation. Light fixtures are energized by manual wall switches and switched circuit breakers. There are no automatic control devices. During our site visit, we noted that very few lights were energized in unoccupied spaces. The current staff recognizes that lights can be shut off in unused spaces and appears to be diligent in their commitment to save energy in this manner. However, installing occupancy sensor controls, especially in offices, classrooms, restrooms, hallways, storage rooms, and other appropriate areas would ensure the highest level of conservation.

Lighting Recommendations

We expect that a lighting system upgrade, using high efficiency components, could result in about 20 to 30 percent lower lighting system operating costs when compared to the existing systems. The lighting quality can be improved by installing four-foot F32T8 fluorescent lamps with a color rendering index greater than 82. Cost-effective lamps with service lives of 24,000 hours or

30,000 hours are available. High lumen output lamps (3,100 initial lumens) can be combined with a variety of electronic ballasts to provide the optimal illumination with minimum energy consumption.

If existing fluorescent fixtures are used, they can be retrofitted with new electronic ballasts, selected to optimize energy efficiency by ballast factor and starting method. Ballast factor choices include low, normal, and high ballast factor. Starting method choices include instant start, rapid start, and programmed rapid start. If architectural daylighting is added, it is also possible to install continuous dimming systems and automatic controls that can reduce electric lighting consumption when daylight is utilized.

Remove all fixtures with inefficient 8-foot lamps. New fixtures containing high efficacy 4-foot fluorescent lamps and electronic ballasts can result in significant energy savings. 8-foot high output fixture replacements have a mean efficacy of less than 50 lumens per watt. New fixtures with high-performance 4-foot F32T8 lamps and electronic ballasts, in contrast, can have a mean efficacy greater than 90 lumens per watt. Elimination of disturbing ballast hum will be an additional benefit.

Any metal halide fixtures can be replaced with linear fluorescent fixtures that have significantly higher color rendering, longer lamp life, and quiet ballast operation. In addition, the linear fluorescent fixtures can be switched off during short unoccupied periods, without having to wait for the lamps to restrike.

Incandescent lamps and fixtures can be retrofitted or replaced with compact fluorescent (CFL) screw-in lamps or new CFL fixtures. These new components will use 1/3 or less of the energy used by the incandescent lamps. However, the most environmentally beneficial strategy is to replace incandescent fixtures with CFL fixtures requiring the hi-efficiency bayonet-style lamps; this eliminates the need for the mercury-containing ballast that is an integral component of screw-type CFL lamps. Note that –despite the oft-repeated misconception– it is a scientifically proven fact that the use of CFL replacement lamps releases much less mercury into the environment –when the ballasts are disposed of in landfills, for example, or worse, dumped illegally– than the mercury released in the atmosphere by coal-burning power plants in order to produce the additional energy required to light an equivalent output incandescent screw-bulb.

EVALUATION OF EXISTING HVAC SYSTEMS

Space heating

Social Hall, kitchen, and lobby outside Gretchen's and Pam's offices

Gas furnace, Payne Company (La Puente, CA), model 160CFU, serial #50919, 510 series, 160,000 Btu/hr. input, 128,000 Btu/hr bonnet capacity, 68%–72% AFUE (Annual Fuel Utilization Efficiency).

Furnace serves social hall, kitchen, and lobby outside Gretchen's and Pam's offices. Furnace is probably oversized, making the furnace turn on and off more frequently than necessary and increasing fuel consumption.

Insulation of ducts in crawl space is damaged in places; there are disconnected ducts.

Pilot light sometimes extinguishes. Controlled by simple non-programmable thermostat in social hall.

Sanctuary

The room seems to have inadequate ventilation, occasionally leading to unpleasant chemical odors, perhaps due to off-gassing of carpets or other materials. Additionally, the space overheats during summer services even, with outdoor temperature in the 60 degree range. The sanctuary piano necessitates that the sanctuary be kept at 60 F or above at all times.

North Sanctuary system

The smaller of the two sanctuary furnaces is by Lennox, gas-fueled, model G16Q2-50-1, input of 50,000 Btu/hr, with pilot light, 81% AFUE.

White-Rodgers Thermostat, type # 1F81-26. Because this thermostat cannot be programmed to turn on only the furnace fan, it cannot be programmed to perform a night-flush to pre-cool the sanctuary at night during hot summer months.

Furnace supplies air only to two upper registers on the north wall, the return grille is below one of the supply registers.

Outside air damper is set to 3/8 open.

South Sanctuary system

The larger of the two sanctuary furnaces is by Lennox, gas fueled, model G12RQ5E-165-8, input of 165,000 Btu/hr, 79% AFUE.

Invensys thermostat. This thermostat can be programmed to operate the furnace fan and so can be programmed to perform a night-flush to pre-cool the sanctuary during hot summer months.

Supply ducts (well insulated) are in the crawl space, while return ducts enter furnace from the ceiling area. Location of the return air grille is unknown.

Outside air damper is set to 3/8 open.

Foyer

Heated by several manually operated electric resistance wall heaters. Sometimes the heaters are left on by mistake, wasting considerable energy.

There are floor registers on the east and west ends of the foyer. It is unknown whether they are connected to the Payne furnace off the social hall.

Pam's and Gretchen's offices

These spaces are the most highly used during the weekdays. These offices are heated by manually operated electric resistance wall heaters. Sometimes heaters are left on by mistake.

RE wing

Existing gas-fired furnace system appears to be function properly and has been services recently by heating contractor

<u>Water heaters</u>

Kitchen water heater under east counter

Bradford White, electric, 120V, model M120U6SS13, 0.90-0.93 energy factor, 19 gallons capacity, no upper heating element, lower heating element is 2,000W, temperature is set at 135 F.

Kitchen water heater under island

State, electric, 240V, model PV501LS1OH, 47 gallon capacity, 0.90-0.93 energy factor, no upper element, lower element is 4,500W, R-value of tank insulation is 16.7.Mfr'd 1983. Temperature is set to 140 F.

No tank insulation. No timer to turn off heat at night.

Supplies the island kitchen sink, Hobart dishwasher (model SR24C), and the two lavatories in bathrooms. Probable peak demand of 47 gallons per hour.

Good pipe insulation in crawl space.

Religious Education water heater

State, natural gas, model PRV 40 NRT2 H, 40 gallon capacity, 32,000 Btu/hr input, with pilot light. Temperature set below "energy saving" setting but still above the "warm" setting. Energy Factor (EF) of 0.50-0.60.

Serves 1 kitchen sink, 8 classroom sinks, 1 bathtub/shower, and 4 lavatories. Probable peak demand of 23 gallons per hour.

Pipe insulation in crawl space looks good, except for some areas under rooms 7 and 8.

CODE ANALYSIS

Meeting with Plans Examiner Bill Clemens and Planner Jason Yaich 541-766-6929

Proposed building: New building, 16,142 sf proposed
Existing Construction Type: V-B unrated wood construction, sprinklered
Occupancy: A-3 Assembly occupancy (Sect. 303)
Table 503 permits only max 6000 sf and 1 story for A3
Area Modifications (Sect. 506): Increase permitted to 22,260 sf and 2 stories, due to sprinklers and frontage/yards setbacks
Sprinklers permit an increase of floor area over Table 503 (Sect. 504.2), plus 20 ft in height and one additional story
Plans Examiner Bill Clemens states that it is necessary to design to the most restrictive occupancy, which is A3
Occupancy separation (Table 508.3.3): no separation required between A3 and other occupancies as long as accessory B occupancy areas are less than 750 sf (Sect. 508.3.1, exception 2)

Maximum floor area allowances per occupant (Table 1004.1.1):

Assembly-concentrated use	7 sf net
Assembly-tables and chairs	15 sf net
Daycare	35 sf net
Classrooms	20 sf net
Business	100 sf gross

Table 1004.1.1, exception: bldg official may allow fewer occupants than prescribed in the table
Sect. 1004.2 allows increased occupant load, to 7 sf/occ. As long as other code req'ts are met for higher occupancy load

Building Uses:

- Group E Occupancy (Sect. 305.2) Daycare: educational, supervision, or personal care services for more than 5 children older than 2.5 yrs shall be classified as Group E occupancy
- Group B Occupancy (Sect. 304): office uses and education above 12th grade
- Education for students above 12th grade can be considered B occupancy
- Sect. 303, exception 3: If rooms are less than 750 sf and accessory to other uses, then they may be considered as a B occupancy
- Sanctuary: Assembly concentrated use ---7 sf net / occupant
- Social Hall: Assembly, unconcentrated use ---15 sf net / occupant
- religious education rooms accessory to religious buildings and w/ less than 100 occupants are classified as A3 (Sect. 305)

Mezzanine:

- may be 1/3 of the area or room served; mezzanine requires 2 exits into the space to which it is connected, neither exit needs to be enclosed. If the stairs don't end up in that room then it will be necessary to provide rated doors at the bottom of the stairs.
- Stairs and mezzanine may be unrated, but a door is required at bottom of stairs

Corridors:

- Corridor needs no rating (Table 1017.1), no rating required w/ sprinklers; if RE wing is seen as E occupancy then no rating is req'd for corridor if each classroom has an exit to the outdoors (Sect. 1017)

Ramps:

- Ramp required off decks and panic hardware on gates

Exits:

- Table 1015.1: A, B, E occupancies require only one exit for 49 or fewer occupants
- Daycare use requires 2 exits if higher than 10 occupants
- 2nd floor Assembly occupancy –if sprinklered - allows for only one rated stair to the outside, in addition to another unrated stair to the inside
- Exit required at the end of the corridor, due to dead-end restriction (Table 1017.1)
- Entry Foyer: Not required to be 1-hr rated as long as RE Wing has doors
- Hallway to Social Hall: Not considered a corridor and will not need to be rated

Kitchen:

- Needs 1-hr separation from adjoining spaces; including shutters at pass-throughs

Parking:

- 1 space per 4 fixed seats or 1 space per 50 sf of public space
- Adding more than 2 new spaces requires a total parking upgrade to meet current code
- Only major use will be used to count parking; based on current sanctuary will need at least 50 spaces. Note that changing to Social Hall as Sanctuary in the future will require re-evaluation of parking req'ts (this would in any case also require a review of the conditional use permit CUP)
- 40% compact
- 10% reduction for bus stop within 300 yards
- 10% reduction for bike facilities
- Possible additional reductions

Conditional Use Permit: Modification of CUP will be required

MASTERPLAN DESIGN NARRATIVE

(Refer to existing and proposed Masterplan Design Drawings in the Appendix)

The work resulting from the two month-long combined efforts of the SEA team, their consultants and owner's group of representatives is graphically illustrated and described on two 18" x 24" final presentation boards (see Appendix) that were presented to the leadership on August 26, 2007. In the process of putting together the final product, we discussed, researched and compared dozens of issues, problems and opportunities. Throughout the process we kept in mind the following major themes:

1. Reflecting its leadership in upholding positive environmental values, the UUFC is committed to a project with a strong emphasis in sustainability.
2. Wise use of resources through renovations and additions that rehabilitate/reuse/recycle as much as possible of the existing the building.
3. Consider phasing that permits the projects to be implemented over time, in accordance with availability of funds.
4. Improve the proper functioning of current operations while keeping in mind adaptability for future functional needs and expansion.
5. Correct deficiencies in building infrastructure, including universal access, lighting, electrical, HVAC systems, and parking.
6. As a non-profit organization, UUFC will need to raise funds through capital campaigns, grants, donations, and community partnerships.

The Big Ideas: Design Concepts, Opportunities and Solutions

The design team's final presentation is characterized by the following design concepts, opportunities and solutions, some of which are discussed in detail below.

A positive and exemplary presence in your Community

UUFC represents a strong positive presence in its community, an image that is reflective of its mission of education, inclusiveness, environmental activism, and community service. The following proposed design strategies help promote this leadership:

- A lush and healthy landscape is aesthetically and spiritually uplifting.
- A comprehensive Masterplanning process will include a fully integrated landscape design concept.
- Incorporation trees and vegetation, bioswales and storm-water retention pond(s).
- Landscaping that is user-friendly, native and/or drought-resistant, low-maintenance, and provides beneficial wildlife habitat.
- Exhibit and demonstrate sustainability principles through natural, local, strongly textured materials; promote recycling that works; incorporate skylights, solar power, wind power, stormwater collection, and recycling centers.
- Maintain a beautiful edge along the street, with native vegetation, shade trees, and

bioswale(s).

- Create an attractive and inviting entrance to the site and the building –the main vehicular access and the main pedestrian entrance all converge to one, attractive clear entry gate.
- Build in the Northwest vernacular, with large (composite) wood beams and posts, natural rocks, attractive exposed hardware, etc.

Parking

- Automobile parking should be developed in clustered pockets surrounded by landscaping to soften its appearance, and by shade trees to reduce the heat island effect typical to surface parking lots.

Improved entries

- Develop a central point of contact with clearly recognizable entry and dropoff.
- Create a hub, the point of contact for all who arrive at the building –the reception, visible, clear, and accessible. The new Social Hall entry will include a large inviting entrance deck stairs and ramp, path, and patio, perfect for socializing and celebrating family and community.
- Provide and promote universal and easy access for all, with inviting ramps, walkways, stairs and terraces.
- At the Main Entrance, on NW Firwood Street, create a Gateway to the campus, with a nice large sign.

Good personal work space

- Create great, functional and comfortable workspaces, better organized, clustered to allow people who work together to be more functionally grouped together
- Develop the needed spaces to permit people to carry out the work they need to do – including private offices, social/shared spaces, and the support spaces such as kitchen, dining, restrooms, etc.

Bright, functional spaces that work well

Redesign the facility's interior spaces, and construct additions of new spaces, so that staff can work in comfortable and functional spaces, and the educational programs benefit from spaces and support amenities that meet the functional needs of its users -be they teachers, students, community members, informal groups, and the like:

- In the existing administrative area, design improved administrative offices, reception, and ministers' offices.
- Outside of the existing main entry off NW Circle Blvd, create a small vestibule with large coat closets.
- In the location of the existing kitchen, build a large informal Meeting Room, with a fireplace, comfortable furniture, a coffee bar, and open connection to the existing east deck.
- Renovate the existing RE wing to provide improved accessibility, a larger number of

flexible and specialized classrooms and meeting spaces, better acoustical separation of spaces, more storage, improved offices and library, and better lighting throughout. On the second floor renovate the entire area, by designing three large classrooms, improved restroom facilities, an elevator for full accessibility, and new storage.

- To the north, add a new 2400 sf octagonal public space, intended as a multi-functional social hall with the capacity to accommodate large numbers of people and a variety of activities and events. As the membership of the UUFC grows, this new space could be converted into a new sanctuary, while the current sanctuary could be used as the social hall.
- Between the new Hall and the new Meeting Room, build a large new commercial kitchen and serving area. The new kitchen, serving area and Social Hall will provide the UUFC with the opportunity to rent out the spaces for weddings and other large events.

ENERGY EFFICIENCY STRATEGIES

We take a very specific approach to energy efficiency design, and we have developed a set of strategies that allow us to get the best building possible at the least cost. The efficiency design strategies are structured with the goal of minimizing the required work (in the thermodynamic sense) associated with the infrastructure of a building. Often referred to as the "Systems Approach" or "Downstream Thinking," a strategy of minimizing work can result in minimal site impact, maximum resource efficiency, efficient and sustainable materials of construction and occupancy practices, and a superior environment for the building's occupants. The efficiency strategies are organized and identified as the following categories:

1. Create Small Loads
2. Reduce loads
3. Efficient Plant
4. Efficient HVAC Systems
5. Integrative Controls
6. On-Site Renewable Resources

Design strategies that minimize loads are a natural fit for the larger set of sustainability concepts. Each strategy set builds on the previous set. Reducing loads implies a reduction of all waste streams, resulting in the elimination of unnecessary energy and water use, as well as the minimization of solid waste streams. Once waste streams have been minimized, efficiency can be maximized.

TARGETED PROJECT EFFICIENCY STRATEGIES

1. CREATE SMALL LOADS

Optimal grouping of programmatic areas with similar load and schedule characteristics. Grouping of public functions allows for optimal scheduling of comfort systems (HVAC and lighting) to best match actual occupancy patterns.

Thermal and visual comfort criteria are tuned to specific space functions. Visual and thermal comfort criteria are established on a space-by-space basis. East and west glazing, with their associated solar control difficulties, can be reduced or possibly eliminated from the project.

High efficiency exterior lighting -only as needed- with combination timeclock-photocell control. Exterior lighting is designed to meet area and security lighting needs. Exterior lighting controls should be able to de-energize most of the exterior lights after the last occupants leave the facility.

2. REDUCE LOADS

A. Reduce Envelope Loads

Exterior shading elements for fenestration, to control solar heat gain. All windows, other than north-facing glazing, should be equipped with exterior shading elements that will prevent solar heat gain during the cooling season. Design of exterior shades should be integrated into architectural daylighting concepts.

Tuned insulation levels in walls and roof with minimum air-leakage and thermal bridging. Higher-than-code insulation levels should be evaluated for walls and roofs. Special attention should be given to the location of insulation and to the construction details of the wall. Careful detailing and implementation of exceptional air-sealing is critical. Thermal bridging effects should be minimized or eliminated. With new high-efficiency windows and doors, new exterior insulated building sheathing, and elimination of superfluous thermal bridging, air-leakage rates of 2.5 ACH50 (air changes per hour at 50 Pascal pressure) can be achieved.

Reflective roof, as applicable. Exterior roof color and mass should be designed and specified to minimize transmission of solar heat. This can be accomplished with reflective roof membranes, green "living" roofs, or roof shading elements (such as photovoltaic and solar thermal panel arrays).

Optimized window geometry (in support of daylighting and view criteria). Window area and configuration should be driven by daylighting and view criteria. View windows should be designed in such a manner as to provide appropriate and comfortable intermittent visual connections to the outdoors and allow operation by the occupants, yet be located, sized and spaced to limit excessive heat loss or solar gain. View windows should be equipped with internal shade- and glare-control devices that can be controlled by occupants, while daylight windows (located high) are not typically equipped with interior shading devices -though they may be provided with light shelves or louvers to control glare.

High performance glazing and thermally-improved window framing. Glass and glazing frames should be specified with thermal and optical characteristics that are correctly tailored to the performance goals of specific windows.

B. Reduce Internal Loads

Daylighting. Artificial lighting accounts for as much as 40% to 50% of the energy consumption in most commercial and institutional buildings. Effective daylighting design introduces natural light while balancing the elements of artificial lighting, solar heat gain, heat loss through glazing, and internal sources of heat gain. It attempts to maximize diffused light throughout the building interior, minimize direct sunlight and control heat gain. To be most effective, daylighting must be integrated with electric lighting, lighting controls, heating, cooling, and ventilation systems and occupant movement patterns. Success will provide a comfortable and energy-efficient building. This success results in savings to the building owners -through reduced construction costs for electrical lighting and HVAC, and savings to the building tenants -through decreased operating costs, increased sales, and increased performance by building occupants.

Successful daylighting begins with building orientation and ends with proper daylighting controls, the correct combination of interior finishes, lighting, ballasts and sensors. There are somewhere between six and ten key elements to a successful daylighting system. If the design team fails to implement any of them perfectly, it will fail to achieve the systemic effect of daylighting. If one does four things 90 percent right, the building ends up with a solution that is about 60 percent as good as it could have been.

Daylighting and Productivity. Ongoing research into daylighting as a source of energy conservation is voluminous. The subject of daylighting became common currency, however, when the Heschong Mahone Group's study on daylighting and productivity demonstrated that daylighting, the effective combination of exterior glazing, skylights and control systems, a) greatly improved student performance in schools and b) boosted retail sales in malls and shopping centers.

Cost Effectiveness of Daylighting. To be cost-effective, the savings on lighting and cooling must offset the costs of buying, installing, and operating daylighting features in a reasonable amount of time. Typically, and depending upon the percentage of the total construction budget devoted to daylighting, the payback period for new buildings is only from two to five years.

Daylighting can reduce overall construction costs—through dramatic reductions of mechanical system costs. Indeed, the design of a high-performance glazing system combined with daylighting controls may result in up to 35% annual savings in energy and operating costs.

C. Lighting Controls

Integrated daylighting / electric lighting dimming control for ambient interior lighting system. This is a high priority strategy for an energy-efficient building. Ambient electric lighting fixtures, located in daylit areas, should be equipped with continuous dimming controls.

High efficiency light sources – ambient and task lighting systems. Both ambient and task lighting systems should predominately use high efficiency fluorescent light sources. The ambient lighting system might combine programmed-start, low-ballast factor (or dimming electronic) ballasts with extended life high output T8 fluorescent lamps. The task lighting design should be composed entirely of high efficiency fluorescent source fixtures, including CFL, T5, and T8 sources.

Comprehensive installation of occupancy sensor lighting (and plug) control. Occupancy sensor lighting controls should be used extensively in the lighting design. Lighting fixtures should be controlled by occupancy sensors in private offices, meeting rooms and utility areas. The design should provide for portable electric lighting devices to be connected to dedicated occupancy sensor controlled receptacles

D. Plug Loads

Purchase of efficient electric equipment (monitors, computers, refrigerators, dishwashers, washing machines, etc.). Office equipment and appliances should be selected using energy efficiency criteria (in addition to other relevant criteria). Office planning and equipment placement should be coordinated to maintain total connected equipment load at 1.0 watt per square foot or less. This effort to reduce plug load will need to continue over the life of the facility. An initial equipment replacement plan should be included in the original design, detailing equipment replacement plans for the first five years.

Automatic unoccupied period control of selected electric receptacle loads. The electrical design should provide for selected receptacle loads to be connected to dedicated automatically controlled receptacles. Loads connected to automatically controlled outlets will be de-energized during unoccupied periods, or on a customized-time schedule.

E. Other Loads

Water efficient plumbing fixtures for hot water-using fixtures. The plumbing design should incorporate hot water conserving fixtures to minimize hot water consumption, consistent with occupant needs. Low flow showerheads (1.5 to 2.0 GPM), low flow faucets (0.5 GPM), and automatic sensor valves should be used extensively in the plumbing design.

3. EFFICIENT PLANT

For space heating the following options are considered, in order of increasing energy efficiency:

- Ground-source water-to-air heat pumps with ducted air for heated spaces. This option would allow for the addition of air cooling and filtering.
- Ground-source water-to-water heat pumps supplying heated water to unit ventilators and/or fan-coil units ducted to heated spaces.
- Split Ductless Heat Pump system (air-to-air) supplying heads in each space or room. Requires additional mechanical or natural ventilation for fresh air. This system would permit both heating and cooling.
- High-efficiency gas water heaters supplying unit ventilators

4. EFFICIENT HEATING VENTILATION AND COOLING SYSTEMS

A. Gas and Electric Utility Billing Takeoffs:

A combined average yearly electrical heating consumption of about **49,000 KWh** was derived using UUFC gas and electric utility billing records for the years 2006-2009. This number includes heating energy only; baseload energy used for lighting, appliances, and hot water was deducted from the total billings. At current CPI electricity rates, this translates to about **$3950** spent yearly on electrical energy equivalent for heating (note that all electrical energy costs are at the **current $.08/KWh price**.)

Natural gas heating therms were converted to electrical energy KWh to facilitate heating energy savings calculations using electric ground source and air source heat pumps, and to make on-site photovoltaic system capacity equivalences easier. Keep in mind that over the last 30 years electric rates in Oregon have risen at 5% per year. Savings from efficiency upgrades increase with electric rates.

B. Thermal and Pressure Envelope Improvements to Existing Buildings:

The buildings in the existing complex vary in age and shell insulation levels. Approximate yearly energy savings of 20-35% may be gained by improving the entire complex to current residential new construction levels (R-38 ceiling, R-21 wall, R-30 floor, U-0.35 windows) or better.

A thorough envelope upgrade is the first improvement to make to the complex. Thermal and pressure envelope improvements are effective for several reasons in this situation; reducing the heating loads makes the building more comfortable, reduces the carbon footprint, can reduce the cost of new –smaller- heating system equipment by up to 1/4th, and may allow the re-use of existing heating ductwork with the cooler delivered air characteristic of heat pumps. The yearly electrical heating energy equivalent can be brought down into a **33-38,000 KWh ($2640-3050 yearly energy cost)** range by insulating and air sealing.

The insulation R-values in some parts of the building may warrant removal of existing siding to add rigid insulating sheathing, which will also provide a real opportunity for building envelope air-sealing. Air-sealing and insulation work should be performed by a contractor very familiar with the NW Energy Star Homes Thermal Bypass Checklist.

Window upgrades with operable panels can also improve natural ventilation in most of the spaces in the complex, saving ventilation energy costs. The skylight in the sanctuary can be replaced with an opening unit to provide inexpensive ventilation when needed. Windows are now readily available with U values at 0.32 (double-glazed) to 0.18 (triple-glazed or with one or more suspended film between two glass panes).

Forced air ductwork sealing and insulation should be performed with any heating system changes and perhaps even before then if disconnects or large leaks are visible.

C. Heating and Ventilation System Upgrades:

a. Ground Source Heat Pump for Space Heating

The energy efficiency of the existing forced air and electric resistance heating systems can be dramatically improved by investing in **Ground Source Heat Pump (GSHP)** air handlers to supply heating air, and/or installing a zoning system so that areas of the building that are used at different times can be heated or set back accordingly.

The GSHP has a Coefficient of Performance (COP) of about 3.6, meaning it uses less than 1/3rd the energy to produce the same heat as an electric resistance heater that has a COP of 1. The Religious Exploration building is a zone in itself. Four zones are probably appropriate in the remainder of the existing building complex, with a fifth zone in the proposed new Social Hall addition.

Upgrading to GSHP air handlers can bring the weatherized 33-38,000 KWh yearly electrical heating energy equivalent down into a **12-15,000 KWh ($960-1200 yearly energy cost)** range.

The exciting corollary of the combined envelope improvements and highly efficient electrical heat source is that the yearly total energy consumption of the complex has been lowered much closer to the yearly power output of a **22KW PV system**. (There will be some take-back effect if the cooling capacities of the new system are used often.)

(Cost estimates provided here are for rough scoping purposes only. Proposals from heating contractors based on an engineered system design will show whether it is more economical to install one or up to three heat pumps for the heating loads and zones.)

The cost of making this GSHP upgrade in the Meeting Hall/Social Hall/Office complex will probably be in a $20-35K range. The proposed new Social Hall addition will probably need its own GSHP air handler, at a cost range of $18-30K. The Religious Exploration building will also probably need its own GSHP air handler, at a cost range of $25-38K.

b. Ground Source Heat Pump combined with Solar for Water Heating

Complementing a 2-3 panel solar thermal water heating system, a dedicated domestic water heating coil can be built into a GSHP, which would provide hot water backup for the complex solar hot water system at a COP of 3 or more. The solar hot water system itself has a COP of 20-25.

c. Heat Recovery Ventilation

As part of the heating source upgrade, independently-ducted Heat Recovery Ventilators (HRV), with a bypass or economizer mode, should be considered to recover heat energy from exhaust airflows and return it to incoming fresh air. A good HRV, with a combined heat recovery and motor efficiency of 89% to 93% has a COP of 7 to 12, so it is a very energy efficient means of keeping the heat in a commercial building that needs a lot of ventilation air. In economizer mode, outside air is introduced directly into the building for low-cost ventilation and cooling. One to three commercial HRVs should probably be installed, at a total cost range of $30-50K.

d. Split Ductless Heat Pump Alternative

An alternative technology to consider for heating the many Religious Exploration (RE) building classrooms and offices nearby is an air-source Daikin multi-head Split Ductless Heat Pump (SDHP). The SDHP is an alternative to the GSHP in this application, because it has a COP around 3 or better, and a commercial unit can both heat or cool up to 10 rooms independently from each other. They are extremely quiet inside and outside.

The only drawback to the SDHP is that because it is an air-source system, it requires a backup heating system for the times when the outdoor temperature falls below 28 degrees. However, since it isn't that cold very often in Corvallis, the existing heating system could back up the SDHP, as well as provide ventilation air. The 3-line Daikin SDHP commercial system is specified here because it alone efficiently simultaneously heats and cools different zones on the same compressor unit.

The RE building would need two of these multi-head units, and there would be capacity on the second-floor outdoor unit to supply heat to maybe six other offices or spaces nearby; or a less costly 4-head unit could be installed for the RE second floor only.

The SDHPs could be installed at a cost range of $25-45K, depending on how many indoor heads are needed. The SDHPs could reduce the weatherized 33-38,000 KWh yearly electrical heating energy equivalent down into a **15-18,000 KWh ($1200-1450 yearly energy cost)** range. This is not quite as low as the GSHP option, and SDHPs do not make hot water to back up the solar hot water system. Additionally, in general, air-source heat pumps require more maintenance than GSHPs.

e. Ducting:

For energy efficiency and longevity, any forced air and HRV ducting should be built with galvanized steel ductwork, sealed with duct mastic, tested for leakage with a Duct Blaster, and insulated to at least R-11. Higher R-value is better for ducts carrying hot air. Ductboard should never be used, under any circumstances. Flex duct, if used at all, should only be used for sound attenuation, in short lengths, where it is easily accessible for inspection and replacement. Building the system to NW Energy Star specifications, which should be attached to the construction contract, will help insure an energy-efficient system that will last as long as the building.

f. Natural Ventilation

We propose that most spaces be naturally ventilated. Summer comfort will be encouraged through a combination of passive strategies, including:

- Improved envelope insulation
- Improved shading of exterior wall surfaces and glazing through shading devices and vegetation

- Improved reflectivity characteristics of exterior roof and wall surfaces
- Reduction of internal gains (increased daylighting, high-efficiency lighting and controls, and reduction of plug loads)
- Natural ventilation integrated with thermal mass

Natural ventilation capability could be integrated, allowing two modes of passive operation:

- Natural ventilation mode: Natural ventilation mode occurs during the occupied period when ambient weather is mild and spaces are calling for cooling. Dedicated louvered natural ventilation openings can be enabled.
- Night flush for pre-cooling of interior thermal mass surfaces (plaster and gypsum board; concrete, tile and stone floors and countertops): Automatic night flush controls will open natural ventilation dampers to allow cool night air to pre-cool the building, especially any floor slab.
- Low velocity ceiling fans can provide air movement in naturally ventilated spaces, promoting evaporative and convective cooling benefits for the building occupants.

5. INTEGRATIVE CONTROLS

Options include:

1. Direct digital control (DDC)-implemented sequences that support automatic temperature control and equipment operation for the HVAC approaches discussed above.

2. Manual programmable thermostat for individual zones.

6. ON-SITE ENERGY GENERATION AND RENEWABLE RESOURCES

(See PV System Proposal in Appendix)

Self-contained photovoltaic exterior lighting system. Exterior lighting can be powered by a dedicated low voltage photovoltaic system, integrated into the lighting system.

Building-integrated (and grid interactive) photovoltaic system using window sunshades and roof area as module array locations. A photovoltaic system incorporating an inverter and grid inter-tie will help offset building electrical loads. Photovoltaic modules should be integrated into the building exterior design wherever practicable, such as exterior shading devices. Roof area should be used for installation of conventional modules.

Solar water heating system to serve major potable hot water loads. Potable water heating would be via flat plate solar collectors. Supplemental heating would be via heat pump water heaters tied to the earth loop, or via heat exchanger connection to condensing boiler loop.

PARTNERSHIPS FOR TRANSFORMATION

The new Masterplan for UUFC comes with many opportunities for partnerships that will help ensure its success. Successful implementation of this Plan will necessitate the attention and dedicated work on the part of several individuals over a period of several years. A major component of this work will involve raising the funds necessary for the project, through capital campaigns, grants, and donations. However, the search for, and organization of, in-kind donations, service exchanges, and partnerships, resulting in donated services, tax credits and incentives, favorable credit, rebates and discounts will be a crucial component for a successful realization of the project. There is no doubt that, as this effort progresses, additional opportunities will present themselves, but following is a discussion of some of the potential alliances, programs, incentives, and opportunities available for this project.

Below is a summary of some of the potential partnerships available to UUFC to help design, fund, implement, construct, and commission building and energy efficiency projects.

1. PARTNERSHIP: OREGON DEPT OF ENERGY

(See additional ODOE incentives information in the Appendix)

The Oregon Department of Energy offers the Business Energy Tax Credit to those who invest in energy conservation, recycling, renewable energy resources and less-polluting transportation fuels.

Business Energy Tax Credit

The Oregon Department of Energy (ODOE) offers the Business Energy Tax Credit (BETC) to those who invest in energy conservation, renewable energy resources, and sustainable buildings. Energy-efficiency and renewable energy improvements are right in line with the purpose of public and nonprofit organizations—to serve others. Reducing energy costs frees funds for important projects, and demonstrates the organization's good stewardship of taxpayer or contributor dollars. Energy-efficiency projects have an immediate effect on operating expenses, and many building upgrades return their investment in just three to five years or less. These improvements also create more comfortable conditions for employees, visitors and guests while conserving resources and reducing the organization's environmental impact.

For a range of non-profit organizations Energy Trust can help with cash incentives, technical assistance, finding a contractor, installation and renewable energy solutions like solar electric, solar water heating and more.

Typically trade, business or rental property owners who pay taxes for a business site in Oregon are eligible for the tax credit. However, a project owner can also be an Oregon non-profit organization, such as a religious institution, that partners with an Oregon business or resident who has an Oregon tax liability. This can be done using the Pass-through Option.

Pass-Through Option for religious institutions

The Pass-through Option allows a project owner to transfer their Business Energy Tax Credit project eligibility to a pass-through partner for a lump-sum cash payment. A project owner may be a public entity or non-profit organization, such as a church, with no tax liability or a business with tax liability that chooses to use the Pass-through Option.

2. PARTNERSHIP: CORVALLIS PUBLIC UTILITY

Pacific Power works in partnership with the Energy Trust of Oregon to provide energy efficiency incentives to building owners and organizations.

3. PARTNERSHIP: ENERGY TRUST OF OREGON, INC.

Houses of worship can be very inspirational—but lots of windows and large spaces also create buildings that are expensive to heat and cool. With many congregations operating on small budgets, energy efficiency presents an opportunity to demonstrate stewardship of both your financial and natural resources. ENERGY STAR® estimates that most congregations can cut energy costs by up to 30 percent through efficient equipment, facility upgrades and maintenance.

Energy Trust of Oregon is an independent nonprofit organization dedicated to helping Oregonians benefit from saving energy and tapping renewable resources. Its services, cash incentives and solutions have helped customers of Portland General Electric, Pacific Power, NW Natural and Cascade Natural Gas save over $600 million in energy costs.

Energy Trust provides Oregon congregations with cash incentives for making energy-efficiency upgrades—as well as implementing smart energy solutions in new houses of worship—that save energy, reduce operating costs, improve comfort, help cool global warming and contribute to a more sustainable energy future. Areas of assistance include:

- **Heating + Cooling**
- **Insulation**
- **Lighting + Lighting Controls**
- **Solar Electric**
- **Solar Water Heating**
- **Wind – Commercial Scale**
- **Wind – Small Scale**

Additionally, Energy Trust offers incentives to offset the costs of professional services required to meet the project energy goals.

- **Early Design Assistance**
- **Energy Modeling Assistance**
- **Commissioning**

Installation incentives help finance the costs of energy-efficient equipment and systems that help your building exceed 2010 Oregon Energy Efficiency Specialty Code.

- **Standard Equipment**

- **Lighting and HVAC**
- **Modeled Savings**
- **LEED®** Energy Trust offers incentives to projects that achieve any level of LEED certification and save energy beyond the 2010 Oregon Energy Efficiency Specialty Code
- **ENERGY STAR®** Once the building is constructed and occupied, Energy Trust can help cover the costs of earning the ENERGY STAR from the U.S. Environmental Protection Agency

4. PARTNERSHIP: LEED - LEADERSHIP FOR ENERGY EFFICIENCY & ENVIRONMENTAL DESIGN

The United States Green Building Council's (USGBC) LEED Green Building Rating System is a voluntary, consensus-based, market-driven building rating system based on existing proven technology. It evaluates environmental performance from a whole building perspective over a building's life cycle, providing a definitive standard for what constitutes a "green building." LEED is a measurement system designed for rating new and existing commercial, institutional, and high-rise residential buildings. It is based on accepted energy and environmental principles and strikes a balance between known established practices and emerging concepts.

LEED is organized into the five environmental categories of Sustainable Sites, Water Efficiency, Energy & Atmosphere, Indoor Environmental Quality, and Materials & Resources. An additional category -Innovation & Design Process- addresses design measures not covered under the five environmental categories, as well as sustainable building expertise.

It is a performance-oriented system where credits are earned for satisfying each criterion. Different levels of green building certification are awarded based on the total credits earned. The system is designed to be comprehensive in scope, yet simple in operation.

To earn LEED certification, the applicant project must satisfy all of the prerequisites and a minimum number of points to attain the established LEED project medal ratings of Certified, Silver, Gold, or Platinum.

There are now LEED programs for nearly every conceivable building project type, including for LEED for Existing Buildings (LEED-EB), LEED for Commercial Interiors (LEED-CI), LEED for New Construction (LEED-NC), and LEED for Operations & Maintenance (LEED-O&M). A building may earn certification in more than one program; UUFC could earn, for example, LEED-EB for remodeling and adding on to the existing building and LEED-O&M for exemplary operational and maintenance improvements.

Benefits of LEED Certification

Significant national recognition and publication on the USGBC web site

Significant local publicity and recognition

Significant State financial incentives through the Oregon Dept. of Energy, and through the local utilities and Energy Trust of Oregon.

LEED Certification for UUFC

In order to pursue LEED certification in earnest, a sustainable design workshop led by a LEED-accredited design professional, schematic design phase energy analysis, in-depth programming, implementation of sustainable design measures incorporated in the construction documents, and –finally- commissioning of the project will all be required. As mentioned elsewhere in this report, financial support for professionals' fees may be included in the incentive packages.

5. PARTNERSHIP: UO DEPT. OF LANDSCAPE ARCHITECTURE

The UO Landscape Architecture department offers studios and courses with depth and variety, which arises from a congruence of faculty expertise and the resources of the community and region. This is reflected in the school projects focused on local urban issues, rural area and small community development, neighborhood planning and design, park and open space design, planting design within the regional context, and ecological design and planning.

The department and its faculty are keen on connecting its students with real-life projects, especially within the wider community in order to provide them with an opportunity for personal development through environmental problem-solving and project-oriented study. The UUFC project could be an opportunity for a class of students to conceptualize a site development concept and construction program and perhaps assist the Fellowship in the implementation of the chosen concept.

6. PARTNERSHIP: ECUMENICAL MINISTRIES OF OREGON

Mission and Vision – Oregon Interfaith Power & Light

Oregon Interfaith Power & Light (OIPL) engages the faith community to strive for accountability in our individual and collective energy decisions in an interdependent world. Their vision is a rich, abundant life for all creation rooted in renewable resources for a society moving into a post-fossil fuel era. The principles guiding this our vision include justice, equality, compassion and respect for the sacredness of Earth.

Oregon Interfaith Power & Light realizes its vision through:

- Compelling models of low-carbon facilities and lifestyles.
- Workshops on energy efficiency and conservation for congregations.
- Grassroots advocacy for global warming solutions, policies and initiatives.
- A cool congregation program to reduce carbon footprints.
- A solar congregation and renewable energy program.
- Opportunities for theological and spiritual reflection.

Cool Congregations

Interfaith Power & Light is mobilizing a religious response to global warming in congregations through the promotion of renewable energy, energy efficiency, and conservation.

www. http://coolcongregations.com/

Cool Congregation Calculator. Use our Cool Congregations Calculator to estimate your congregation's carbon footprint. It offers a snapshot of your carbon footprint, allowing you to look at the best places to lower your footprint and become more energy smart. We break your carbon footprint down into four sub-components:

Energy use: we estimate the carbon emissions from your congregation's use of electricity, natural gas and other fuels.

Transportation: carbon emissions from congregations and staff travel.

Goods and services: carbon emissions associated with food, office products, cleaning products, and everything else your congregation purchases.

Waste: emissions from landfill waste (mainly methane) converted into carbon equivalent units.

Then we give credit for lands your congregation may manage in their natural state as carbon sinks and for any carbon offsets your congregation has purchased.

CONCLUSION

The purpose of this Masterplan study was first and foremost to improve the UUFC's functional infrastructure, so the Fellowship can most effectively carry out its mission to promote justice, spirituality and environmental stewardship. The infrastructural improvements will include demolition of some portions of the building to make way for some remodeling as well as additions of new spaces. As these moves are considered, the temptation to choose the most expedient solution will be strong, given the fact that construction funding usually is a challenge for most non-profit organizations. However, given the Fellowship's mission of stewardship, and the fact that, after staff salaries and benefits the greatest costs are operations and maintenance of the facilities, the long-term view strongly suggests building as green as possible.

1. A green UUFC will save energy. Buildings account for 39.4% of the total U.S. energy consumption. Through intelligent building design, solar orientation, air sealing, high performance windows, efficient HVAC, and much increased insulation this demand can be cut in half or even more. As our rough analysis of HVAC and Envelope improvements (see Appendix: Estimated Energy Savings From Electric and Envelope Efficiency), the UUFC has the opportunity to reduce its energy costs considerably. We suggest considering LEED (see www, usgbc.org) certification and Passive House air-sealing and insulation techniques (see www.passivehouse.us).

2. A green UUFC will save water. While its water usage is likely quite modest, the Fellowship could consider collecting and storing its stormwater, for re-use in irrigation or even for toilet flushing.

3. A green UUFC will be healthier. The levels of indoor pollutants may be two to five times higher than outdoor levels, and on average, Americans spend about 90 percent of their time indoors. Green buildings improve indoor air quality by air sealing, proper ventilation, air filtration, moisture management, and avoiding potential sources of pollutants such as VOCs and formaldehyde. The proper combination of natural ventilation and incorporation of a new HVAC that includes Heat Recovery will permit near continuous fresh filtered air while maintaining the highest efficiencies.

4. A green UUFC will protect our waterways from pollution. Buildings and their pavement replace natural surfaces with impermeable surfaces. This creates runoff that washes sediments

and pollution into our waterways. This runoff is the fourth leading source of pollution in rivers, third in lakes, and second in estuaries. Green buildings help to prevent this runoff by reducing impermeable surfaces, minimizing soil disturbance and erosion, and managing storm water by using low-impact development. At the UUFC all new site work and paving should include on-site treatment of all stormwater runoff, through the development of beautiful bio-swales and rain-gardens, pervious paving and stormwater retention.

5. A green UUFC will reduce waste. Construction and demolition (C&D) debris accounts for nearly 60% of our total non-industrial waste each year. Green building works to prevent this type of waste by utilizing advanced framing techniques, using materials that use fewer resources, using renewable resources, and reclaimed or recycled materials.

6. A green UUFC will use materials that are environmentally preferable. Using materials that are locally sourced, from renewable stock, and that have been repurposed saves energy, encourages local and preferable extraction techniques, and promotes local economic development. Additionally, using materials that require no or low maintenance further reduces long-term environmental costs and waste, while saving the UUFC money.

7. A green UUFC will reduce your Carbon Dioxide Emissions. When we think about CO2 emissions we usually think about cars and trucks as the worst offender. But buildings account for 38.1% of the U.S.'s total CO2 emissions. Green buildings reduce our carbon footprint by reducing energy requirements, and the amount of materials and resources needed for construction. Further, by shifting the UUFC's energy use from fossil fuels to electricity, permits us -with Coefficients of Performance in the 3-4 rang- achieve savings that far exceed what is possible with gas or oil. When this is partnered with on-site renewable production and perhaps wind-power purchased from the utility, the UUFC can start aiming for Carbon-Neutrality.

Given the extraordinary commitment of the UUFC community, the potential for operational and functional improvement, increased comfort and well-being for staff and visitors, and pride and satisfaction is great. I look forward to watching your congregation reach for and attain exemplary levels of community leadership and environmental stewardship.

END OF REPORT

We have made every effort to be comprehensive in this report. The report contains those conditions and deficiencies observed during site visits, programmatic concerns and issues raised during our meetings with staff and leadership, design concepts discussed and developed together with UUFC personnel, and costs associated with these concepts. There may be other conditions, deficiencies, issues or concerns which were not observed, or concepts which have not been specifically developed or noted in this report.

APPENDIX